AGRICULTURAL REQUISITES in LATIN AMERICA

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REPORT OF THE JOINT
ECLA/FAO WORKING PARTY

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Letter of Transmittal

Santiago, Chile,

4 January 1950

Sir,

In accordance with the instructions of the Assistant Secretary-General in charge of Economic Affairs, Mr. A. D. K. Owen, I have the honour to submit herewith the report prepared by the Joint Working Party established by the United Nations Economic Commission for Latin America and the Food and Agriculture Organization, under resolution E/CN. 12/60 adopted by this Commission on 23 June 1948, pursuant to the resolution of the Economic and Social Council on "co-ordinated action to meet the continuing world food crisis" (103(VI)).

The Working Party was organized in Mexico City in late October 1948 in accordance with an agreement with the Director-General of the Food and Agriculture Organization. The members of the Joint Working Party have visited all the countries of Latin America doing research work on the supply situation of agricultural requisites and collecting data for the report. The report analyses the use of agricultural requisites in Latin America and the factors which are retarding the increased production of food in the region.

I have the honour to be, Sir,

Your obedient servant,

Gustavo MARTÍNEZ CABANAS

Executive Secretary

Hon. Trygve LIE,
Secretary-General,
United Nations,
Lake Success, New York

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Introduction

In the aftermath of war, the world faced a critical food emergency. Short-term measures tending merely to ensure a better distribution of existing supplies were not sufficient. Agriculture had to be expanded together with expansion of industry, transport and finance.

In 1947, the Governments meeting at Geneva at the third session of the Conference of the Food and Agriculture Organization requested unanimously that international action be taken through the Economic and Social Council by "an effective integration of all efforts directed towards the expansion of world economy".

Subsequently, the Economic and Social Council at its sixth session invited the specialized agencies and the regional economic commissions concerned, in consultation with the Food and Agriculture Organization, to study suitable measures to bring about an increase in food production by the elimination of supply shortages.

This resolution was brought to the attention of the Economic Commission for Latin America. It was the view of the Governments, as expressed at the first session of the Commission, that the extended period of shortages of foodstuffs called for immediate action and that an increased supply and a better distribution of agricultural requisites as well as improvements in transport facilities were needed.

The Executive Secretary of the Economic Commission for Latin America and the Director-General of the Food and Agriculture Organization were therefore requested to set up a joint working party from the secretariats of both organizations to study co-ordinated action in these two vital areas.

This report represents the first step taken jointly by the Food and Agriculture Organization and the Economic Commission for Latin America to implement this resolution.

In recent years, the supply of food available for consumption in Latin America has increased but there has also been a considerable increase of population. According to "The State of Food and Agriculture (1948)" [1] supplies of food in Latin America in 1947-1948 as compared to supplies available in the pre-war period (1934-1938), have risen by 27 per cent. During the same period the population has increased by 24 per cent. In

[1] Food and Agriculture Organization, United Nations, Washington, D. C., 1948.

broad terms, therefore, average food supply levels remain as unsatisfactory as before the war. Although some countries have a reasonably good diet the average *per capita* food intake remains very low in the large majority of Latin-American Republics. Furthermore, wide variations in diet between the different social groups justly causes concern to Governments.

Moreover, pre-war levels of nutrition unsatisfactory as they are, have been maintained owing to a decline of exports and a sharp increase of imports of food. The volume of food exports in 1947-1948 is 98 per cent of the pre-war period. In fact the volume of food production has only been augmented by 20 per cent, compared to a 24 per cent increase in population.

Governments represented at the first session of the Economic Commission for Latin America wisely gave primary importance to means of increasing agricultural production, without losing sight of the serious shortages in farm requisites.

In Latin America—as in other regions—the war period was marked by a sharp decline of imports of agricultural requisites and of transport equipment, resulting in an accumulated demand in the immediate post-war period. The situation in this respect as between Latin America, for instance, and Europe, implies in no way that the factors determining the demand for agricultural requisites and transport facilities are comparable. In Europe—as in certain parts of the Far East—the demand was accentuated by war destruction. The problem in these regions was mainly one of reconstruction, at least in the first post-war years. In Latin America, moreover, the war period has brought about a widespread desire to expand industry, due mainly to the difficulties of procurement of manufactured products in Europe and the United States, coupled with a growing consciousness of the importance of technical progress in agriculture. Governments recognized that industry could not expand while agriculture remained in its archaic state.

The extension of the use of means of production became therefore a matter of policy on the part of the Governments.

The Joint Working Party was thus led to examine the agricultural policies of the Governments, as these are intimately related to food and nutrition policies they have adopted. The post-war period is marked, in Latin America as in other parts of the world, by a growing consciousness of the food and nutrition problems.

As an example, the Latin-American Governments have, in many cases, encouraged the development of fisheries. The problem is an important one as a development of the fish industry would be likely to improve the nutrition of the populations by adding protein and calcium to their diets.

The Joint Working Party has found instances of supply shortages which constitute an obstacle to the development of agriculture, as for

instance, nitrogenous fertilizers, which remain in short supply. Where shortages are not so acute in other materials, stocks are so depleted and transportation so deficient that serious delays in delivery occur.

It would be unwise to generalize from these examples, moreover, because this is a continent of contrasts. From the densely populated areas of the Caribbean to the rich and sparsely populated southern plains, from the rugged mountains of the Pacific to the plains of the Atlantic, the environment varies greatly. Man-created troubles or benefits vary according to the political moment; general economic conditions influence and sometimes determine the advisability of the use of certain requisites.

To increase food production in this region demands something more than a struggle against shortages; agriculture must be given the place it deserves in the total economy of Latin America. Hope for future expansion springs from the growing consciousness of Governments and of peoples as to the importance of modern methods and techniques. The immediate need is for action in these fields. Increased supplies of fertilizers, farm machinery, pesticides and fungicides must flow into countries where research and extension work are organized, education services established and health conditions improved. The inter-relationship of these elements constitutes the main difficulty and the challenge which Governments now confront. The Joint Working Party felt it necessary to face up to the comprehensive total problem, including all favourable or unfavourable principal factors which influence the means of production.

In adopting this approach, the Joint Working Party based its findings, not only on statistical and economic data collected in the course of its visits to the twenty Latin-American Republics, but also on the opinions of the officials interviewed who stressed that the problem be examined in the light of the special characteristics which distinguish Latin America.

The above considerations determined the organization of this report. Chapter I studies the physiographic, sociological, economic and financial factors affecting good production. While not intended to be a general survey, this chapter sets out the theoretical approach with which the Joint Working Party was confronted, and points to the extremely complex inter-relationships between the various obstacles in the way of greater use of agricultural requisites.

In chapters II to VII, the material factors influencing food production in Latin America are discussed. The Joint Working Party has felt that, in no case could a quantitative evaluation of future needs be made, due, among other causes, to the lack of statistics to evaluate those needs.

Wherever possible the problems of Latin America have been treated on a regional basis, with attention paid, at the same time, to particular situations in individual countries.

Such a brief survey of these important questions, in so vast a region, would be presumptuous if it pretended to have found a solution to the supply shortage problems. Nevertheless there are some problems calling for national or international action, in the solution of which the international organizations can assist greatly. These have been listed at the end of each chapter in addition to their inclusion in the summary which follows. It is hoped that they will lead to practical steps in the expansion of the economies of Latin America and of the world.

Summary

A. CONCLUSIONS

1. During the war there was an acute shortage of agricultural requisites, particularly of farm machinery, but, with few exceptions, this stage came to an end in 1948. The 1945 to 1948 period was marked by a sharp increase in the volume of imports. By the end of 1947, Latin America was importing (in value) three times more fertilizers, four times more tractors and four times more pesticides than in the pre-war period.

2. The Joint Working Party has found that lack of availability of supplies is not now a major impediment to the increased use of agricultural requisites in Latin America.

3. Nevertheless, supply shortages continue to restrict the use of agricultural requisites in certain important cases; supply shortages appear to be confined to heavy equipment, particularly crawler tractors. There is great difficulty in obtaining equipment required for earth moving and land clearing, and this is an impediment to irrigation, drainage and colonization programmes in some countries. There is also a shortage of certain types of equipment needed for well drilling, particularly piping and well-casing. Fencing wire, including barbed wire, appears to be the most serious shortage in general farm equipment.

4. The principal impediments to the greater utilization of agricultural requisites in Latin America are:

(*a*) Inadequate agricultural extension services. In many countries there are no extension services and where they do exist, they are insufficiently financed, staffed and equipped. Farmers in Latin America need advice if they are to improve their production methods and learn to utilize modern agricultural requisites;

(*b*) Lack of technical education. There are few agricultural schools which provide intermediate and higher education;

(*c*) Inadequate research into the types of agricultural requisites needed for specific conditions. Not enough is known yet regarding the fertilizer needs of different soils, the adaption of pesticides to local pests and diseases, or the kinds of machinery required for the various types of work in different localities;

(*d*) Insufficient credit facilities, both for the purchase of agricultural requisites and for the general fostering of agricultural development. In

many countries it would appear that the sales of farm machinery would be multiplied if farmers were able to obtain equipment on easier payment terms. Insufficient credit for fishermen, processors and distributors has also been found to be a major handicap to development of the fisheries industry;

(*e*) The high cost of most requisites to the Latin-American farmer compared with the prices which he has to pay in industrially more advanced countries. These high costs result from ocean and land freights and from distribution charges from town to farm;

(*f*) Shortage of foreign exchange, particularly of dollars. Foreign exchange difficulties limit the quantity of agricultural requisites which are permitted to enter the countries in approximately one-third of the Latin-American nations, accounting for more than one-half the total of imports into the region;

(*g*) Low yields per unit-area, which are not only partly responsible for the poverty of farmers but which often make the use of modern requisites actually uneconomic. For instance, yields are so low in some regions that, even when fertilizers give a high percentage increase in production, the absolute gain is insufficient to pay for the cost of the fertilizer. In such cases, higher yielding varieties are a necessity for the economic use of fertilizers.

(*h*) The smallness of the farms or operating units in many parts of the region. This is an impediment chiefly to the use of power-machinery pools, such as are being used in a number of countries;

(*i*) Low rural incomes and comparative abundance of labour due principally to lack of alternative employment opportunities, which would be provided by industrialization. This is an impediment chiefly to the use of machinery, which displaces labour;

(*j*) The poor transport network, particularly the primitive rural roads or tracks. In many areas the distribution of fertilizers, machinery and fuel is practically impossible, or, if physically possible, the costs by the primitive means of transportation available from town to farm are prohibitive.

5. In so far as the factors listed above, rather than supply difficulties, constitute the principal impediments to the greater use of agricultural requisites in Latin America, the Joint Working Party considers that the objective of increased utilization of modern techniques can be attained only by paying attention to these problems.

Utilization of Agricultural Requisites

6. Although the use of machinery, fertilizers and pesticides within the region is now so much higher than before the Second World War, it remains almost negligible per unit of crop area when compared with other regions.

7. The Working Party has noted that the utilization of modern agricultural requisites is concentrated on a few crops and in relatively few areas. With very few exceptions, chemical fertilizers, pesticides and modern agricultural implements are used only in connexion with export crops. Fertilizers are used principally for sugar-cane and cotton. Most pesticides are used on bananas, cotton and some fruits. More than half of the tractors in the region are concentrated in certain areas of Argentina and Mexico. The staple food crops of the region, particularly corn and beans, continue to be produced by primitive methods.

8. The recent increase in utilization of agricultural requisites is linked to a large extent with direct government sponsorship. Many Governments in Latin America have recently established farm machinery pools, and government agencies are responsible for a large proportion of the importation of power machinery in many countries. The use of pesticides except on specialized export crops is almost entirely limited to cases where infestation reaches the proportions of a national catastrophe, and in these cases it is the Governments that intervene.

Production of Agricultural Requisites in Latin America

9. With the exception of fertilizers, the production of agricultural requisites in Latin America is very limited: only five countries (Argentina, Brazil, Chile, Peru and Mexico) possess facilities for the manufacture of farm machinery and equipment on a substantial scale. In these cases, production is principally concentrated on simpler type implements and the manufacture of spare parts. Fertilizer production is concentrated in only five countries (Chile, Peru, Argentina, Brazil and Mexico) on a limited scale. Pesticides, pesticide materials and equipment are not produced in the region, except to a certain extent in Argentina, Brazil and Mexico.

10. Plans for the expansion of production of agricultural requisites in Latin America indicate that in the next few years domestic production will become more important, and, particularly, more varied in regard to the range of products and the number of countries involved. It is also evident, however, that the region will continue to be essentially dependent on outside sources for most of its agricultural requisites.

11. It must be emphasized, moreover, that the level of import requirements will be greatly influenced by the prices for agricultural products. Experience has shown that farmers in Latin America, as in other parts of the world, are very sensitive to changes in the ratio of the prices of requisites to those of products.

Losses through Pests and Diseases

12. Latin America lacks warehousing facilities to an alarming degree, especially in the tropical regions. Particularly notable is the lack of grain

drying and cold storage facilities. Losses of grain in storage range from approximately 15 per cent in the temperate areas to a maximum of 50 per cent in the tropical. The biggest step that can be taken towards increasing food supplies for consumption and export lies in the extension of warehousing facilities and improvements in methods of storage.

13. Losses in growing crops cannot be accurately assessed, but they are estimated to be approximately 25 per cent as a regional average. These losses could be greatly reduced by a more adequate supply and expert use of pesticides.

Possibilities for Expansion of Cultivated Areas and for More Intensive Farming

14. Programmes for increasing the area under cultivation affect the future demand for agricultural requisites. The opportunities in Latin America in this field are considerable. Events have indicated that to bring the unutilized territories of Latin America within the effective economic territories of those states is a matter beyond the power of individual initiative and requires the action of Governments.

15. Large programmes for increasing the area under irrigation are being undertaken and, when completed, will increase the total irrigated area by approximately 1,300,000 hectares, thus adding more than 20 per cent to the total irrigated area of Latin America.

16. Land reclamation and colonization programmes require large capital investments. Finance presents the main obstacle to bringing new areas under cultivation and this raises the question whether such money could not often be expended to greater effect in programmes for raising the yield on land already farmed.

Improvement of Fisheries

17. Fisheries are not well developed in Latin America. The 135,000 fishermen of this region land less fish than the 6,300 fishermen of Iceland. This implies a great potential improvement in fishing operations through the introduction of economic equipment, larger gear, etc. Experience has shown that the introduction of equipment is slow when the fisherman is not acquainted with it, and particularly when it has not been tested out in the region. Priority should be given to the purchase of engines for the existing fleet and attention paid to improvement of the design of boats built locally, as well as to larger or more efficient gear of the types locally in use.

18. The greatest impediment to the expansion of the fishing industry, in the opinion of the Joint Working Party, is lack of local markets for

tresh or processed fish. Efforts to increase fish production in the region have often proved valueless, due to the lack of demand.

19. Along with efforts to increase the demand, parallel action should be taken in the field of distribution of fishery products. There is need for improvement of transportation facilities, such as insulated trucks and freight cars, as well as improved facilities for cold storage, the preservation and display of fresh fish in shops and markets.

20. The possibility for increased consumption of salt and dried fish is limited, and the purchasing power of the greater part of the population does not permit of a substantial increase in the sale of canned or frozen fish. It is felt, therefore, that distribution will be mainly in the form of fresh fish. For this purpose the most urgent need is ice and the Joint Working Party has noted that supplies of ice are generally very small indeed.

21. It is important that fishery resources should be better known to avoid wasting effort in unproductive waters. This calls for biological investigation, experimental fishing, collection of statistics and the education of fishermen and technicians. The Joint Working Party feels that these problems are international in scope and that, therefore, the countries of Latin America might well pool their financial resources and technicians in order to co-ordinate this work. It suggests furthermore, that the international organizations concerned should help Governments to promote co-operation in this field.

B. SUGGESTIONS

Before stating the suggestions which emerged from its deliberations, the Joint Working Party wishes to make one important observation of a general character. Having started its enquiries upon the assumption that shortages of farm requisites are the major impediment to agricultural improvement in the region, the Joint Working Party has been driven inexorably to the conclusion that, in most cases, the chief obstacles are quite otherwise. The reasoning which forced the Working Party to this view is elaborated in the body of the report, but the conclusion which has been reached explains why it has seemed right to place first, the suggestions on government services to agriculture and other general topics, and second, the suggestions on individual requisites.

In making these suggestions, the Working Party has endeavoured to concentrate upon items which lie within the competence of the Government concerned, acting individually or in concert. It is hoped, therefore, that on political as well as on technical grounds the suggestions will be recognized as reasonable and practicable.

General

1. *Extension services.* Such services should be immediately developed by appropriating funds on an increasing scale and by plans for the training of the necessary personnel.

2. *Higher agricultural education.* More schools should be provided for technical training and the courses brought within reach of a larger segment of the agricultural population.

3. *Research.* More research should be undertaken on the application and adaptation of various farm requisites under local conditions, and to this end, some additional experiment stations will be needed. Research stations should pay greater attention to programmes for the breeding and distribution of improved seeds.

4. *Agricultural credit.* Credit facilities should be greatly expanded by the creation of new credit institutions, by government measures to make more funds available and by provision of loans to farmers on terms which make it easier for them to pay for agricultural requisites.

5. *Transportation.* Highways and railroads should be greatly extended in order that a larger proportion of farmers can market their crops and obtain access to agricultural requisites.

6. *Farm machinery.* Governments and research stations should take steps to improve the simpler types of farm tools and implements and arrange for the cheapest possible manufacture and distribution.

7. Governments should study the experience of other countries in respect to farm machinery pools and related services and, where these do not yet exist, should consider introducing them. Furthermore, those Governments who have had useful experiences should supply details to the international agencies concerned, in order that the information may be more widely distributed.

8. In several countries, schools should be established for tractor operators and mechanics as well as repair shops for the various types of farm implements.

9. *Fertilizers.* FAO should take the initiative in organizing a Latin-American regional meeting on the use, requirements and supplies of fertilizers.

10. Steps should be taken to reduce the cost of fertilizer to the farmer, particularly by modification of import duties and transportation costs and, where necessary, to the extent of subsidizing fertilizer prices, at least as a temporary measure.

11. *Pesticides.* Governments should promote field experiments in the use of pesticides and equipment for their application.

12. International co-operation in pest control should be further developed.

13. Governments should, as a matter of urgency, establish at least small stockpiles of important pesticides as a safeguard against emergencies.

14. *Warehousing.* Since much waste can be avoided by the action of individual farmers, distributors and consumers, campaigns should be carried out in schools, through the Press, radio and the cinema to publicize the seriousness of losses of food in storage and to teach simple methods of conservation.

15. The more advanced countries should make available to other countries, either directly or through the international organization concerned, the knowledge they have acquired regarding infestation of stored foods and its control.

16. Training programmes should be established for persons responsible for food conservation, in particular on grain drying methods and cold storage.

17. Pending the establishment of modern warehouses which involve large capital investment, technical personnel should be sent by FAO to selected areas to examine existing storage systems and to recommend improvements, including the treatment of stored grain, and also to study the possibility of establishing low cost modern storage units in selected centres.

18. *Increase in cultivated area.* Before undertaking land reclamation or colonization projects, Governments should develop plans to enlist all the services involved, such as agriculture, health, communications, etc., and ensure that the necessary funds are appropriated in each of these fields before a project is commenced.

19. Where countries are engaged in drawing up such plans, the international agencies concerned should stand ready to make technical advisers available, when requested by the Governments.

20. *Fisheries.* Priority should be given to the purchase of engines for existing fleets, to improvements in the design of locally built boats and to obtaining larger or more efficient gear of the existing types.

21. Governments and private organizations should encourage consumption of fish through consumer education.

22. Steps should be taken to develop the production of ice where it is needed for the preservation and distribution of fish.

23. In order to promote research into fishery resources of the region, the international organizations concerned should facilitate co-operation among Governments in the pooling of financial resources, technicians and research equipment.

CHAPTER I

General Factors Affecting the Use of Agricultural Requisites in Latin America

The use of agricultural requisites is conditioned by a variety of factors which lie outside the limits, strictly interpreted, of the terms of reference of the Joint Working Party. It became evident during the Working Party's investigation that farm machinery, fertilizers and pesticides are not, in many cases, the primary elements in the problem of increasing food production in Latin America. To a considerable extent, the wider use of these requisites depends upon such factors as profitable markets based on high consumer purchasing power, good transportation, warehousing and processing facilities, adequate agricultural credit at low interest rates and sufficiently long terms of repayment, an efficient marketing organization which will enable the farmer to obtain the full value of his product, higher yielding crop varieties, and increased availability of dollar exchange.

In general it may be said that there are no simple solutions to the problems involved in introducing modern agricultural techniques. The solution of one problem depends on the simultaneous solution of several others. Only through programmes of co-ordinated action knit together as part of a long-range policy, can headway be made.

In examining the factors which retard or promote the use of agricultural requisites, the physical and social environment must be borne in mind. For example, there are regions in Central America and all along the Andean chain where it is not practicable to use motor draft power on account of the rugged configuration of the land. Climate influences the incidence of plant diseases, thus increasing or diminishing the need for pesticides. By its direct or indirect influence on soil formation, climate is also one of the factors determining the use of fertilizers.

On the social side, extreme subdivision of the land impedes technical progress and retards the further use of requisites. The low income derived from very small holdings makes it impossible for the farmer to purchase expensive implements and particularly farm machinery. The conditions under which subsistence farming is carried out often make it extremely difficult for the farmer to adopt new methods of cultivation. By contrast, very large landholdings have, in many cases, led to under-

utilization of the land and have retarded the intensification of production which usually results in greater use of agricultural requisites.

The contribution which requisites can make towards an increase in agricultural production depends in a large measure upon certain elements in the general environment.

These elements may be considered in three groups: (1) government services to agriculture including research, education and extension; (2) market prices, credit and other elements of finance; (3) transportation.

1. GOVERNMENT SERVICES TO AGRICULTURE

(*a*) Research

Some agricultural research has been carried out in almost all the countries of Latin America. Among the several important experimental stations may be mentioned the *Instituto de Campinhas* in Brazil, *La Molina* in Peru, *Chapingo* in Mexico, *La Estranzuela* in Uruguay and the Inter-American Institute of Agricultural Sciences in Turrialba, Costa Rica, as well as groups of stations established jointly by certain Governments collaborating with the Office of Foreign Agricultural Relations of the United States Department of Agriculture. Valuable as the current work in these stations undoubtedly is, its total volume must be regarded as small compared with the vast number of "unknowns" in the agriculture of the region.

For example, although some of the stations are carrying out useful fertilizer experiments on particular soils for particular crops (mostly "export crops") there remain many important soil types within the region on which no research has as yet been undertaken. Agricultural machinery has been tried out for a few of the more significant cash crops in rather limited environments, but much remains to be done by improving hand tools and introducing small motors for irrigation pumping and other farm operations. Similarly, in some localities pesticide experiments are in progress but at the same time many local pests and diseases, both on crops and on livestock, have received little or no attention.

In some countries of the region, outstanding results have been obtained by research into agricultural seeds in order to discover varieties and strains best adapted to local conditions with benefits to the entire farm population. The following are selected examples.

In Bolivia, two experimental stations have been established. One is working in the moderate altitudes of the valleys; the principal crops being studied are maize, wheat, barley, potatoes, vegetables and fruits. The second is in the highlands, where sheep are the main product, and the plant work is mostly concerned with forage crops, potatoes and quinoa. The last crop, because it grows at higher altitudes than other cereals

(14,000 feet), is of great importance to the agriculture and food supply of Bolivia.

In Peru, it is reported that some highly skilled technicians are employed in the five different experiment stations. Work is under way to develop rust resistant wheat in the low coastal areas. Maize breeding is also being done particularly for suitable hybrids. Other work is being undertaken on cotton, beans and rice.

In Ecuador, seed breeding is being done in conjunction with the OFAR Laboratory.

In Mexico, remarkable work is being done at Chapingo by the Mexican Ministry of Agriculture and the Rockefeller Foundation. They jointly furnish technicians including plant breeders, soil scientists, plant pathologists and entomologists. Plots for field crops, field labour and some operating capital are furnished by the Mexican Ministry of Agriculture. In the five years' existence of this project, ten years' study on maize have been accomplished by planting two crops a year. A number of new pure strains of maize adapted to specific areas and some hybrids have thus been developed. In addition, three new wheats, resistant to black stem rust, have been developed on a scale sufficient to furnish seed for a sizable acreage. This wheat can be grown in the summer in the high rainfall areas, a revolutionary development in Mexico.

(*b*) Agricultural Schools

In some countries there is provision for higher agricultural education; in others it is almost wholly lacking. About half a century ago, schools for higher agricultural education were established in the Argentine, Brazil, Chile, Mexico, Peru, Cuba and Uruguay and more recently in Venezuela, Ecuador, Costa Rica, Colombia and Bolivia. A network of schools offering primary and intermediate agricultural instruction exists in very few of the countries. Yet without these means of lower technical education, it is difficult to see how schools of higher instruction can fully serve their intended purposes. There is small likelihood of attendance by the sons of medium and small scale farmers; in general the attendance will be from the well-to-do classes. Moreover, at the end of their training, the students expect either to become managers or directors of large farms or plantations or alternatively to enter administrative work in government offices. Rarely do those who have been trained go out and spend their lives helping the farmers in the villages and remote areas.

(*c*) Extension Services

The organization of extension or advisory services to farmers is embryonic or non-existent in most countries of Latin America. In the opinion of the Joint Working Party this constitutes the greatest single

impediment to agricultural improvement in the region. Without an extension service, the results achieved in the research stations are never disseminated among the farmers; neither are they made aware of the fertilizers, pesticides or improved tools which it would be to their advantage to use. It would be imprudent, in most cases, to augment substantially the supply of farm requisites unless, at the same time, Governments organize extension services. There are notable exceptions to this general observation.

In Mexico, for example, the Government has taken special steps to distribute the specially developed maize seed through the recently established *Comisión del Maíz,* with excellent results. Ten per cent of the 3.5 million hectares of maize are planted with hybrids and it is hoped that within three years, hybrids will be used throughout the country. Officials of the *Comisión del Maíz* teach, by precept and demonstration. the use of improved seeds and also improved methods of cultivation. While its principal objective is to ensure the distribution of seeds at fair prices, this commission incidentally performs an important educational function.

(*d*) General Observations

The Joint Working Party is aware that a wider use of farm requisites will not come about until the majority of Latin-American countries make greater provision for research, education, and, above all, for extension. If this is to be undertaken it involves the appropriation of government funds.

At present, the proportion of public funds devoted to the improvement of agriculture is inadequate in all the countries. In the majority of them less than 5 per cent of the public revenue is devoted to agriculture, and in none as much as 20 per cent, although agriculture is the occupation of approximately 60 per cent of the population. An upward change in this ratio is needed for agricultural progress to be made.

Once the decision has been taken to make more money available, the shortage of trained teachers and extension workers will become immediately apparent. Training facilities will need to be provided as a first step, to a large extent within the countries themselves, but a selected number of teachers and extension workers might usefully study abroad. Moreover, advisers from countries with experience might be invited to help in the early stages of establishing extension services.

The degree to which research, education and extension activities are expanded, is, in most parts of the world, an accurate indication of the degree to which Governments promote agricultural development. Latin America will be no exception.

2. ECONOMIC AND FINANCIAL FACTORS

The utilization of agricultural requisites is limited in Latin America, as in every other part of the world, by the economics of their use. However favourable may be the physiographic, sociological and other conditions for the employment of modern production techniques, these tend to be confined to areas and crops where they are most profitable. The additional return from the use of fertilizer must clearly cover its cost; power-machinery must be cheaper than draft animals and human labour. Even where modern farm requisites can be shown to be economically justified, their use will be very limited if farmers find it difficult to afford them.

The prospect for the greater employment of modern agricultural requisites in Latin America can, therefore, only be understood in the light of the prices which farmers obtain for their products, the prices of modern equipment in comparison with that displaced, and the credit facilities available to assist farmers in paying for such requisites. Generally speaking, these economic factors are not favourable in Latin America to the extensive use of agricultural requisites. But they are becoming more favourable.

(*a*) Markets and Prices for Agricultural Products

One of the most important factors affecting agriculture in Latin America is the poverty of the domestic market. With the exception of the Argentine, Uruguay, Chile and Cuba, almost two-thirds of the population is rural and most of these have very low levels of income. Among the urban one-third, wealth is very unevenly distributed. Only in two or three countries has a wider diffusion of wealth begun.

Industrialization is undoubtedly the basis for the growth of the internal market. Every advance in industrialization may expect to be reflected in greater demand for farm machinery, fertilizers, pesticides and the other requisites of modern agriculture. The growth of secondary industries during the last decade and the high level of urban economic activity since the war are among the major factors making for increased use of agricultural requisites.

It is not what the consumer pays but what the farmer receives that determines the latter's ability to buy agricultural requisites. Poor transportation and marketing facilities take a high toll of farm prices in many parts of Latin America. At least two factors are responsible for this. First, the real costs of transportation and marketing are high for the many areas not served by modern transport facilities. Among these costs must be included losses, spoilage and deterioration due to slowness of transport and poor methods of preservation. In many regions these factors commonly prohibit the marketing of animal products or produce, and,

by restricting the farmer's choice of production, further limit his income. The second factor, which eats into the "consumer peso", is the lack of adequate distribution systems. In the opinion of the Working Party this is a serious impediment to the growth of farm income to the point where there would be a mass demand for modern agricultural requisites.

Among the factors responsible for the weak bargaining position of the mass of the farmers in Latin America *vis-à-vis* the merchants, the following may be mentioned:

(i) The small farmer's constant need of cash. Because of this he usually has to sell his harvest as quickly as possible, in doing so sacrificing money for time. In many cases he is even forced to sell his harvest in advance, or, at least, to bind himself to a single dealer, in return for the financing of his production costs and his living expenses during the pre-harvest months. In either case, he receives less than the market price. One of the necessities for strengthening the position of small farmers is provision of an alternative source of credit;

(ii) Dependence upon middlemen for getting the product to market in certain cases. Where transportation is by road, the supply of trucks available for bringing the products from farm to town is sometimes more or less a monopoly of the wholesalers, which places the latter in a particularly strong position to determine the price of the farmer's products;

(iii) The low standard of education and, particularly, the farmer's ignorance of market conditions. Insufficient attention has been given to the dissemination of market news. Furthermore, it is more difficult here to reach the farmer than in countries where standards of education and facilities of communication are better;

(iv) There has been very limited development of co-operative or government-sponsored marketing in Latin America;

(v) Legislation to guarantee minimum prices is confined to a few countries and to a few commodities. Where such legislation exists, it is not always effective because the enforcement of price guarantees requires either active government purchasing or a system of loans against stored crops and a sufficient network of storage facilities.

These generalizations are based on observations throughout Latin America and are believed to reflect the position in the majority of countries. There are, of course, some notable exceptions. In the Argentine, all major export products, except wool, are sold to the *Instituto Argentino para Promoción al Intercambio* at government-decreed prices. Uruguay has a system of government price-fixing for the major agricultural products. Among the institutions established in other countries to help maintain farm prices for basic crops may be mentioned the *Nacional Distribuidora y Reguladora* in Mexico, the *Instituto Nacional de Abastecimientos* in Colombia and the *Instituto de Economía Agrícola* in Chile.

The above remarks apply principally to crops grown for the domestic market. Generally speaking, higher prices are received for export crops than for commodities produced for the local market. It is partly for this reason that the use of modern production techniques has developed to a much higher degree for export crops as a class (e.g., sugar-cane, cotton, bananas, rice). Where commodities are produced for export, economic conditions in the external markets determine the prices received. The high level of employment in the rest of the world since the war has stimulated the demand for agricultural requisites in Latin America.

Marketing defects are not nearly so important in the case of export crops. In order to compete on world markets, industries have had to develop proper standards of grading and efficient marketing organization. Furthermore, export crops are produced by large landholders with adequate capital, to a much greater extent than are crops for domestic consumption. In some countries, and for some products, such production for export is largely by foreign companies.

It is necessary to recognize that the availability of markets at present limits production of export products in Latin America in some cases. For instance, a declining market for beans has forced contraction of plantings in Chile. The Dominican Republic is excluded from the Cuban rice market by preferential rates for United States rice. As post-war shortages disappear, market limitations may be more important and even dominant in some economies which are principally geared to export markets, such as in the Argentine, Uruguay, the coast of Peru, and the sugar-cane, coffee, cacao, banana and rice regions of tropical Latin America. Market limitations are not, at present, an important factor in limiting the demand for agricultural requisites, but they could become so.

(*b*) Cost of Agricultural Requisites

The use of agricultural requisites is determined as much by their price as by the price of agricultural products. Generally speaking, the prices which farmers have to pay for these requisites in Latin America are high, sometimes very high, and this proves a major impediment to their wider use.

Latin America has to import practically all modern farm requisites. Only the simpler types of farm implements are manufactured locally even in the industrially most advanced countries. With the exception of Chile and Peru, all other countries have to import the bulk of their fertilizers. Pesticides are sometimes prepared locally, but the materials are mostly imported. For certain simple types of machinery, costs from factory to distributor sometimes exceed the cost of manufacture. These freight and handling charges are more or less inseparable. To these

must often be added the excessive costs arising out of local conditions, such as high costs of delivery and of distribution per unit of sale.

The high cost of machinery and equipment must be considered in relation to labour costs and costs of feeding draft animals. Compared with North America or Western Europe these are low, although rural wages are rising in most countries. It is important that these impediments, which have to be overcome before mass use of better techniques can be expected, be thoroughly understood.

(c) Agricultural Credit

Agricultural credit is of primary importance for the majority of farmers in the purchase of farm machinery, irrigation equipment, construction materials or fertilizers. Cash outlay is often beyond the means of the farmer who can only pay for agricultural requisites gradually as he reaps the benefit of their use. For example, the farmer needs credit for fertilizers until after he has harvested his crop: the time when he has to use the fertilizers is the time when he is least able to pay for it. Farm machinery and equipment yield their benefit over a period of years at the same time that the capital outlay involved is very considerable. For the majority of farmers in Latin America, the ability to purchase and utilize these aids to production is absolutely dependent on being able to spread the burden of payment over several years.

Experience has shown that adequate agricultural credit can generally be obtained through the establishment, under government auspices, of specialized credit institutions. Although commercial banks frequently grant agricultural credits, terms of repayment are not usually flexible enough to meet the needs of agriculture. Such credits are on commercial terms, which confine them pretty much to larger or well-to-do farmers who can offer good security. The large proportion of other farmers find themselves dependent for credit, at high rates of interest, on merchants or middlemen: either those to whom they sell their products or those from whom they buy their farm and household needs.

High rates of interest, low selling prices of agricultural products and the high prices charged for farm needs, all contribute to make the use of machinery, fertilizers and other modern aids to production, uneconomic. The establishment of an adequate system of public credit helps to strengthen the position of the small farmer so placed. State credit to farmers on small and middlesized farms creates conditions favourable to the widespread use of modern agricultural requisites by them.

Considerable progress has been made in Latin America in providing credit for farmers, particularly in recent years.[1] On the whole, however,

[1] For details see "Preliminary Draft of Economic Survey of Latin America", ECLA document E/CN.12/82.

credit facilities remain poor. Where public funds are admittedly inadequate, a proportion of farmers are thrown back on merchant credit for urgent needs and have to forego developmental projects. In countries where requests do not have to be rejected for lack of funds much credit is still supplied by middlemen at more onerous terms. In the Argentine, 20 to 40 per cent of farm credit is supplied by dealers at rates 2 per cent above bank interest and with a 10 to 15 per cent surcharge on goods supplied on credit. In Brazil, dealers and merchants still provide most of the credit at 10 to 12 per cent, as well as commonly binding borrowers to sell through them. The Banco Agrícolo in Peru considers that it meets only a portion of agricultural needs even though it can fill all sound requests.

This situation may be due to lack of knowledge on the part of farmers of the facilities at their disposal, but it may also indicate that there are difficulties in utilizing public credit facilities, such as an insufficient network of branches, overlong delays in granting loans or failure to meet certain types of needs. Merchant credit appears to offer certain advantages in accessibility, flexibility, speed and variety which offset their more onerous terms. In so far as credit institutions fail in these respects, the credit system can hardly be considered satisfactory from the farmer's point of view, even though funds are adequate to meet applications.

Interest rates are high, even in public credit institutions. The most common rate is probably 6 per cent (e.g., Argentina, Peru) although some lower rates are found (e.g., Chile 5 per cent, Uruguay 5.5 per cent). A rate of 7 per cent is not uncommon, (e.g., Bolivia) and rates are as high as 8 per cent (e.g., Mexico, El Salvador and Ecuador). Commercial bank rates are sometimes limited by law to those of the public institutions, but they are often higher because of commission and special charges imposed. For instance, in Ecuador the legal maximum rate is 8 per cent, but the actual rate is said to approximate 12 per cent. In Chile, the theoretical rate for commercial bank loans is 7 per cent but official statistics for the first half of 1948 show an average rate of 9.84 per cent with a range up to 14.76 per cent.

Generally speaking, the period of repayment allowed appears to be fairly adequate for crop production and livestock breeding, but to be frequently restrictive for developmental loans. This applies to investment in farm machinery, where sometimes only two to three years is granted in practice, even though the legal maximum is for a longer period.

(*d*) Foreign Exchange

The economic and financial factors so far considered have one thing in common—they affect the ability of the individual farmer to utilize economically, and to pay for, modern production requisites. The following section is concerned with the ability of a country, as a whole, to

pay for imported agricultural requisites. There are several countries in Latin America where farmers would like to buy more farm machinery, more fertilizers or more pesticides than are available, but they are limited by foreign exchange quotas granted for such imports.

The war transformed the foreign exchange situation throughout Latin America. The value of exports in practically every country multiplied rapidly to two or three times the pre-war level, while the value of imports changed little because of the difficulty of obtaining supplies. In consequence, every country in Latin America built up its holdings of gold and foreign exchange to very high levels, judged by pre-war standards; four-fold and five-fold increases were common. Many countries even experienced considerably greater gains. Total gold and foreign exchange assets increased from the equivalent of less than $1,000 million to nearly $5,000 million. After the war, as supplies became available and prices rose rapidly in the United States, the pent-up demand of the wartime years expressed itself in large increases in imports. In some cases, wartime balances were lost even more rapidly than they had been built up (e.g., Argentina, Chile, Mexico). On the other hand, a number of other countries (e.g., Cuba, El Salvador, Venezuela) maintained and even increased their balances. In still other countries, while total balances did not decline appreciably, the drain on gold and dollar holdings has been severe enough to necessitate careful rationing of imports from dollar areas.

In the Caribbean and Central American regions there are a number of countries where availability of foreign exchange for the purchase of agricultural requisites has not constituted a problem. Venezuela, Cuba, the Dominican Republic, Haiti, Guatemala, El Salvador and Panama have had a strong and adequate inflow of dollars in return for their petroleum, sugar, coffee and bananas.

There is a second group of countries where exchange is stringent but cannot be considered a major impediment to the greater use of agricultural requisites: Brazil, Uruguay and Ecuador. Here there has been strong pressure toward over-spending of dollars but the supply has been sufficient, together with selective control of imports, to make possible full, or nearly full, exchange allocations for essential commodities. Dealers in farm machinery, fertilizers and pesticides report exchange for these purposes. In Uruguay some difficulties have arisen during the last twelve months.

There remain six countries where exchange difficulties constitute a serious impediment to the more extensive use of agricultural requisites: Mexico, Colombia, Peru, Bolivia, Chile and Argentina.

In Chile, the problem of foreign exchange has eased considerably since 1947 and there is not now any difficulty as far as ordinary farm machinery is concerned. The exchange budget for 1948 provided for $US 3 million for tractors and spare parts and an equivalent amount for other classes of agricultural machinery. The 1949 budget provides $US 5 million for

each of these groups. However, foreign exchange limits imports of construction equipment for irrigation and related programmes. The 1948 budget of $US 200,000 for this purpose is considerably below the needs of this work. Among the factors responsible for the improvement in the situation in Chile may be mentioned foreign credits and Marshall Plan expenditures.

In Colombia, importers particularly of agricultural machinery and equipment reported extreme difficulty in obtaining foreign exchange. While the Caja de Crédito Agrario has been able to obtain sufficient exchange, partly because of foreign credits, private importers of agricultural machinery have been unable to meet the demand for equipment or even to secure dollars in cases where machinery has been ordered and is awaiting shipment. Even semi-governmental organizations have been unable to obtain exchange for heavy equipment needed for irrigation and drainage projects. Dealers in farm machinery in Bolivia reported inability to obtain sufficient foreign exchange.

Mexico has not instituted any system of foreign exchange control or rationing. Instead the Mexican peso has been permitted to find its own level in relation to the dollar. Although importers of agricultural requisites are able to obtain all the foreign exchange they wish, they do not have the facility granted in other countries of obtaining it at rates more favourable than in the open market. The depreciation of the Mexican peso has increased the cost to the Mexican farmer of agricultural requisites by approximately 45 per cent, thus seriously restricting their importation.

Exchange difficulties have had their most serious effect in Peru and Argentina. Peru is the only country in Latin America which did not accumulate exceptional reserves of gold and foreign exchange during the war, and, measured by post-war standards, the current balance is only one-half of pre-war holdings. Exchange controls, while giving agricultural requisites top priority, have not sufficiently assisted imports of agricultural production needs. This probably arises from the lack of a continuing policy. For instance, in September 1948 and the preceding months, import licenses for class A commodities were issued in excess of available foreign exchange and no licenses were issued for the following three months. This seriously affected the importation of pesticides, which are imported principally in the last quarter of the year, for use on the cotton crop. Farm machinery dealers likewise complain that the policy, or changes in policy, on the part of the Government have caused confusion and loss. They claim that, while the sum of 7,500,000 soles was allocated at the beginning of 1948 for the importation of farm machinery, less than 20 per cent of this has actually been made available. It is stated that importers have not been able to take possession of farm machinery actually in the port of Callao because they could not obtain the necessary exchange. Another aspect of exchange policy which must be noted is

that, since September 1948, only part of the exchange earnings have gone into the common pool. Exporters are at present permitted to retain 55 per cent of the exchange earned by their products. In practice this is almost the only source of dollars for farm machinery and consequently the imported cost of tractors and other equipment has almost tripled. The cost of pesticides has risen similarly. There is no doubt that the foreign exchange situation during the last twelve months has been a major impediment to the obtaining of increased supplies of agricultural requisites in Peru.

The same is true of Argentina. During the war, Argentinian farmers were unable to obtain replacements for their machinery; since the war the backlog of needs, together with the rural labour shortage resulting from the industrialization programme, has caused a widespread demand for agricultural equipment of all types. However, the severe exchange crisis, developing since 1947, has prevented the meeting of this demand. From the end of 1946 to November 1948, Argentine gold and exchange holdings fell from $US 1,696 million to $US 613 million, a large part of which consists of inconvertible sterling. Apart from the allocation of $US 2,500,000 in hard currencies for spare parts in October, the Government has made practically no exchange available for agricultural machinery during 1948 and early 1949.

3. TRANSPORTATION

Deficiency of transport facilities constitutes, in some Latin-American countries, a serious impediment to transportation of food products to consumption centres and of agricultural requisites from distribution centres to farms. Even where there are roads, high freight rates are often an additional limiting factor.

A recent study prepared by the *Corporación Venezolana de Fomento* illustrates how freight rates in Venezuela rise according to means of transport. Prevalent agricultural freight rates are: by mule back, 2 bolivares per ton-km.; by secondary roads, 0.50 bolivares per ton-km.; by first class roads, 0.25 bolivares per ton-km. As indicated in table I-1, transportation costs about one-eighth by first class roads of what it costs by mule back. Only a small proportion of the rural areas in Latin America are serviced by first class roads: in many countries, transportation by mule still remains important.

Applying current freight rates, in this same country, to the transportation of agricultural requisites, it is easily seen how their utilization is hampered in certain crop areas. A metric ton of Chilean nitrate, for instance, costing approximately 260 bolivares c.i.f. at La Guaira, will increase to 275 bolivares when transported to Caracas, 40 km. away, and

TABLE I-1

Influence of freight rates on distance to which agricultural products can be transported

Venezuela, 1948

Product	*Cost of production*	*Wholesale price*	*Mule back*	*Secondary roads*	*First class roads*
		(Bolivares per 100 kg.)			
Bananas	2.7	8	13	53	106
Beans	20	40-50	50-75	200-300	400-600
Rice	30-40	55-70	62-75	250-300	500-600
Wheat	18-20	36-40	45-50	180-200	360-400

Source: Corporación Venezolana de Fomento.

to 455 bolivares at Pariguan, 521 km. further. Dependence upon transportation by mule back in many areas, and the fact that it adds another 2 bolivares for each ton-km. obviously impede the more extensive use of agricultural requisites in Venezuela.

In many other areas, badly needed tractors, harvesters or fertilizers cannot be utilized, because the high cost of transportation renders them uneconomical. For a period of time, particularly when agricultural prices are high, farmers can afford to pay high freight rates to transport needed agricultural requisites. But when crop prices decline they may not be in a position to do so. This is feared in such areas as the State of Sao Paulo in Brazil where coffee prices have fluctuated at the same time that transportation costs have risen, from 200 to 595 per cent, during the past five years. In spite of the fact that state-owned railroads have reduced freight rates for fertilizers by 50 per cent, farmers are still in a more difficult situation than they were before. In order to transport a metric ton of fertilizer from Sao Paulo to Rio de Janeiro, 480 km. away, a small farmer has to pay 309 cruzeiros. For calcium superphosphate this represents about 39 per cent of its original price.

In Guatemala, railway freight for 319 km. adds $US 622 to the factory cost of a D.8 caterpillar tractor. This is in addition to $US 292 for inland freight in the United States plus $US 1,070 for ocean freight. Therefore, total shipping costs amount to about 17 per cent of the factory price of such a tractor, which in 1948 cost $US 11,600.

An even more pointed example: shipping thirty-two ox cart wheels and sixteen axles represented more than a doubling of their cost at the factory. Charges on this shipping were as follows:

	$US
Cost at factory	1,047
Inland freight Quincy to New Orleans	170
Ocean freight	448
Railway freight for 319 km. in Guatemala	198
Custom House fees	218
Shipping expenses	18
Banking charge	32
Total freight charges	1,084

In Colombia, the transportation of a food product for 100 km. may raise its cost 75 per cent; in Ecuador it is estimated that agricultural production is economical only within a radius of 20 km. from the Guayaquil-Quito Railway. The high cost of transportation prevents the use of fertilizers in the highlands.

Freight rates vary considerably from one country to another, according to their physiographic and economic conditions, and even fiscal policies which makes comparisons between them futile. Nevertheless, the Joint Working Party has collected some data from which a few general conclusions may be drawn.

Rates for highway transportation in Bolivia seem to be the highest in the entire region, varying from $US 0.09 to $US 0.19 per ton-km. Obviously this is due to the rugged nature of the country, lack of good roads and the decrease in the power of trucks at high altitudes. In regions such as the Peruvian coast or the Mexican plateau, the low cost of motor fuel and the good paved roads over flat country make for the lowest transportation tariffs; from $US 0.02 to $US 0.03 per ton-km. in Peru and from $US 0.01 to $US 0.02 in Mexico.[2]

Bolivia, Ecuador and particularly Venezuela show the highest railroad freight rates in Latin America. This is probably due to factors similar to those which make transportation by truck more expensive in these countries. Railway freight rates are as high as $US 0.13 per ton-km. in Bolivia, $US 0.12 in Ecuador and $US 0.44 in Venezuela.

The cost of transportation does not seem to be strikingly high in countries like Argentina, Brazil, Chile, Cuba and Uruguay, which have rates of around $US 0.05 per ton-km. for both highway and railroad.

[2] *Source:* Interviews of the Joint Working Party with government officials and transportation companies, 1948.

CHAPTER II

Farm Machinery

Mechanization in Latin America is in a phase of rapid expansion. Import of tractors is four times higher than in 1938 and the countries themselves are manufacturing more and more farm implements. Latin America nevertheless remains a region where production of foodstuffs is carried on overwhelmingly with hand tools and animal-drawn implements. Of a total of over 2,000 million hectares which make up the twenty Latin-American Republics, 621 million hectares are cultivated. Only 13 per cent of this area could be worked with the tractors now in use.

Varieties of climate and soil, topographic contrasts, different types of farming, diversities of administrative and financial structures, make it difficult to determine what are the general characteristics of mechanization in this region. The fact that Latin America is sparsely populated and that only 3 per cent of its area is cultivated should imply that the limiting factor to an increased production is labour. But it is also a low-income region, where wages in general have remained at subsistence levels. The relative cost of labour and farm machinery (a labour-saving device) determines the economic use of the latter. Though labour costs may vary considerably from country to country, they remain very low in comparison with those of industrialized countries. Low wages are an impediment to the use of farm machinery; higher wages and industrialization are an incentive to its use.

This region has relied solely on imports of farm machinery up to the last decade when manufacture of farm machinery was begun. The output remains negligible compared to imports from the United States, Europe and Canada. Prices are therefore determined in the exporting countries, and they are increased by freight, duties, inland transport and dealer's margins. Farm machinery must be paid for in foreign currency, and mostly in hard currencies since the United States exports at least 90 per cent of the farm machinery used in this region.

A third characteristic is that the processes of cultivation are not wholly mechanized. Some operations are carried out with tractors and others continue to be done by draft animals. Tractors are used primarily for

first ploughing but are not used so much as in highly mechanized areas for cross ploughing and other operations.

In addition, only certain crops are mechanized. Corn, which is the basic food of Latin America, is not produced with the help of farm machinery, due to the fact that it is grown on small holdings. The owners lack the purchasing power to buy farm machinery and are not familiar with its use. It is the opinion of the Joint Working Party that the help which can be given to farmers in the form of credit, farm machinery services and technical education, is the principal step which can be taken towards an expanded use of farm machinery.

1. FACTORS INFLUENCING THE ECONOMIC USE OF FARM MACHINERY

(*a*) Credit

Specialists and government officials repeatedly gave the members of the Joint Working Party their opinion that lack of credit impeded progress in mechanization. In Chile it has been estimated that due to the credit facilities given to farmers, the purchases of farm machinery have been at least doubled.

Small farmers, in most cases, cannot purchase farm machinery if they do not obtain credit, nor can they pay back on a short-term basis. Generally the only security they can offer is their land and crops. It is difficult, and in most cases uneconomic, for them to make commercial loans, even though in Latin America, up to recent years, they had no other choice.

However, in the last decade a new sense of the national role in easing credit for farm machinery has emerged. The following are examples of structural changes that have been brought about by government action in the banking systems of selected countries.

In Argentina, the *Banco de la Nación* was authorized in 1943[1] to make loans with or without security to farmers who wanted to purchase farm machinery. Terms are 720 days maximum, and interest not to exceed 6 per cent per annum.

In Chile, the *Caja de Crédito Agrario* makes two-year loans to farmers for the purchase of farm machinery at 5 per cent per annum. The *Corporación de Fomento* also offers facilities to farmers to buy farm machinery with 25 per cent cash payment, the balance to be paid in from one to four years with interest at 5 per cent.

[1] *Ley No.* 11684 *del Crédito Agrario del* 15 *de Mayo de* 1943, *Almanaque del Ministerio de Agricultura,* 1943. (Law No. 11684—Agricultural Credit—15 May 1943, Ministry of Agriculture Almanac, 1943.)

In Uruguay, the *Banco de la República* gives credit on 70 per cent of the value of machinery purchased. Loans run for three years and at 5 per cent per annum. The farmer repays 20 per cent of the loan the first year, 30 per cent the second year and 50 per cent the third year.

The farmer in Colombia is granted credit facilities by the *Crédito Agrario, Industrial y Minero.* If he buys farm machinery from this institution he is granted a three-year credit; if from a local distributor the term is two years. In both cases he makes a 30 per cent down payment.

In Mexico, a special form of agricultural credit for farm machinery is offered by the *Banco Nacional de Crédito Agrícola.* This organization is said not to have earmarked sufficient funds for this purpose, and it can loan only 10 per cent of the total credit needs. This situation, the members of the Joint Working Party have learned, could be generalized. Government-controlled banks make loans under conditions that are favourable to farmers in rates of interest and in terms, but unfortunately they do not have enough funds available. The farmer must then fall back on middlemen or local banks at higher interest and shorter terms.

In Ecuador, for instance, loans granted by machinery distributors require a 50 per cent cash payment and the balance payable monthly within 180 days at an interest of 12.5 per cent per annum.

In Cuba, the normal form of credit for farm machinery is 25 per cent cash payment and the balance within one year at 9 per cent. In addition, a 3 per cent government tax is imposed on this kind of operation.

In Mexico, the majority of private loans are made at 12 per cent, with a cash payment of 40 per cent and the balance due in one year.

(*b*) Services

Besides enabling the small farmer to use more modern methods of cultivation, farm machinery services can fulfil other functions. Whatever the size of their holdings, many farmers have not the technical knowledge, or cannot obtain the help of competent operators, in order to use farm machinery effectively. Well organized services provide trained operators to such farmers. Where farm machinery is unknown and its advantages unsuspected, such services provide farmers with a practical education. The Joint Working Party has been impressed by the remarkable work done by the farm machinery services and commends it to the attention of the Governments.

The general tendency in recent years has been to create such services under the auspices of the ministries of agriculture. The machinery is owned by the Governments and loaned to small farmers who pay sums equivalent to amortization, interest, upkeep and salaries of the operators. However, in some cases, semi-governmental organizations such as the *Corporación de Fomento* in Chile or government-controlled banks such as the *Banco Nacional de Crédito Ejidal* in Mexico have established such services.

An effort has also been made in this direction by some of the organizations created jointly by the United States and certain Latin-American Governments such as the SCIPA in Peru. Lastly, in Brazil, the Government has taken the initiative in making sums available setting up farm machinery services which would be profit-making entities. The Brazilian Government has earmarked 100 million cruzeiros for loans to private enterprises on terms of 25 per cent down-payment, 4 per cent interest, and the balance due in four years.

Except in the special instances noted above, the functions performed by the farm machinery services are similar in every country. The following are selected examples. In Guatemala, the Ministry of Agriculture established, early in 1948, a special *Departamento de Mecanización Agrícola* with fifteen completely equipped tractors. The Ministry also owns two combines. This machinery is distributed between two "mechanization stations" (*Estaciones de Mecanización*): one in Guatemala City in the maize area, and one in Quetzaltenango in the wheat area. These two stations provide services to the farmer at cost and both have proved successful. In the Quetzaltenango region, where wheat was produced entirely with hand tools, farm machinery has already had beneficial results, and it is hoped that in the near future this region will produce food under more favourable conditions. The Government also plans to establish two other stations, one in the Retalhuleu-Suchitepequez region and another in the Alta and Baja Verapaz region.

In the Dominican Republic, a special section of the Department of Agriculture has purchased sixty-eight tractors which it lends to farmers at rates which pay operating expenses. This project has proved to be so successful that the Government is in the process of buying 100 tractors. A five-year plan provides for the purchase of 231 tractors and equipment at a total expenditure of 4,400,000 Dominican Republic pesos. It is estimated that 80,000 hectares could be opened up if the project were put into effect.

In Chile, the *Servicio de Equipos Agrícolas Mecanizados* of the *Corporación de Fomento* is a financially autonomous body within the Corporation. A system of rates has been established to include amortization, interest and operational expenses including the upkeep of ten repair shops located in the principal agricultural regions. In 1948, the *Servicio* ploughed 105,000 hectares, harvested 25,000, and cleared 2,800 hectares of stumps with the 197 tractors and 180 combines it owns. In addition, help was given for irrigation works.

The establishment of farm machinery services throughout Latin America is a recent development, and at this time they cannot be considered as having a direct influence on food production. There are insufficient data available to assess the total number of tractors operated

by the farm machinery services, but it can be estimated that in the whole of Latin America only 1,500 are now in operation.[2]

These services present unquestionable educational advantages, and it is the opinion of the Joint Working Party that they constitute a definite means whereby farm machinery can, in the future, be utilized by small holders, who produce a high percentage of foodstuffs.

(*c*) Education and Training

In the faculties of agriculture or agronomic schools, courses on farm machinery are given to the future leaders in agriculture. However, in so far as benefits from the use of farm machinery are concerned, instruction which brings the results of scientific research directly to the farmer is of first importance. The lack of extension services and of other forms of itinerant instruction is particularly felt in the field of farm machinery, and the establishment of these services is a great step forward.

The training of operators and mechanics is needed for the success of any mechanization programme. A distinction must be made between mechanics and operators. In the beginning at least, the duties of the latter should be confined to the actual operation of the machine and not to its repair.

In 1946, the Venezuelan Government established the *Escuela de Traccionistas y Mecánicos de Boca de Río* to give three months' courses to approximately forty-five operators. The school has so far graduated seventeen mechanics since establishment.

In Brazil, special courses have been given to state agronomists; since 1948 the latter have given courses on maintenance and operation all over the country.

The Chilean *Corporación de Fomento* has organized courses for operators in collaboration with the military authorities. As part of their military training, recruits are given lectures and practical training on maintenance and operation of tractors. Each year, through these means, 500 to 600 recruits get proper instruction in this field.

Training of mechanics is at least as important as training of operators. According to the information gathered by the Joint Working Party, no country in the region has a sufficient number of mechanics and repair shops. Moreover, in most countries, repair shops are located in the cities and when (as is often the case) no transport facilities exist, the farmer has no means of ensuring the maintenance of his machines. As a consequence, machinery and tractors deteriorate faster than they should and the unit cost of operating equipment is increased. It is, of course,

[2] The Joint Working Party has obtained data on the number of tractors in use in farm machinery services in the following countries: Chile (197), Costa Rica (14), Cuba (113), Dominican Republic (68), Guatemala (15), El Salvador (9), Venezuela (301).

impossible to assess the losses incurred through this lack of repair shops and of adequately trained personnel, but they appear to be large enough to justify establishment of government-sponsored training centres.

2. SOURCES OF SUPPLY

Latin America produces a very small proportion of the farm machinery it uses, relying almost entirely on North American and European sources of supply.

Although the United States has always been the principal supplier, before the war Latin America was a good market for European exports as well. Trade with Europe was particularly important in the southernmost countries of the continent. Chile and Argentina were the principal Latin-American importers of farm machinery, which came, primarily, from the United Kingdom and Germany. France and Italy were also a source of supply for these countries.

During the 1940-1947 period, imports from Europe declined to negligible proportions and North America became practically the only supplier with the United States exporting 90 to 98 per cent of the imported farm machinery. Canada was, and still is, an exporter of harvesting machinery, and has supplied the region with approximately 30 per cent of its present stocks.

Since 1947, European countries have shown a marked tendency to regain their former position. Official statistics are unfortunately not available at this time, but partial information has been gathered from unofficial sources. From this it appears that exports—particularly exports from the United Kingdom—are rising rapidly. According to the Society of Motor Manufactures and Traders (UK), Britain exported 2,949 agricultural tractors to the Argentine and 1,511 to Uruguay.[3] France has also exported tractors to the Argentine which have been arriving late in 1948.

This sudden rise in European exports is due both to the programmes for increasing tractor production in France and in the United Kingdom, and to the exchange situation of both European and Latin-American countries. It is imperative for the former to carry on an export drive, and opportune for the latter to use the accumulated credit balances in currencies other than United States dollars.

The tractors imported from Europe are medium and small-size types which, as will be shown in section 3 of this chapter, are gaining popularity in this region.

So far as local production is concerned, only four countries have manufacturers of farm machinery of some importance: ploughs, harrows and corn shellers are produced in the Argentine, Brazil, Chile and Mexico.

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[3] *The Economist*, 19 February 1949, London.

During and especially since the war, the tendency has been to produce more complex machinery. In Brazil, the National Motors Factory, established during the war, will soon be in a position to manufacture tractors. In the Argentine, spare-parts factories have been established with the help of United States manufacturers. It is estimated that, during the period under consideration, approximately 2,000 harvesters have also been produced. Spare-parts factories in Chile are found in Santiago, Rancagua, Talca, Tomuco and Osorno. In Mexico, the Pantaco Farm Machinery Factory which, during the war, had been used for other purposes is now being reconverted, and there are plans to establish a farm machinery factory at Saltillo. The other Latin-American countries do not, as yet, produce farm machinery, although a tendency is noted to encourage the establishment of such industries. The chief obstacle is lack of raw materials, which prompts one school of thought to believe that, at present, it is more economical to install assembly plants and spare-parts factories.

3. TRENDS IN IMPORTS

Tables II-1 (A) and II-1 (B) give total imports from the United States by countries of destination, in numbers and in value of tractors from 1938 to 1947, inclusive. Table II-2 gives the export values of farm machinery, other than tractors of the same origin, during the same period.

Some major exporting countries (e.g., the United Kingdom) do not give a detailed breakdown of their exports by country of destination. However, exports from the United States give a clearer picture since, from 1940 to 1947, their share in the total Latin-American imports of farm machinery and equipment is over 90 per cent.

Chart I shows that, from 1938 to 1941, imports of farm machinery followed a downward trend and that, in 1942, owing to the war, there was a sharp decrease, particularly in tractors. In 1943 and 1944 the situation improved slightly, and by 1945, the 1941 level had been reached. From 1945 to 1947 there was a very sharp increase due primarily to accumulated demand, to the reconversion of factories in the United States, and to the accumulation by Latin-American countries during the war of hard currency reserves.

Tractors follow the same trend as other farm machinery. However, changes in imports of tractors are more sudden and cover a wider range. The impact of war is more marked, owing to the close relationship between the production of tractors and that of armoured vehicles and the subsequent post-war rise is more pronounced owing to the marked tendency to use motor instead of animal draft power.

The most striking phenomenon is that, during the 1945-1947 period, imports of farm machinery, and of tractors in particular, reached levels far higher than in pre-war years.

TABLE II-1 (A)

Number of tractors exported by the United States to Latin America, 1938-1947

	1938	*1939*	*1940*	*1941*	*1942*	*1943*	*1944*	*1945*	*1946*	*1947*	*1938-1947*
Argentina	4,347	1,115	758	525	21	—	—	73	2,145	6,066	15,050
Bolivia	16	29	24	96	39	73	70	73	109	78	607
Brazil	391	565	205	399	164	174	86	405	787	1,979	5,155
Colombia	139	269	206	193	71	135	303	610	345	834	3,105
Costa Rica	16	68	1	61	10	11	76	75	76	52	446
Cuba	59	79	71	186	135	64	62	142	616	1,439	2,853
Chile	131	207	590	591	179	18	199	484	705	805	3,909
Dominican Rep.	23	18	12	16	1	28	54	12	72	115	351
Ecuador	24	69	37	39	6	16	35	156	132	108	622
El Salvador	4	9	3	5	1	—	11	45	56	142	306
Guatemala	12	52	56	11	10	18	23	134	151	197	664
Haiti	1	2	—	7	—	3	9	5	1	23	51
Honduras	11	13	29	13	1	2	8	13	58	100	248
Mexico	334	643	741	1,728	590	1,477	2,026	2,342	2,826	4,390	17,097
Nicaragua	11	13	63	20	—	6	16	57	55	56	297
Panama	3	8	11	39	6	40	34	27	35	111	314
Paraguay	13	—	9	—	—	—	—	8	12	25	67
Peru	448	179	78	129	89	140	198	380	253	439	2,333
Uruguay	74	203	308	263	127	37	112	318	336	871	2,649
Venezuela	138	313	280	198	64	189	446	519	765	2,105	5,017
Totals	6,195	3,854	3,482	4,519	1,514	2,431	3,768	5,878	9,565	19,935	61,141

Source: Foreign Commerce and Navigation of the United States, US Department of Commerce, 1938-1947.

TABLE II-1 (B)

Value of tractors exported by the United States to Latin America, 1938-1947

(In thousands of US dollars)

	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1938-1947
Argentina	4,875.2	1,322.0	927.1	444.4	21.9	—	—	73.1	1,679.7	11,565.4	20,908.8
Bolivia	29.8	56.7	37.6	121.3	72.1	47.1	99.6	146.8	317.5	221.3	1,149.8
Brazil	827.5	1,003.7	577.0	943.5	285.1	762.3	234.3	1,079.6	2,125.7	4,682.3	12,521.0
Colombia	264.0	649.0	378.2	322.6	85.7	116.5	431.4	923.8	867.7	2,007.4	6,046.3
Costa Rica	43.5	274.6	1.6	70.1	28.3	21.5	77.6	108.4	160.0	135.7	921.3
Cuba	116.4	162.8	168.7	371.8	330.5	164.2	422.6	97.7	996.0	2,055.8	4,886.5
Chile	274.1	363.1	818.4	861.1	221.4	20.5	221.4	515.9	1,088.3	1,331.4	5,715.6
Dominican Rep.	72.0	46.9	50.7	17.3	2.2	76.0	61.2	28.8	154.8	452.6	962.5
Ecuador	65.5	152.6	77.7	95.7	7.4	41.7	89.7	402.1	392.0	353.0	1,677.4
El Salvador	3.0	24.0	4.7	3.8	4.0	2.6	33.3	97.6	139.5	204.1	516.6
Guatemala	25.4	90.6	70.2	15.2	59.6	92.3	31.7	143.1	157.1	300.5	985.7
Haiti	2.1	9.4	—	12.3	—	13.2	25.0	19.5	0.3	44.5	126.3
Honduras	38.1	25.5	54.2	17.1	2.8	22.1	17.6	23.9	102.1	270.8	574.2
Mexico	512.5	781.8	911.5	2,341.8	774.9	1,964.9	2,247.9	2,678.5	4,360.3	6,900.0	23,474.1
Nicaragua	29.2	35.3	181.1	41.2	—	20.5	153.9	91.0	105.0	179.7	836.9
Panama	9.5	14.9	50.0	60.8	7.8	42.6	84.9	74.8	86.7	260.9	692.9
Paraguay	16.3	—	47.7	—	—	—	—	21.1	24.8	88.5	198.4
Peru	607.5	268.5	101.9	211.2	133.8	145.2	239.2	650.7	495.1	826.2	3,679.3
Uruguay	64.2	192.6	405.5	248.4	96.8	134.0	136.7	329.1	391.9	980.2	2,979.4
Venezuela	379.0	696.0	610.2	501.0	120.6	164.0	148.1	984.1	1,789.6	4,668.8	10,679.4
Totals	8,254.8	6,170.0	5,474.0	6,700.6	2,254.9	3,851.2	4,756.1	8,489.6	15,434.1	37,529.1	99,532.0

Source: Foreign Commerce and Navigation of the United States, US Department of Commerce, 1938-1947.

TABLE II-2

Value of United States exports of farm machinery other than tractors to Latin America, 1938-1947

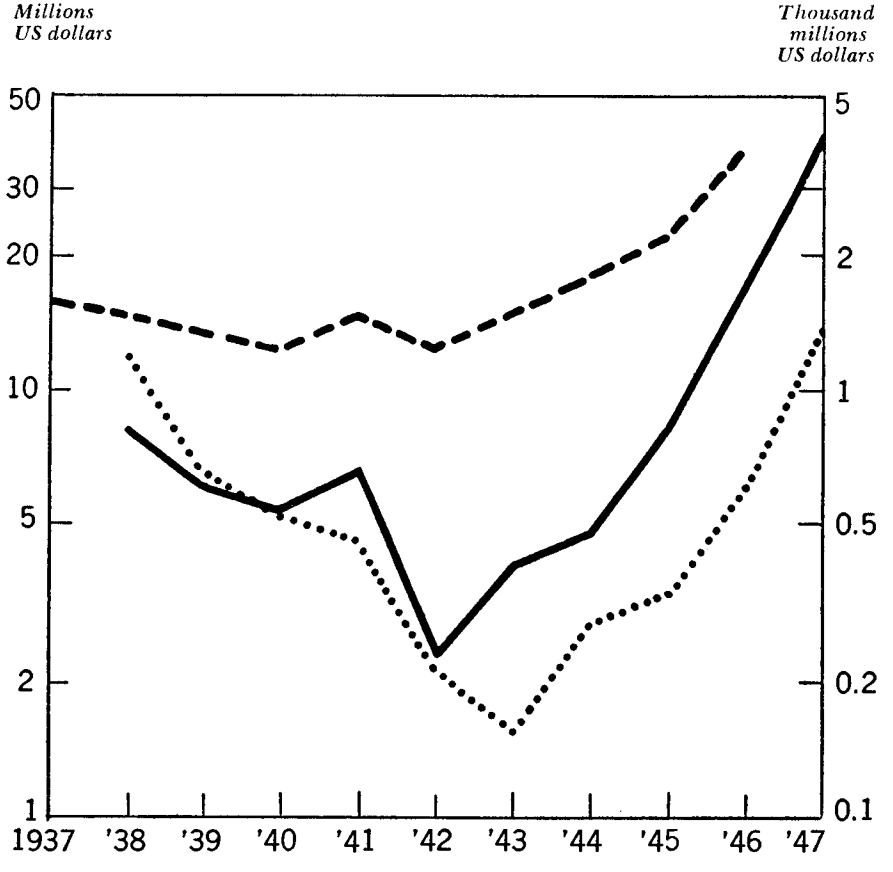
(In thousands of US dollars)

	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1938-1947
Argentina	7,729.9	4,268.7	2,453.9	642.2	219.9	0.1	0.6	124.7	705.3	3,704.6	19,849.9
Bolivia	30.6	19.2	31.0	54.6	29.4	52.3	28.8	15.2	33.5	26.4	321.0
Brazil	485.0	385.7	198.3	185.6	86.0	121.3	159.5	148.9	328.0	1,267.2	3,365.5
Colombia	179.8	173.4	217.3	222.3	80.1	96.0	157.4	144.9	315.0	636.8	2,223.0
Costa Rica	9.0	12.3	14.1	34.2	31.7	8.0	27.9	35.3	34.0	159.9	366.4
Cuba	68.3	92.1	127.8	221.6	204.4	150.2	137.5	109.6	241.9	671.3	2,024.8
Chile	249.2	235.1	679.3	876.4	145.7	68.2	300.2	539.4	563.5	1,144.1	4,801.1
Dominican Rep.	33.0	39.7	20.9	14.6	13.8	22.5	106.9	44.1	76.7	99.9	472.1
Ecuador	20.9	37.3	39.0	33.9	13.0	25.5	20.1	41.3	121.9	108.5	461.4
El Salvador	7.9	10.7	6.7	8.4	2.3	4.1	11.4	30.0	38.3	129.9	249.7
Guatemala	32.4	14.1	16.5	30.4	5.4	8.4	17.0	31.0	35.2	71.4	261.8
Haiti	5.7	5.2	9.9	30.0	30.6	3.3	7.9	2.5	7.7	16.4	119.2
Honduras	17.1	7.0	11.5	23.2	3.1	3.0	9.7	33.4	56.9	63.0	227.9
Mexico	629.8	751.3	737.2	1,411.3	970.1	686.1	1,430.7	1,339.2	2,255.3	3,123.3	13,334.3
Nicaragua	2.6	11.6	37.2	17.8	2.8	12.2	14.6	23.9	38.5	59.3	220.5
Panama	11.3	7.1	10.1	31.4	34.3	33.6	35.9	24.4	49.9	56.0	294.0
Paraguay	3.3	1.3	0.4	1.3	2.8	18.0	20.7	47.3	55.8	20.5	171.4
Peru	143.2	136.6	108.8	106.7	49.9	36.7	103.5	63.5	151.6	338.5	1,239.0
Uruguay	466.8	228.2	356.6	213.3	239.7	101.8	54.2	156.2	228.2	866.7	2,911.7
Venezuela	103.6	172.8	197.5	179.1	71.7	122.7	238.3	163.1	540.9	913.3	2,703.0
Totals	10,229.4	6,609.4	5,274.0	4,338.3	2,236.7	1,574.0	2,882.9	3,117.9	5,918.1	13,479.0	55,617.7

Source: Foreign Commerce and Navigation of the United States, US Department of Commerce, 1938-1947.

CHART II-1

Latin-American imports of tractors and farm machinery from the United States, 1938-1947



Note. Total imports, Latin-American trade ▬▬▬
Tractors ▬▬▬
Agricultural machinery, other than tractors .....

Source: Foreign Commerce and Navigation of the United States, US Department of Commerce, and statistics of the Economic Commission for Latin America.

We have reproduced [4] a graph showing the comparison between total imports (in US dollars) with imports of farm machinery during the same period. The trends in the two are similar, but the variations are more marked with regard to farm machinery due to the fact that international trade in this commodity, in addition to having been affected by the war, is very sensitive to a series of other factors.

In the first place, imports of farm machinery are influenced to a large extent by the policy of Governments. Governmental irrigation or mechanization projects have, in the last few years, caused changes in the trends of imports, in many Latin-American countries. In Mexico, the Government is carrying out large irrigation works coupled with mechanization of the irrigated areas (*c.f.*, chapter on "Programmes for Increasing the Area under Cultivation"). At the time the Joint Working Party visited Mexico, it was stated by the *Dirección General de Distritos de Riego* that 3,000 tractors, as well as farm and transport equipment, were needed for the upkeep and mechanization of the irrigated districts. In Venezuela, the Ministry of Agriculture is endeavouring to open up 89,000 hectares of new land for cultivation. Approximately 2,000 tractors with related equipment will be needed for land-clearing and agricultural operations. In Brazil, the SALTE Plan provides for the purchase of 1,000 tractors each year for five years for the mechanization of areas under cultivation.

A second factor which influences the import of farm machinery is foreign exchange. The Central American countries which, in 1947, had no balance-of-payments difficulties (El Salvador, Guatemala and Honduras) imported more than eight times as many tractors (in value) in 1947 as in 1938, whereas the two other Central American republics which were experiencing balance-of-payments difficulties in 1947, imported only five times as many. Countries facing grave balance-of-payments difficulties import little more farm machinery now than before the war. Peru, for instance, has imported fewer tractors in 1947 than in 1938, at slightly higher value. The Argentine is no longer the most important importer of farm machinery from the United States due, in part, to balance-of-payments difficulties.

Thirdly, the price paid for farm products has a particularly important influence on imports of farm machinery. The fact that farm machinery is used primarily for the production of certain basic commodities like wheat, makes even closer the relationships between prices of commodities and farm machinery imports.

Other factors influence the trade in farm machinery: the inflationary pressures conducive to higher imports of luxury goods and the farm machinery credit situation. On the whole, however, these are intimately related to the three main factors mentioned above.

[4] From *Economic Survey of Latin America*, chapter VII, "Foreign Trade".

The increased use of wheel tractors—particularly of the small, field-crop type suitable on small farms—is one of the most encouraging features of mechanization in Latin America.[5]

Imports of wheel tractors in 1947 were nearly four times higher than in 1938. Imports of track-laying tractors were merely one-fifth higher than before the war.

This trend is not accidental. As shown in table II-3, the war period was marked by a sharp decrease in the percentage of imports of track-laying tractors and an increase of the proportion of wheel tractors. This may have been due, in part, to the acute supply shortage of heavy equipment during the war. A persistent shortage still exists and deliveries of this type of machines continue to be slow.

Further, wheel tractors are generally less powerful, cheaper and easier to manage than the track-laying type. The latter were used in the early days of mechanization in Latin America for opening up new lands and for certain specific heavy-duty operations on large holdings. They are still used for those purposes. Changes in the average unit horse power of this type indicate that the high power, very costly models are preferred.

For wheel tractors, on the contrary, the average horse power per tractor has diminished steadily since 1938. The preferences for these less powerful machines shows that they are gradually getting on to smaller farms and are being used more for the food crops generally produced on medium and small holdings. The successful appearance, in 1945-1947, on the Latin-American market, of the horticultural or garden-type tractor for the mechanization of small farms and gardens is another indication of the increasing popularity of the small tractor.

TABLE II-3

Percentages of wheel and track-laying tractors and average h.p. per tractor of each type imported from the United States in 1938-1941, 1942-1945 and 1946-1947

Period	*Wheel tractors*		*Track-laying tractors*	
	Per cent of total imports	*Average h.p.*	*Per cent of total imports*	*Average h.p.*
1938-1941	67	25.5	32	34.9
1942-1945	85	23.4	15	40.2
1946-1947	87	19.3	13	41.8

Source: Foreign Commerce and Navigation of the United States, US Department of Commerce.

[5] A detailed breakdown by countries of destination of the imports from the United States of carburetor and injection type track-laying and wheel tractors is shown in appendix A.

In the light of the foregoing, it can be concluded that the use of motor draft power is spreading rapidly in Latin America. Unfortunately, this cannot be said for farm machinery and equipment other than tractors.

It must be remembered that in Latin America, draft power is overwhelmingly animal. The total number of motor draft power units is approximately 400 thousand against approximately 42.2 million animal units. This proportion must constantly be borne in mind when considering the immediate future of Latin-American agriculture.

The Joint Working Party considers that great benefit would result from improvements in hand and animal operated implements. Archaic implements such as the chaqui-taclla plough of Peru and Bolivia, the Egyptian plough and the hoe—used all over the region—the cuma of El Salvador and the machete of the Caribbean area should be replaced by such simple, modern steel, animal-drawn, walking-type implements as moldboard ploughs, planters, cultivators, mowers, etc.

4. SYSTEMS OF PURCHASE AND DISTRIBUTION

Latin-American Governments have, during the last few years, tended to assume more responsibilities in the importation and distribution of farm machinery. This tendency is due in part to a world wide movement, more specifically to three important phenomena in the economic development of this region.

The war brought an acute supply shortage of farm machinery and equipment. For the Latin-American Governments, it became a matter of official policy to ensure the best distribution possible of the reduced availabilities.

The second influence on import policies stems from increased government interest in stepping up agricultural production, particularly foodstuffs. Devices have been found to facilitate imports of farm machinery and ensure their distribution.

Thirdly, Governments have had to face, especially during the last two years, balance-of-payment difficulties, which have led them to control, in one way or another, imports of farm machinery along with other classes of imports.

In general terms, Governments have intervened either by importing farm machinery themselves or by creating semi-governmental organizations for their purchase and distribution.

The Joint Working Party found no Government in Latin America which took charge of all imports of farm machinery. Where they have taken charge of the import of certain items for a specific purpose, they have left importing agents as normal distributors for all other purchases.

In Costa Rica, for instance, the Government earmarked $US 600,000 for the purchase of farm machinery to increase the area of rice under

cultivation. Departments of agriculture in Guatemala, El Salvador, Cuba, Bolivia and the Dominican Republic have also bought farm machinery for the purpose of establishing or improving farm machinery services. These are isolated instances and are not to be considered as examples of structural changes in the systems of imports and distribution.

The Republics have adopted two broad categories of organizations to procure and distribute equipment to farmers. In the first, special organizations have been created to develop agriculture and industry, and to give credit facilities, either directly or through banks. Such is the case in Argentina (IAPI), Venezuela (*Corporación Venezolana de Fomento*) and Chile (*Corporación de Fomento*).

In other cases, government-controlled credit institutions broaden their functions to make possible direct purchases of machinery for distribution to the farmers. Such is the case in Nicaragua (*Banco Nacial de Nicaragua, Departamento de Importación y Exportación*). Paraguay (*Banco del Paraguay, Departamento Agrícola*), and Colombia (*Crédito Agrario, Industrial y Minero de Colombia*).

The following exemplify two typically different methods.

In Chile, the *Corporación de Fomento* has obtained a four to six and a half year loan from the Export-Import Bank and the International Bank, guaranteed by the Chilean Government at an interest varying from 3.5 to 4 per cent per annum. With these funds the *Corporación* buys farm machinery in the United States. The imported machinery is distributed through normal channels. The authorized agents of the exporting firms sell it to the farmers at prices fixed by the *Corporación* at cost, plus 20 to 25 per cent (according to the type of machinery) which represents the commission of the distributors. The latter are obliged to maintain repair shops and spare parts at fixed prices according to the norms fixed by the *Corporación*. The *Crédito Agrario, Industrial y Minero de Colombia* makes the direct purchases in the United States and sells directly to farmers who are given special credit facilities.

One of the main difficulties which arises in connexion with imported machinery is that of maintenance. Many machines become useless for long periods of time owing to lack of spare parts or insufficient repair shops. To meet this difficulty, Chile, for example, has made the establishment of repair shops and replacements of spare parts the responsibility of the distributors, under the supervision of the *Corporación de Fomento*. Other Governments, either directly or through the semi-governmental organizations concerned, import spare parts together with the farm machinery. Costa Rica, among others, has installed government controlled repair shops.

The structural changes here enumerated constitute one of the most important developments in the evolution of purchasing and distribution systems in Latin America. The importance of the local distributors re-

mains great, but Governments also exercise a growing influence on the trade in farm machinery through exchange controls and customs regulations.

Countries such as Bolivia, Colombia, Ecuador and Uruguay, which grant the most favourable rates of exchange are thus fostering imports of farm machinery, as a differential rate influences not only the f.o.b. price of machinery but c.i.f. price, custom duties, dealers' margins and related costs.

Countries such as Argentina and Chile, though permitting the import of farm machinery at an official rate do not give it the most favourable rate of exchange, as is shown in table II-4.

Customs duties on farm machinery are generally low, but other levies such as statistical fees are sometimes important. In the Argentine, for instance, theoretically no duty is imposed on farm machinery, but there does exist an "additional" tax of 10 per cent on the appraised value *(aforo)* and a 3 per cent statistics tax.

A similar situation exists in Brazil, but here the Government is examining the possibility of exempting tractors under 45 h.p. from all taxes and duties.

In Bolivia, customs duties on farm machinery are based on a 2 per cent *ad valorem* (c.i.f.) tax but there is an additional tax of 160 per cent on this *ad valorem* tax.

In Mexico, the customs duties are 0.04 Mexican pesos per kg. (gross weight) both for tractors and farm machinery.

TABLE II-4

Rates of exchange applicable to farm machinery in selected countries, October 1948

(National currency per US dollar)

	Rate of exchange applicable to imports of farm machinery	*Lowest official rates of exchange*	*Free exchange or curb*
Argentina	4.230	3.730	— [b]
Bolivia	43.420	42.420	93.66
Chile	43.100	19.470	67.05
Colombia	2.001	1.755[a]	2.75
Ecuador	15.040	13.500[a]	18.53
Peru	6.500	6.500	14.46
Uruguay	1.899	1.899	2.31

Source: International Financial Statistics, I.M.F., 1949.

[a] Lowest exchange with tax.

[b] Not available.

Chile had one of the highest customs duties in Latin America (26 per cent on c.i.f. value for tractors, 29.5 per cent on combines and 58 per cent on spare parts). This situation has lately changed following tariff negotiations with the United States.

Other elements also heavily influenced the purchase and distribution of farm machinery. The Joint Working Party has been impressed by the high cost of distribution of farm machinery, particularly of spare parts.

Freight rates, whether inland or ocean, frequently amount to 20 per cent of factory cost. Dealers' margins on tractors vary from 20 to 40 per cent. Instances have been noted in which the costs of spare parts from the factory to farmer were higher than the f.o.b. factory prices.

5. STATE AND PROSPECTS OF MECHANIZATION IN LATIN AMERICA

Table II-5 shows the state of mechanization in Latin America and the theoretical possibilities for future expansion.

Farm machinery is used primarily for raising crops which yield high returns. In the southernmost countries, especially the Argentine, these are mainly food crops. Wheat production is mechanized in this area and harvesting operations are carried on almost entirely with the help of machinery. Further north the crops that receive the highest degree of mechanization are sugar-cane and cotton. Maize, the basic food of the region and covering the widest area, is hardly mechanized at all.

Within the region there are wide variations in the degree and intensity of mechanization.

The number of hectares of cultivated land per tractor in use, which are a measure of the degree of mechanization, range from 9,500 hectares in Haiti to 180 hectares in Venezuela.

The number of hectares worked by each tractor during a crop year, and the number of hours of work per tractor, both of which are measures of the intensity of mechanization, also vary considerably from country to country. In Mexico, for instance, tractors work on an average of 1,000 hours per annum and cultivate 66 hectares of land. In the Argentine they average 1,200 hours a year and cultivate 240 hectares. This tends to prove that tractors are used for a larger number of operations in Argentina than in Mexico.

In general, however, mechanization is not intensive in this region, compared to the United States. The Joint Working Party has noted that tractors are used in most instances for a limited number of operations, generally of a heavy duty nature. This is important, for the economy of mechanization depends upon the number of operations performed

TABLE II-5

Number of tractors, area under cultivation and possibilities of mechanization

	No. of tractors	*Average h.p. per tractor*	*Total h.p. available*	*Area under cultivation (1,000 has.)*	*Has. of cultivated land per tractor*	*Mechanized area (estimated in 1,000 has.)*[a]	*Possible expansion of mechanized area (1,000 has.)*[a]
Argentina	18,777	23.5	441,125	23,232	1,237	4,097.0	11,623
Bolivia	579	26.8	13,517	342	690	20.0	116
Brazil	4,672	26.5	122,615	15,360	3,287	922.0	5,172
Colombia	2,795	28.7	80,216	2,709	969	271.0	812
Costa Rica	392	28.9	11,270	430	1,096	30.2	141
Cuba	3,515	25.2	88,578	1,970	560	261.0	881
Chile	4,143	26.0	107,718	2,043	493	511.0	510
Dominican Republic	297	27.2	8,091	680	2,289	24.5	111
Ecuador	549	30.2	16,577	732	1,333	29.0	153
El Salvador	298	27.1	8,114	773	2,451	29.2	190
Guatemala	631	22.5	14,197	992	1,572	62.1	235
Haiti	44	27.0	1,191	420	9,545	3.1	80
Honduras	233	26.1	6,095	380	1,630	17.4	96
Mexico	17,035	24.0	408,840	7,394	434	1,109.0	3,327
Nicaragua	255	30.5	7,774	500	1,960	19.5	330
Panama	268	24.0	6,433	122	455	17.7	31
Paraguay	55	27.8	1,530	334	6,072	5.2	61
Peru	2,343	27.5	64,432	1,516	453	182.0	303
Uruguay	2,890	25.0	72,250	1,480	512	444.0	740
Venezuela	4,403	23.0	101,575	730	180	240.0	125
	64,174	24.7	1,584,134	62,139	967	8,294.9	25,037

Source: Foreign Commerce and Navigation of the United States, US Department of Commerce; and official statistics of the Latin-American countries.

[a] These are estimates based on available information which was carefully studied by the Joint Working Party. They are submitted as representing the nearest approximation which can be obtained at this time. More accurate estimates of mechanization could be made only on the basis of complete surveys of land use and land use possibilities.

by the tractor. In many cases the cost of tractors cannot be amortized by the Latin-American farmer because they are not used to maximum advantage.

A distinction must be made between long and short term prospects for mechanization. The region as a whole is in the first stages of mechanization, it has vast agricultural resources and potentialities, and being sparsely populated, is particularly suitable for labour-saving farm machinery.

The need for farm machinery can vary considerably according to the area under cultivation. At present, approximately 3 per cent of Latin America is under cultivation. Expansion depends on many factors, primarily on government policies. To open up new territories is beyond the power of individuals and therefore requires co-ordinated action.

Irrigation and colonization are in great part the concern and responsibility of Governments. A series of Mexican Government irrigation projects of a magnitude unparalleled in this region creates new needs and increases imports into this country. The principal projects undertaken by the Latin American Governments are listed in chapter VI. These show that the development of irrigation projects considerably stimulates the need for farm machinery, in the opening up of new lands and in their later cultivation.

The Joint Working Party feels, however, that it cannot make an assessment of the amount of machinery to be imported for the carrying out of these programmes. Capital is the main factor here; investment needs fall outside the purview of this report. The Joint Working Party nevertheless believes that an investigation of this kind would be highly advantageous.

The theoretical motor draft power needs of Latin America in order to mechanize the area now under cultivation can be estimated. In the light of available information it is estimated that three times the present area could be mechanized. In terms of tractors—provided they would perform the same kind of operations—this would mean approximately 180,000 tractors of 25 h.p. or a total of 4,500,000 h.p. The Joint Working Party stresses that such an estimate is contingent on a number of assumptions: (1) that the number of hectares cultivated, per tractor, in the different countries will not vary; (2) that the use of tractors will not be more intense in the future than it is now, i.e., that they will be used primarily for heavy duties.

The sudden changes which can occur in the market, the overwhelming influence exercised on demand by prices paid to farmers, internal credit and other government policies make any precise prophesy impossible. According to the dealers consulted by the Joint Working Party annual imports of a volume comparable to 1947 would satisfy the present demand.

6. CONCLUSIONS AND SUGGESTIONS

A. The most striking recent event in Latin-American agriculture is the rapid progress of motor draft power. In many places the tractor or the most modern harvester has replaced primitive hand tools. From this praiseworthy process great results have been achieved.

The Joint Working Party feels, however, that the evident advantages of motor draft power must not divert the attention of Governments and of farmers from the manifold advantages to be gained by improvement of simple animal-drawn walking-type implements.

The production of food is carried on in an overwhelming proportion on small and medium-size subsistence farms, where methods of cultivation are often archaic. As mechanization proceeds, it is imperative to make known and available to the farmer all simple and improved implements.

B. In order to achieve this result, Governments must give help to the farmers:

(i) By extending better credit facilities;

(ii) By lending machines to them;

(iii) By bringing to the farm the results of research through itinerant instructors and all other forms of extension services.

The Joint Working Party commends to Governments the methods that have been adopted and suggests that they communicate to each other the results of their experience, as well as to ECLA and FAO in order that these organizations report on the different systems of farm machinery services in this and other regions.

C. The Joint Working Party has noted that, in many areas, tractors were only used for a limited number of operations, whereas the economy of mechanization lies in their full use. In most cases this is due to incomplete mechanical knowledge of tractor operation. The number of schools for operators is not sufficient, especially if imports follow the present trend. The number of such schools should therefore be increased.

D. The maintenance of farm machinery has been made particularly difficult during the war due to shortages of spare parts. Now that the market is becoming normal, special attention should be given to this problem, especially when new projects for mechanization are undertaken.

Maintenance relates not only to the availability of spare parts but also to the number and location of repair shops—particularly in rural districts—and to the training of mechanics. It is suggested that Governments should favour the establishment of repair shops and training facilities for mechanics.

E. Considering the general foreign exchange situation in Latin America, it is probable that, in the short run, Governments will exercise an increasing influence on imports of farm equipment. Whether this

will continue to hamper procurement over the next few years will depend principally on whether necessary priority is given to these goods, under exchange regulations and as regards their purchase and distribution. The Joint Working Party suggests that Governments should consider the problem of mechanization as a whole and take co-ordinated measures within their countries, and among them, in order to ensure the success of mechanization in Latin America.

CHAPTER III

Fertilizers

Soil experts are generally concerned about the fact that land in many regions of Latin America is not compensated by use of fertilizers for the plant nutrients absorbed by the crops. Estimates made in the Argentine, for instance, show that the agricultural products exported during the years 1939-1940, contained an average of 250,000 metric tons of N, 127,000 metric tons of P 205, and 56,000 metric tons of K 20. This is a considerable export of phosporous and potassium; the export of nitrogen is less serious because it is offset by accumulation of nitrogen in the extensive alfalfa pastures.

Dr. A. Boerger, in a study published in Uruguay in 1948, draws attention to the progressive loss of phosphates and calcium extracted in the form of meat and cereals, and by the irrational use of the soil.

In tropical regions where heavy rains occur, or where sandy soils can be cultivated by means of irrigation, the shortage of nitrogen soon becomes evident, because the organic matter is either originally lacking or is rapidly burned. In some areas of Brazil (Caiua) a drop of 95 per cent in the humus content of the soils has been noted after only 2 years of cultivation. In the sandy or semi-sandy soils of Peru which are brought under cultivation by means of irrigation, the use of nitrogenous fertilizers is indispensable from the outset.

These facts show that the use of fertilizers has become a major problem in Latin America. Although a complete estimate is impossible because the data are inadequate, the information obtained by the Joint Working Party suffices to substantiate some general observations.

1. SOIL DEFICIENCIES AND LACK OF FERTILIZER USE

There is a scarcity of nitrogen in the greater part of the cultivated area of Latin America, but, with very few exceptions, it is impossible to determine its exact proportion. Except in areas which have been intensely cultivated for many years, replacement of the nitrogen absorbed by crops does not seem to be one of the major problems. This is because, among other reasons, farmers cultivate new lands, rotate legumes

with other crops, follow the ancestral practice of inter-planting legumes with other crops, or let the land lie fallow for as long as 7 years after one or two harvests. Furthermore, certain Latin-American countries possess considerable natural sources of nitrogen, such as the Chilean deposits and the guano islands off Peru.

Of phosphorus, it is generally agreed there is a deficiency in most of the cultivated soil. In such important agricultural countries as the Argentine, Brazil, Chile, Mexico and Uruguay, experts consider this a problem of the greatest urgency. In Uruguay, an analysis of 369 samples of soil from different districts showed that 80 per cent were lacking in phosphorus.[1] The only unaffected regions are possibly some of the coastal valleys of Peru, where long use of guano has built up a reserve of this element.

Potassium is also lacking in many soils, though not to such a marked degree as phosphorus. Experiments in sugar-cane production in the Dominican Republic show that the highest yields can only be obtained through the use of formulas including nitrogen, phosphorus and potash. To obtain good yields in Peru, the guano should be mixed with potash fertilizers. In Chile, on the contrary, experiments made with wheat in thirteen different zones, demonstrated that soils show no response to the addition of potash. Experiments in Mexico show that most of its soil contains adequate reserves of potassium for maize cultivation.

A basic lack of calcium has been noted in the tropical and sub-tropical lowlands of South and Central America, and Mexico, as well as in the temperate zones of southern Chile. In the cattle-breeding regions of the Argentine, Uruguay and Brazil, the progressive lack of calcium together with the lack of phosphorus has harmful effects on the health of the breeding stock (osteomyelitis). In Uruguay 95 per cent of 294 soil samples showed a severe deficiency of calcium. Lack of calcium is not felt in the lands fertilized with organic matter rich in calcium, nor apparently in the highlands of the countries under examination. Fortunately, in the majority of cases, calcium deficiencies are easy to correct.

Data on the availability of minor mineral soil are insufficient, but judging by the experiments carried out in other parts of the world, it would be surprising if these were adequate in intensively cultivated soils.

Erosion is causing the loss of top soil in considerable areas of Latin America, though it has not yet reached catastrophic proportions.

Restoration of Nitrogen, Phosphorus and Potassium

In Latin America, the plant nutrients used by crops are not being restored to the soil. This is a characteristic feature of the agriculture of the region. It would be difficult in any part of the world for farming

[1] *Tierras y Fertilizantes*, Andres Aguirre Arregui, Montevideo.

to be carried on economically with such small amounts of fertilizer as are used in this area. This is proved in table III-1, which shows the approximate amounts of N, P 205 and K 20 reincorporated in the soil.

TABLE III-1

Total consumption and theoretical average replacement of N, P_2O_5 and K_2O per cultivated hectare in the Latin-American countries

(Annual average for the years 1946/1947)

	Area cultivated yearly (thousands of hectares)	*Total consumption of fertilizer elements (thousands of M.T.)*			*Average theoretic replacement per hectare (kilos)*		
		N	*P*	*K*	*N*	*P*	*K*
Argentina	23,232	5.7	6.1	1.0	0.24	0.26	0.04
Bolivia	342	[a]	—	[a]	0.06	—	0.02
Brazil	15,360	12.1	21.0	7.1	0.79	1.37	0.46
Colombia	2,709	0.5	0.4	1.7	0.18	0.15	0.63
Costa Rica	430	0.7	0.3	0.4	1.63	0.70	0.93
Cuba	1,970	6.8	12.7	4.5	3.45	6.45	2.28
Chile	2,043	7.6	16.2	5.1	3.72	7.93	2.50
Dominican Rep.	680	0.2	0.2	0.2	0.29	0.29	0.29
Ecuador	732	0.1	—	0.1	0.14	—	0.14
El Salvador	773	0.3	0.3	0.6	0.39	0.39	0.78
Guatemala	992	0.8	0.2	0.2	0.81	0.20	0.20
Haiti	420	—	—	—	—	—	—
Honduras	380	0.7	0.9	0.9	1.84	2.37	2.37
Mexico	7,394	3.9	1.4	0.7	0.53	0.19	0.09
Nicaragua	500	[a]	[a]	[a]	0.01	[b]	[b]
Panama	122	0.2	0.1	0.2	1.64	0.82	1.64
Paraguay	334	[a]	—	[a]	[b]	—	[b]
Peru	1,516	29.3	16.0	4.0	19.33	10.55	2.64
Uruguay	1,480	0.8	2.8	0.1	0.54	1.89	0.07
Venezuela	730	0.3	0.1	0.5	0.41	0.14	0.68
Total	62,139	69.9	78.7	27.3	1.12	1.27	0.44

Source. Estadísticas de Importación, Corporación de Ventas de Salitre y Yodo, and data on production collected by the Joint Working Party. (For further details see appendix B.)

[a] Less than 50 tons.

[b] Less than 10 grammes.

The Latin-American average for nitrogen is approximately equal to that of Asia (excluding Japan). Moreover, totals shown for nitrogen, phosphorus and potassium are insignificant if compared with those consumed in Europe, where, in the agricultural year 1946-1947, they reached a total of 1,174,000 metric tons, 1,615,000 metric tons and 1,536,000 metric tons respectively.

2. PRINCIPAL FACTORS IMPEDING THE USE OF FERTILIZERS

The factors impeding the use of fertilizers are many. Some are of an economic nature, such as the low price of produce, the high price of fertilizer or the excessive cost of transportation. Others are specific, such as short supply, lack of adequate experimentation, or farmer ignorance of fertilization practices. Finally, the fertilizers may prove of no advantage if the methods of cultivation are unsuitable, if there is not enough moisture in the soil, or if the seed is of poor quality. Unless some of these factors are eliminated or modified, the use of fertilizers in many places is practically impossible.

Low Prices of Farm Products

The low price of farm products, especially basic foodstuffs, constitutes one of the main difficulties in the way of the widespread use of fertilizers. Data collected by the Joint Working Party show that in some cases a substantial increase in yield was not sufficient to cover the cost of the fertilizers used.

Experiments conducted in Central America show that in one area, with corn at $US 0.07 per kg., an increase of 770 kg. in yield does not pay the cost of commercial fertilizers. In another area, with corn at $US 0.02 per kg., an increase of 1,200 kg. in yield did not pay for the use of commercial fertilizers.

High Cost of Fertilizers

Even when the price obtained for produce is not low, the price of fertilizers may sometimes prove too high to justify its profitable use. This may be due to the high cost of both land and sea transport, import duties, or the excessive profits of dealers.

Table III-2 shows the price per unit of N, P 205, and K 20 in eight countries of Latin America in 1948. Wholesale prices in the United States during the same year averaged $US 3.10 per 10 kg. of nitrogen in the form of sodium nitrate; $US 2.48 per 10 kg. of nitrogen in the form of ammonium sulphate; US$ 0.84 per 10 kg. of P 205 in the form of superphosphate and $US 0.41 per 10 kg. of K 205 in the form of potassium chloride.

Conversion into dollars, for purposes of comparison, renders these figures less accurate than when expressed in local currency. However, except in Chile and Peru (the two most important producers of fertilizers), Latin-American farmers are at an obvious disadvantage as regards the price of fertilizers, when compared with farmers in the United States. This would be still more evident if a comparison were made of the corresponding price levels of agricultural produce.

When the fertilizer is sold as a mixture, the farmer often has to pay prices far higher than those quoted, in some cases 70 per cent higher. Furthermore, the prices quoted in table III-2 apply to the principal distribution centres, they do not include handling and transportation expenses incurred before reaching the farmer.

TABLE III-2

Prices per unit of N, P_2O_5 and K_2O in eight countries of Latin America in 1948

(In U.S. dollars per unit of 10 kg.[a])

	Nitrogen in sodium nitrate	*Nitrogen in ammonium sulphate*[b]	*P_2O_5 in calcium superphosphate*[b]	*K_2O as potassium chloride*
Argentina	7.10	8.03	5.57[c]	3.90
Brazil	4.75	6.50	3.70	2.35
Cuba	5.00	4.00	1.90	1.80
Chile	2.30	—	0.36	0.35
El Salvador	4.77	—	2.80	1.45
Mexico	6.33	—	1.60	1.45
Peru	4.04	2.20	0.63	1.70
Venezuela	6.12	—	5.97	2.00

Source. Collected by the Joint Working Party.

[a] The following rates were used for the conversion into dollars: Argentina, 4.23 per dollar; Brazil, 18.72; Chile, 43.10; Cuba, 1.00; Mexico, 6.91; Peru, 6.50; El Salvador, 2.51; Uruguay, 1.90 and Venezuela, 3.35.

[b] The per unit prices in Peru refer to nitrogenous guano and phosphate guano respectively.

[c] Price of imported superphosphate. The average price per unit of P_2O_5 in the form of bone meal is only $US 1.65.

The highest prices are found in the Argentine, Venezuela and Brazil. In Peru, the price of guano can be considered a government subsidy to the farmers. In 1948 guano was sold locally at 178.00 soles per metric ton, at the same time that it was quoted at 650,000 soles per metric ton in the foreign market. Furthermore, these prices include from 8 to 12 per cent of P 205, contained in nitrogenous guano. A similar situation doubtless exists for Chilean farmers as regards nitrate.

A drop in the price of potassium fertilizers can be expected as soon as supplies are resumed from European sources. Potassium chloride from this area is already being offered at prices considerably lower than those quoted above.

The cost of ocean and inland transportation is an important factor in the high price of fertilizer. A ton of Chilean nitrate was quoted at

$US 54.50 c.i.f. New York at the end of 1948; at $US 77.25 in La Guayra, Venezuela; and at $US 71.50 in Buenos Aires, Argentina. In the state of Sao Paulo, Brazil, railway freight rates for a ton of fertilizer over a distance of only 200 km. increased its price by 12 per cent. The situation is much worse in those parts of Brazil where transportation is poor. In Venezuela, transport costs may add as much as 250 bolivares ($US 74.30) per metric ton to the original price. For nitrate, this amounts to 75 per cent over the quotation in Caracas. In Mexico, freight rates in regions possessing the best communications, and over relatively short distances (such as from the Federal District to farms in Villa Victoria, near Toluca), may increase the price by 10 per cent. Though essential to the principal zones of the Argentine plains, the application of lime is limited by the high cost of transport from the main source near Cordoba.

Inadequate Moisture

The scarcity or irregularity of rainfall is another seriously limiting factor. This is all the more important in that the percentage of irrigated land, or land with sufficient rainfall evenly distributed throughout the year, is relatively small. However, some confusion is found amongst farmers on this subject. On the Mexican plateau, it was long thought that fertilizers would be useless due to the insufficiency and irregularity of the rainfall. Experiments made in 1945 by the *Oficina de Estudios Especiales de la Secretaría de Agricultura de México* have shown considerable increases in yield through the addition of nitrogen. The average yield increase of maize was 912 kilos per hectare with an application of 40 kilos of N and 1,227 kilos with an application of 80 kilos. In some cases, the second dose of 40 kilos of N failed to result in an increase due to such other factors as unsuitable seed or poor methods of cultivation, Applications of phosphorus increased the yields by 22 and 60 per cent, respectively, while the addition of potash had little or no results.

No general conclusions can be drawn from these experiments, but they show that adequate research on the relationship of water and nitrogen could contribute to a greater use of fertilizers in certain areas of Latin America.

Supply

Although both production and imports of fertilizers have increased materially during the last 10 years, there is no doubt that the potential demand of Latin America cannot be met by the present supplies. A typical example is found in Peru where farmers can obtain only 50 per cent of their nitrogen requirements. Table III-3 shows the stated requirements of nitrogenous fertilizer in various countries for the agricul-

tural year 1948-1949, and the quotas assigned to them by the International Emergency Food Council.

With the exception of Colombia, no country expressed itself as satisfied that the quota of nitrogen allocated by the international organization covered its needs.

Phosphatic and potassic fertilizers were particularly scarce during the Second World War. Requirements of phosphates were met to some extent either through an increase of local production, as in Brazil and Chile, or through the restrictions on exports of packing plant by-products, especially bone meal, as in the Argentine. The problem still remains serious, however.

TABLE III-3

IEFC Quotas of nitrogenous fertilizers for Latin-American countries in 1948-1949

(In thousand metric tons of N)

		Stated requirements	
	Quota	*For agricultural use*	*For industrial use*
Argentina	5.6	(6.0)	—
Brazil	9.0	14.8	—
Chile	—	8.0	6.40
Colombia	1.7	2.8	0.06
Costa Rica	0.8	(1.0)	—
Cuba	8.5	9.0	0.40
Dominican Rep.	0.9	1.2	—
Ecuador	0.15	0.45	—
Guatemala	0.55	(0.7)	—
Honduras	1.6	(2.0)	—
Mexico	5.17	6.2	—
Panama	0.75	(1.0)	—
Peru	28.87	47.2	—
El Salvador	0.3	0.4	—
Uruguay	0.16	0.3	—
Venezuela	1.3	8.1	—

Note. Figures in parentheses by Secretariat.

Source. FAO, Supplementary Report on Nitrogen Fertilizer Production. Washington, 21 October 1948.

The scarcity of potassic fertilizers is particularly acute in Brazil, where the supply of ashes has dropped sharply since the burning of coffee was abolished, and in Cuba, which has not been able to obtain them from original sources of production and is therefore paying high prices to intermediaries. In Venezuela there is a shortage of sulphate of potash; Peru lacks various types of potassic fertilizers to mix with the guano.

The marketing of fertilizers presents further minor obstacles. There are difficulties in the transport and handling of ammonium nitrate in Colombia due to the absence of adequate security measures. Thus, the *Caja de Crédito Agrario* was unable to accept the quota allocated by the IEFC, which, owing to the complexities of its task, is obliged to leave the decisions on the form and price of nitrogenous fertilizers to the importing and exporting countries. Nevertheless, when informed of this difficulty, the IEFC drew the attention of the Colombian Government to Belgium as a possible source of ammonium sulphate, a product which the *Caja de Crédito Agrario* preferred to ammonium nitrate. Uruguay had difficulty in obtaining inorganic nitrogenous fertilizers, especially Chilean nitrate, due to the shortage of foreign exchange and was obliged to use, for mixtures, commercial sulphate of ammonia at a very high price. In the Argentine there is a scarcity of ammonium fertilizers because the quota allocated by the IEFC was not used owing to the high price. Colombia and Cuba have difficulty in receiving their quota of nitrogen, from the United States, due to delay in the granting of the respective export licences.

Use of Mechanical Equipment

Scarcely any mechanical equipment is used in the application of fertilizers in Latin America. For the most part they are still applied by hand, the use of machinery being of importance only in the south of Chile and in the coastal valleys of Peru. Mechanical application is now being introduced in Venezuela, in some of the sugar plantations of Cuba and in those regions where the high cost of labour renders it profitable. In no case is the lack of this type of equipment a handicap to the increased use of fertilizers.

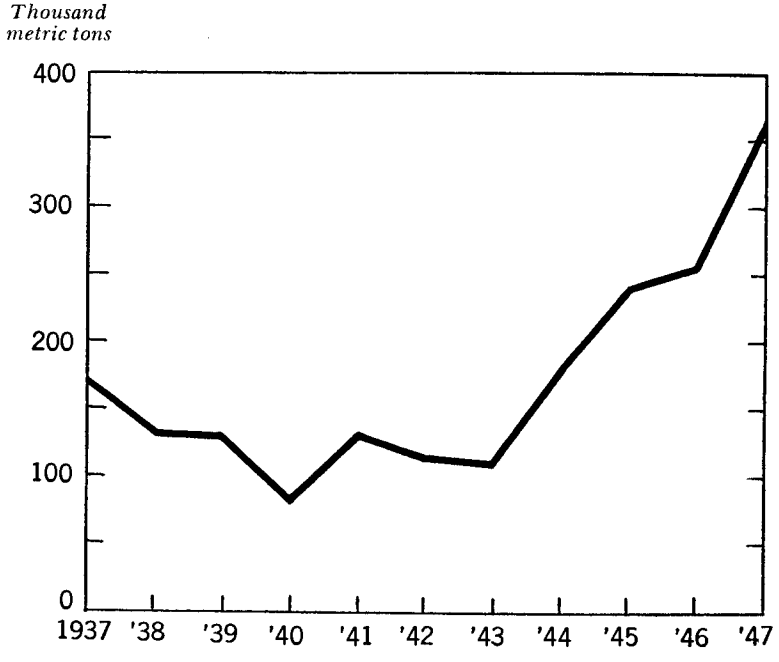
3. TRENDS IN THE USE OF FERTILIZERS

Despite the difficulties mentioned, the consumption of fertilizers in Latin America tends to increase, and was checked only temporarily by the Second World War. An analysis of imports from 1937 to 1947 shows that only in 1940 was there a sharp drop in total imports. In some countries there was of course an evident shortage of fertilizers during certain war years. In Brazil, which seems to have suffered the greatest shortage, the crisis became apparent during the period 1941 to 1943, when average imports dropped by about 44 per cent compared to 1937-1939. Similar situations occurred in Peru and Honduras during 1940-1941 and 1942-1943 respectively. Chilean imports of phosphates and potassic fertilizers which were 8,200 metric tons a year during 1937-1939, dropped sharply in 1940, to be replaced by an increase in local production.

During the pre-war period 1937-1939 the average annual imports of all Latin-American countries (excluding nitrate for industrial purposes) were approximately 144,000 metric tons; in 1940-1945, the war years, 146,000 metric tons, and in 1946-1947, the post-war period, 310,000 metric tons.

CHART III-1

Imports of fertilizers in Latin-America, 1937-1947



Source: Corporación de Ventas de Salitre y Yodo de Chile and official statistics of the countries concerned.

Complete data on imports during 1948 are not yet available. However, total deliveries to Latin-American countries, for agricultural purposes, by the *Corporación de Ventas de Salitre y Yodo de Chile* were only 143,000 metric tons during 1948 as compared with 183,000 in 1947. This reduction in imports of nitrate may have been counterbalanced by increased imports of nitrogenous fertilizers from other sources. Chart III-1 gives an idea of the import trends in fertilizers in the period 1937 to 1947; the table included as appendix B shows the total physical volume of imports by each Latin-American country.

Except for Chile, the supply of fertilizers is highly dependent on imports. Cuba, Brazil, Peru, Mexico and the Argentine are the major importers, accounting for some 83 per cent. Of the 1.9 million metric tons of fertilizers imported by the region during the same period, Cuba took 556,000, Brazil 546,000, Peru 289,000, Mexico 122,000 and Argentina 93,000.

Domestic Production

While Peru consumes all of its production, Chile is one of the major world exporters of nitrogenous fertilizers,[2] consuming only a small proportion itself. Table III-4 shows the annual production in both countries during 1937-1948.

Guano production in Peru diminished between 1941-1946 due to biological factors. Since then production has increased and is expected to stabilize at around 150,000 metric tons a year.

Table III-4

Production of fertilizers in Chile and Peru, 1937-1948
(In thousand metric tons)

	Chile		*Peru*	
	Nitrate of soda [a]	*Nitrate of potash* [b]	*Nitrogenous guano* [c]	*Phosphatic guano* [d]
1937	1,353	58	153	6.6
1938	1,326	71	169	1.2
1939	1,381	66	152	0.6
1940	1,376	62	126	0.9
1941	1,345	57	119	0.2
1942	1,266	61	68	11.6
1943	1,088	64	70	22.1
1944	920	60	76	2.9
1945	1,297	49	86	6.9
1946	1,593	47	111	2.9
1947	1,569	71	158	2.5
1948	1,720	76	162	1.0

Source: Corporación de Ventas de Salitre y Yodo de Chile y 40a. Memoria de la Compañía Administradora del Guano del Perú.

[a] Nitrate of soda contains an average of 16 per cent of N.

[b] Nitrate of potash contains an average of 15 per cent of N and 10 per cent of K_2O.

[c] Nitrogenous guano contains an average of 13 per cent of N, 10 per cent of P_2O_5 and 1 to 2 per cent of K_2O.

[d] Phosphatic guano may contain up to 2 per cent of N and up to 20 per cent of P_2O_5.

[2] U.S. exports of nitrogen are close to those of Chile.

Chilean nitrate production has remained more or less stable, with a slight upward trend, due to heavy international demand. Chile also produces important amounts of phosphates which, in 1947, totalled some 100,000 metric tons.

Argentina, Brazil and Mexico produce mainly organic fertilizers and natural phosphates: this production, although of local importance, has no regional significance. The Argentine produced 50,000 metric tons of fertilizers in 1947, mostly by-products of packing houses, in four main plants. There are, in addition, two factories of compost in Mendoza and Rosario. Brazil produces calcined phosphates in Sao Paulo, using the apatites of Ipanema and Jacupiranga, and additional amounts of ammonium sulphate and other organic fertilizers. Total production in 1947 was 50,000 metric tons, excluding oilseed cake. Mexican total production during 1947 reached 18,000 metric tons of which 3,000 were ammonium sulphate, 2,000 guano, 12,000 superphosphates and 1,000 bone meal. Of the seven plants for the production and mixture of fertilizers, the most important is the semi-private corporation *Guanos y Fertilizantes de México, S.A.,* which operates three plants to produce bone meal, calcium superphosphates and mixed fertilizers. The plants producing superphosphates are at present operating below their annual capacity of 36,000 metric tons, which is far above local demand. Production of organic fertilizers from by-products of packing houses is of some importance in Uruguay. A compost plant in El Salvador daily produces 25 tons out of garbage from the city of Santa Ana. With imported raw materials, Cuba is producing calcium and ammoniated superphosphates and is at present exploiting some peat-bogs. In Ecuador, a factory established in July 1948 for the production of phosphates, utilizes guano with 16 per cent of P 205 content and also markets organic limestone extracted from shells and bone deposits. Guano deposits are small and are expected to last from 8 to 10 years at the present extraction rate of 180 tons a month.

Production of factory-mixed fertilizers has increased in importance during the last few years throughout Latin America and particularly in the Argentine, Brazil, Cuba, Chile and Mexico. In twenty of these plants, in Cuba alone, output increased from 34,000 metric tons in 1940 to 99,000 in 1948. A plant just established in Caracas, Venezuela, has a daily capacity of 100 metric tons; the *Caja de Crédito Agrario* of Colombia has established another at a cost of $US 420,000.

Trade in Fertilizers

Chile is the main source of supply of nitrogenous fertilizers. During 1937-1947 the *Corporación de Ventas de Salitre y Yodo de Chile* marketed, in the region, a total of 792,879 metric tons of sodium and potassium nitrates, equivalent to 42 per cent of total Latin-American imports of fertilizers during the period. The sale of nitrate for fertilizer to the other countries in Latin America increased steadily from 16,799 metric

tons in 1937 to 182,522 in 1947, declining in 1948 to 142,989. Sales are expected to increase in the near future, however. The remainder of the Latin-American imports are supplied by the United States, France, the French Colonies in North Africa, and Belgium. The United States sells various types of fertilizers, while the other sources provide mainly phosphates and potassic fertilizers. Spain supplies small quantities of potassium chloride.

Latin America is a net exporter of fertilizers, not only because of the Chilean exports. During 1946, for instance,[3] Argentine exports included 81,000 tons of bone meal especially destined to Europe, and small amounts to the United States, plus 5,900 tons of dried blood which is used also as chicken feed and is not therefore exclusively a fertilizer, as is the case with the oilseed-cake exports of Brazil. At present, exports of meat-packing by-products, exclusive of dried blood, are banned in this country.

4. PRINCIPAL CROPS FOR WHICH FERTILIZERS ARE NEEDED

Fertilizers are not usually applied to foodstuffs grown for domestic consumption, such as corn, for instance, which is the main food crop. Only rich and deep topsoils such as those of the Rio de la Plata valleys can stand such exploitation. Non-use of fertilizers is one of the causes for the present low corn yields of 600 to 700 kilos per hectare in Mexico and 1,000 in the Peruvian Andes. Little improvement results from allowing the land to remain fallow. In general, fertilizers are never applied to wheat, barley and oats. Potatoes in certain countries like Cuba, Colombia, Chile and Brazil, and rice, particularly in the Peruvian coastal valleys, are the only crops for internal use which benefit from proper use of fertilizers.

Export crops such as sugar-cane and cotton, on the other hand, receive a heavy proportion of fertilizers in the main consuming countries, Brazil, Cuba and Peru. Table III-5 shows the use of nitrogenous fertilizers in the period 1948-1949 as declared to the International Emergency Food Council by the six countries considered.

As may be seen, 28,300 metric tons of nitrogen, 34.9 per cent of the total, were requested for non-food crops—fibres, hay, beverages and tobacco; 32,900 metric tons, or 40.4 per cent, for food crops; and the remainder for unspecified crops. These figures represent requirements and not actual consumption, which may differ from the figures given.

In the Argentine fertilizers are applied exclusively to sugar-cane, orchards, vineyards and tobacco. In Uruguay, also an important cereal producer, 90 per cent of all fertilizers are applied to alfalfa and potatoes, small amounts to orchards, vineyards and oil seeds, and negligible amounts to cereals.

[3] No further data are available.

TABLE III-5

Stated requirements of nitrogenous fertilizers for crop use made to the IEFC by six Latin-American countries, crop year 1948-1949

	Grains	*Rice*	*Sugar*	*Oilseed*	*Legumes*	*Fibre crops*	*Tubers*	*Fruits & vegetables*	*Forage & pasture*	*Beverage crops*	*Tobacco*	*Other crops*	*Total*
Chile	3.0	0.1	—	0.8	0.2	0.3	0.6	2.6	0.1	—	0.1	0.2	8.0
Colombia	1.4	0.4	0.7	0.1	—	0.2	0.8	0.1	—	0.1	0.1	—	2.9
Cuba	[a]	0.1	6.0	[a]	0.1	—	1.0	0.8	[a]	—	1.0	—	9.0
Mexico	2.8	—	0.7	—	0.3	0.6	0.8	0.7	0.3	—	—	—	6.2
Peru	—	6.0	8.2	—	—	14.5	—	—	—	—	—	18.4	47.1
Venezuela	—	—	3.0	—	—	—	1.1	1.5	—	—	1.0	1.5	8.1
Totals	6.2	6.6	18.6	0.9	0.6	15.6	4.3	5.7	0.4	0.1	2.2	20.1	81.3

Source. FAO, Supplementary Report on Nitrogen Fertilizer Production. Prepared by the Committee on Fertilizers, IEFC, 1948.

[a] Less than 50 metric tons.

In Brazil, the state of Sao Paulo absorbs 90 per cent of the total fertilizer used in the country. This is applied to cotton, potatoes, vegetables and other minor crops. Corn and coffee, the main crops in Colombia, receive only minor quantities of commercial fertilizers. More than 50 per cent of the total used by Colombia is absorbed by the potato crop in the departments of Cundinamarca and Boyaca. The highest proportion of fertilizers are applied in Venezuela to sugar-cane, tubers, fruits, vegetables and tobacco, while none is used on corn.

In Central America, both imported and domestic fertilizers are used almost exclusively on coffee, bananas and sugar-cane. Notwithstanding the low average of cultivated area per inhabitant in the more densely populated districts, use of commercial fertilizers is negligible in Ecuador and Bolivia and non-existent in Haiti. Small imports of nitrate by Bolivia are used mainly for orchards and potatoes with small amounts for sugar-cane. Here, as in Ecuador, dried animal manure is only applied to a small proportion of the potato crop.

The minimum acreage to which fertilizers are applied is also an indication of the surprisingly low use of commercial fertilizers in Latin America. A recent study[4] shows that, notwithstanding the fact that Sao Paulo consumes practically all the available fertilizers in Brazil and that cotton is the main crop, only 8.9 per cent of the cotton acreage in 1939 and 6.6 per cent in 1944 received fertilizer. Chile's fertilizer consumption is estimated to cover the needs of only 20 per cent of the total cultivated acreage. In Mexico, only 3 per cent of the total cultivated acreage, or approximately 13 per cent of the irrigated acreage, receives any application of fertilizer. Fertilizers are being used on a large scale for the corn crop, a consequence of the use of hybrid seeds.

In Peru, the main consumer of fertilizers in the region, more than 95 per cent is applied to the irrigated land of the coastal valleys, which represents only 30 per cent of the total cultivated acreage. In these coastal valleys, cotton, sugar-cane and rice use the highest proportion of fertilizers although they represent only 50 per cent of the total acreage cultivated there. In Cuba, sugar-cane uses 50 per cent of the total fertilizer consumption which is applied to not more than 12 per cent of the total cane acreage. Potatoes, however, are grown entirely with fertilizers, which are also essential for tomato and tobacco crops, vegetables and orchards.

5. POSSIBILITY OF A GREATER USE OF FERTILIZERS IN LATIN AMERICA

The use of fertilizers will continue to increase in the near future unless agricultural production is limited by some major economic factor. This increase will not be spectacular and will probably result from a wider understanding on the part of farmers.

[4] *Situacao dos Fertilizantes en Sao Paulo,* by Oscar Jose Thomazini Ettori (mimeographed report).

The Joint Working Party does not make any estimates of future requirements, as under the circumstances these would be academic. However, Latin-American experts agree that the trend is upward, with increases expected to be considerable in some countries and moderate in others. Nitrogen can be estimated on the basis of the stated theoretical requirements of sixteen countries as shown in the report of the IEFC Committee on Fertilizers to the fourth session of the Food and Agriculture Organization (see table III-6).

TABLE III-6

Future requirements of nitrogen for agricultural use
(In metric tons of N)

	Annual consumption 1946-1947 [a]	*Estimated requirements* [b]		
		1948/1949	*1949/1950*	*1950/1951*
Argentina	5,700	6,400	6,400	6,400
Brazil	12,100	14,800	(14,800)	(14,800)
Chile	7,600	8,000	8,480	8,800
Colombia	500	2,770	3,800	6,000
Costa Rica	700	(1,000)	(1,000)	(1,000)
Cuba	6,800	9,000	9,540	10,000
Dominican Rep.	200	1,200	(1,200)	(1,200)
Ecuador	100	450	500	500
Guatemala	800	(700)	(700)	(700)
Honduras	700	(2,000)	(2,000)	(2,000)
Mexico	3,900	6,200	8,650	11,300
Panama	200	(1,000)	(1,000)	(1,000)
Peru	29,300	47,200	49,350	51,250
El Salvador	300	393	393	393
Uruguay	800	(300)	(300)	(300)
Venezuela	300	8,100	11,300	15,750
Total	70,000	109,513	119,413	131,393

Note. The figures in parentheses were provided by the Secretariat.

Source. Supplementary Report on Nitrogen Fertilizer Production, IEFC, 21 October 1948, and table III-1.

[a] Average of two years.

[b] For crop years.

The trend in fertilizer consumption in Latin America will be conditioned, in the immediate future, by the price of its principal crops, particularly those for export. After the First World War and the increase in the international price of sugar, fertilizer consumption in Cuba reached 250,000 metric tons a year. This fell to 30,000 metric tons when prices dropped. It is said in Cuba that except for the shortage of fertilizer during the Second World War and the consequent rise in its price, that

level would have been reached again. The same thing occurred in Brazil where record quantities of fertilizers were imported in 1929 for coffee cultivation. When the price of this product decreased, fertilizer consumption dropped as well. Later, an increase in the cotton acreage was followed by a high consumption of fertilizers from 1937-1939; restricted imports thereafter were due only to supply and transportation difficulties caused by the war.

6. FUTURE DEVELOPMENT OF THE REGIONAL FERTILIZER INDUSTRY

Almost all the Latin-American countries will have to depend on fertilizer imports for some time to come. However, production, even on the basis of imported raw materials, will not undergo any sizable increase during the next three years at least, because current projects will not have been completed.

Nitrogenous Fertilizers

Production of nitrogenous fertilizers could be increased in the nitrate regions of Chile if existing plants were re-equipped or new units added. Despite some increasing capacity, production is not expected to go up more than 80,000 to 100,000 tons in the next few years, especially since European plants will be operating at full capacity in the near future. In Peru, the possibilities of increased production are limited by the size of guano deposits and biological fluctuations.

A Cuban project for production of nitrogenous fertilizers, a small plant to produce annually 8,000 tons of ammonium sulphate, is on the point of completion. Expected to start operating in June 1949, it will nevertheless require imports of anhydrous ammonia. This same plant plans to increase production of ammoniated superphosphate to 60,000 tons a year by reducing output of simple calcium superphosphates. In Mexico, a plant to produce ammonium sulphate is to be completed by the beginning of 1950. It will process natural gas from the oil deposits of Poza Rica. According to information supplied by *Guanos y Fertilizentes de México, S.A.,* this plant will include units for the recovery of sulphydric acid from the gases, for the processing of 53 metric tons daily of anhydrous ammonia and 200 tons each of sulphuric acid and ammonium sulphate. The processing of the latter would provide a surplus of 54 tons of sulphuric acid which could be used in the production of superphosphates. It is evident that ammonium sulphate produced in this plant, which it is estimated will cost 40,000,000 Mexican pesos ($US 6 million), will more than suffice for the actual needs of nitrogenous fertilizers in Mexico. Even though the cost of production per unit of nitrogen will be considerably less than in other countries—roughly $US 1.25—output will have to be conditioned, at least at the beginning, by foreign market requirements.

Two years ago, the Argentine Government requested tenders for the installation of plants for the production of nitrogenous fertilizers with an annual capacity of 14,000 tons of sulphate of ammonia and 15,000 tons of calcium nitrate. The Salte Plan of Brazil also includes the installation of a plant with an annual capacity of 100,000 tons of nitrates, using only local raw materials.

In Colombia, the *Caja de Crédito Agrario* which, as already stated, has just installed a plant to mix fertilizers, is planning to use part of the $US 2 million loan from the *Eximbank* to establish a plant for the production of nitrogenous fertilizers, using the natural gas of the oil wells. No further details are available. It seems, however, that the loan will not cover the cost of the installation and that a further loan will therefore be required. The *Corporación Peruana del Santa,* which is carrying out a number of hydroelectric projects in the north of Peru, plans a plant for the production of ammonium sulphate. The Venezuelan Government is considering a proposition to install two plants, one in Maracaibo and the other in the eastern oilfields to produce 150 metric tons of ammonium nitrate daily. Both would use the natural gas of the oil wells which is at present being wasted. As in both Colombia and Venezuela domestic consumption of fertilizers is low, these enterprises will require an extensive foreign market. An agreement between the two countries to determine their mutual requirements and co-ordinate the plants would be advisable.

The preparation of compost in Latin America deserves attention. In El Salvador, a new plant is being set up for the preparation of compost with an annual capacity of 18,000 metric tons. The Costa Rican Government has declared the conservation of organic residue to be a matter of public concern and has organized a national corporation with a capital of $US 20,000 to establish several plants at various points. There are not, unfortunately, many similar projects.

Phosphates

Latin America has but small resources of phosphate minerals. There are none at all in countries like the Argentine, where the lack of phosphorus is a serious problem.

Brazil's supply could be increased by improving or extending existing plants, if there were a reduction in transport costs and sufficient specialized technicians. The Salte Plan includes proposals for prospecting for further sources of phosphate, nitrogenous and potassic minerals. It also provides for the exploitation by State monopoly of the Ipanema, Jacupiranga, and Camisao (in Bahia) mineral deposits in order to supply both industry and agriculture with phosphatic concentrates at a low price. Unfortunately, deposits at Ipanema and Jacupiranga are apatites mixed with much iron and the processing difficulties are as yet unsolved. A laboratory process has been developed for making fertilizer from an iron-aluminum phosphate found on Trauira Island, but it is not yet estab-

lished whether this will tend to change into an insoluble form, the usual trouble with phosphate fertilizers. Good results have been obtained from the application of ground rock phosphate from a deposit at Serrate. This material could be made available at a comparatively low cost if additional grinding equipment were obtained.

The Chilean Government is promoting production of superphosphates, using low-grade deposits, chlorapatites, which are ground and then roasted with nitrate of soda and coal or with sodium sulphate, lime and coal. Neither process is satisfactory. In the first, nitrogen is wasted; in both, the solid reactives give a final product containing less phosphate than the original apatites. It therefore appears advisable to use a high grade apatite or to go to the expense of concentrating a low grade apatite by flotation and by electromagnetic separation of iron. Other countries face similar difficulties and the problem awaits a satisfactory solution. Chile is planning to produce superphosphates for both home consumption and export. This would require considerable imports of rock phosphate. Apatite deposits in Chile are expected to be exhausted in 20 years at the present rate of consumption.

The phosphate sources now being worked in Mexico are poor and are not expected to last more than 5 years. The deposits of Sierra de Mazapil in the state of Zacatecas are the most important of those surveyed; they consist of phosphorites with a mean content of 19.85 per cent of P 205 totalling two and a half million tons of minerals. Further sources in the state of Nuevo Leon, though not sufficiently surveyed, are estimated to contain one and a half million tons. It is considered that until these deposits are exploited, the Mexican superphosphate plants—especially that of *Guanos y Fertilizantes de México, S.A.,* in San Luis de Potosi,—will have to continue to import rock phosphate from Florida. Prospecting is also being carried out in Venezuela for minerals which could be used in the production of fertilizers. So far only scattered phosphate deposits have been found: unfortunately, these are made up of tricalcic elements, contain iron, are insoluble in citrates and would consequently have to be processed with sulphuric acid, which though planned for, is not produced in Venezuela at present.

The production of superphosphates with imported raw materials will increase in the region. A new plant in Uruguay, with a capacity of 50 metric tons every eight hours, will soon be in operation, and also a complementary plant for the production of sulphuric acid.

As farm demand increases, an increase in the production of phosphates in the Argentine, Brazil and Uruguay will more and more be obtained by reducing exports of packing house by-products and using them for factory-mixed fertilizers.

Potash

There is little prospect of an increase in the output of potassic fertilizers. Chile is producing at full capacity. In many other countries, par-

ticularly the Argentine, Brazil, Mexico and Peru, prospecting for soluble potassium minerals has been unsuccessful. In the state of Bahia, Brazil, there are deposits of nitrate of potash and deposits of leucite (compound silicate of aluminum and potassium) have been found in the state of Sao Paulo. While no thorough investigation has yet been made, all evidence seems to indicate that they could not be economically exploited.

Fertilizer Mixtures

A number of plants for the preparation of mixtures are likely to be set up within the next few years, which would greatly contribute to an increase both in natural fertilizer consumption, and in the imports of raw materials. Some of these plants will be set up by private enterprise while others will be governmental or semi-governmental corporations. The *Corporación Venezolana de Fomento,* for example, is contemplating the immediate installation of a plant of this nature at Puerto Cabello, with an annual output of 10,000 metric tons, dependent for the time being on imported raw materials.

7. CONCLUSIONS AND SUGGESTIONS

Latin America, as a whole, is a net exporter of fertilizers and consumes far less than it needs. Inadequate and inefficient soil management and, in particular, insufficient use of fertilizers coupled with soil erosion are depleting the fertility of the soils. Although the increased production obtained by the use of fertilizer is, in many cases, very satisfactory, economic returns are often insufficient to enable the farmer to pay for the necessary fertilizer, the price of which is generally very high when compared to the price of food grown for local consumption.

Conclusive evidence is lacking, but there are several indications that most Latin-American countries are in rather urgent need of phosphates. Nitrogen is needed but this could be met more or less fully by existing and projected arrangements. The need for potassium is felt less, though experiments in certain areas show that the addition of this element to fertilizer mixtures yields good results. Most countries have adequate supplies of calcium.

Governments are favouring the local production of fertilizers by establishing synthetic plants or by making use of natural deposits. Nitrogen resources are adequately exploited. Phosphate resources are little used. There are no important projects so far as potassium is concerned. Particular attention should be given to the increased use of organic fertilizers and green manures as well as to plans for crop rotation suitable to the various agricultural areas.

This growing concern of Governments and the plans which are under way are encouraging. The problem is not only one of increased production, but also one of extended economic use. Fertilizer has its place in skillful farming and appropriate land use, and every effort should be made to achieve a high level of agricultural production within economic and social conditions that permit and encourage this development.

There is insufficient knowledge of this distribution—composition and deficiencies of Latin-American soils. The Joint Working Party believes that primary importance should be given to the completion of the soil surveys now under way and to the bringing of these studies to good effect.

Expansion of the production and use of fertilizers in the region calls for co-ordinated action between Governments.

A. Requirements and Supply of Fertilizers

It is suggested that FAO and ECLA should convene a meeting of the soil and fertilizer experts of the region to examine the current needs and present plans for increasing production of fertilizers. An effort could be made at such a meeting to estimate the actual and potential requirements for the different types of fertilizers. Since the supply of nitrogenous fertilizers is not an immediately serious problem, the meeting might devote its chief attention to the problem of phosphates, i.e.:

(i) The principal types required in each country;
(ii) Sources of supply;
(iii) The comparative efficiency of the various types of phosphates, and,
(iv) Transport problems.

B. Prices

Since the use of fertilizers, particularly for food crops, is largely dependent on their availability at reasonable prices, measures might well be taken to reduce undue costs, particularly import duties and transportation changes. It would also be desirable to urge the enactment of laws to control the marketing of fertilizers and to prevent speculation.

C. Conclusion

Any action taken with regard to fertilizers should form part of a wider programme of sound land use and general agricultural development within the general framework of co-operation among the countries concerned, as the Joint Working Party has suggested for other aspects of the over-all problem.

CHAPTER IV

Pesticides

1. PESTS AND LOSSES

Among the principal agricultural pests in Latin America are the migratory locusts, the leaf-cutting ants, the corn-earworm and fall armyworm, various *coleoptera* and *lepidoptera* of grains in storage, the cotton boll-weevil and boll-worm, the common cattle tick, and anthrax. Others are important for certain countries, but not regionally; the *sigatoka* disease in the banana areas, the *mosca prieta* of the citrus farms and the hoof-and-mouth disease in Mexico, the *broca do cafe* in Brazil, the stink-bug of sesame in Nicaragua, etc.

As statistics are very inadequate, only rough estimates can be made. After consultation with the various ministries of agriculture, the Joint Working Party believes that the losses incurred by the region from the injuries caused by insects, fungi, etc., in the field, average around 25 per cent of the planted crops. The losses in livestock are less precisely known, but are by no means unimportant.

Estimates made by the *Servicio Cooperativo Interamericano de Producción de Alimentos* (SCIPA) in Peru indicate average yearly losses due to insects of more than $US 29 million in cotton, maize, sweet potato, potato, citrus and alfalfa crops.

The *Banco Nacional de Nicaragua* estimates that the *maya* or stink-bug of sesame was responsible, in 1947, for the loss of 60 per cent of this crop. This represented a decrease of $US 3 million in foreign exchange receipts.

Although the ants of the genus *atta* and *acromyrex* are one of the most injurious pests, damages caused by them have not been calculated. Like the locust, the leaf-cutting ant [1] attacks many species whose foliage provides a suitable means for the propagation of the fungi which are its only food. It attacks most plants cultivated by man, especially the fruit trees and, among them, the citrus.

During 1947 and 1948, Central America suffered from a heavy infestation of locusts mainly in the Guanacaste Peninsula. Similar invasions

[1] *Hormiga arriera, parasol, agricultora, zompopo, coqui,* or *bibijagua*—a variety of common names which indicate the breadth of the territory subject to its depredations.

have occurred in the past whenever environmental conditions have been favourable for the reproduction of the insect. This latest plague, one of the worst, was the first to be fought through international action. The locust clouds flew north from the breeding grounds, devastating crops and multiplying themselves in Nicaragua, Honduras, El Salvador and Guatemala. Recently they have invaded also the central plateau of Costa Rica. No exact data are available on the damage caused in each country. However, El Salvador spent $US 800,000 during 1947 [2] fighting the locust, and still lost 10 per cent of its crops. Guatemala, normally self-sufficient in maize, had to import more than 10,000 metric tons during the last part of 1948 to compensate for the loss in areas heavily damaged by locusts.

Mexico slaughtered more than 500,000 head of cattle in less than a year, before it began to use serum in its fight against hoof-and-mouth disease.

The damage done by the other known insects and pests, for example, on grain in storage,[3] are considerable. but never have been measured.

2. IMPEDIMENTS TO THE USE OF PESTICIDES

The principal factors limiting the use of pesticides are: the scarcity of specialists, the low level of education of the farmers, and the lack of adequate extension services. Because no complete research has ever been carried out on the adaptation of pesticides and equipment, expensive, highly specialized power equipment is often used inefficiently where simple hand equipment would be quite adequate. The use of insecticides is often directed by unqualified persons because skilled personnel are lacking. As a result, insecticides and fungicides are used in excessive concentrations which may actually have harmful effects. Knowledge of techniques must now be put into practice; a well-organized, completely-staffed extension service would find this a challenge because of the difficulties of travel and the low level of education of the farmers.

The low prices paid for growing basic foodstuffs render uneconomic the use of pesticides in the ordinary conditions of production. Prices of pesticides range from low competitive offers to prohibitively high prices, presenting a real obstacle to their increased consumption. Import duties, where imposed, are not high enough to constitute an additional obstacle, as do deficiencies in farm credit systems. On the other hand, lack of foreign exchange during recent years has been partially obviated by placing these agricultural requisites in the highest priority for dollars. Peru was the only country found by the Joint Working Party where the lack of foreign exchange hindered the purchase of needed pesticides, especially

[2] Without taking into account the expenditures incurred by private farmers for the same purpose.

[3] See section 2, chapter 5 of this report.

during the last part of 1948. In August and September, nine principal importers requested foreign exchange for the importation of 1,720 tons of pesticides valued at $US 505,000. In September, permission for 245 tons was granted, but since then and until the visit of the Joint Working Party at the end of November no more foreign exchange had been provided. SCIPA expects heavy losses this year, especially in cotton as a result. It is possible, however, that the situation may be greatly improved by now.

3. PRESENT USE OF PESTICIDES

Insecticides and fungicides are used almost exclusively on highly profitable crops such as bananas, cotton and some fruits, especially citrus and grapes. The bases of the Latin-American diet—maize, wheat, rice, pulses and manioc—receive very few pesticides. Only when the ravages of a pest reach nationally catastrophic proportions are these crops properly treated, the State taking charge of the operations and bearing the cost.

There has been no shortage of pesticides in the selling markets, whenever such countries have had dollars or pounds sterling for their purchase. The Joint Working Party believes that the use of pesticides will contribute less to raise the level of nutrition of the Latin-American peoples than to protect harvested grains in storage.[4]

The domestic production of pesticides is rather small and the United States is the main supplier. It may therefore be assumed that imports from that country fairly reflect the trend in consumption. Chart IV-1 shows clearly the impact of the war; its influence was stronger in the South American countries than in some of the Caribbean countries which maintained a rising import curve throughout the period.

Copper sulphate, used in the preparation of Bordeaux mixture against the Sigatoka disease in the banana areas, constitutes the greater part of Latin-American imports of pesticides as shown in table IV-1. In Guatemala, Honduras, Costa Rica and Panama, four of the largest importers of pesticides, copper sulphate accounts for 85 to 95 per cent of total yearly imports. The Argentine, Venezuela, Cuba, Mexico and Colombia, also among the principal importers, use equally large quantities.

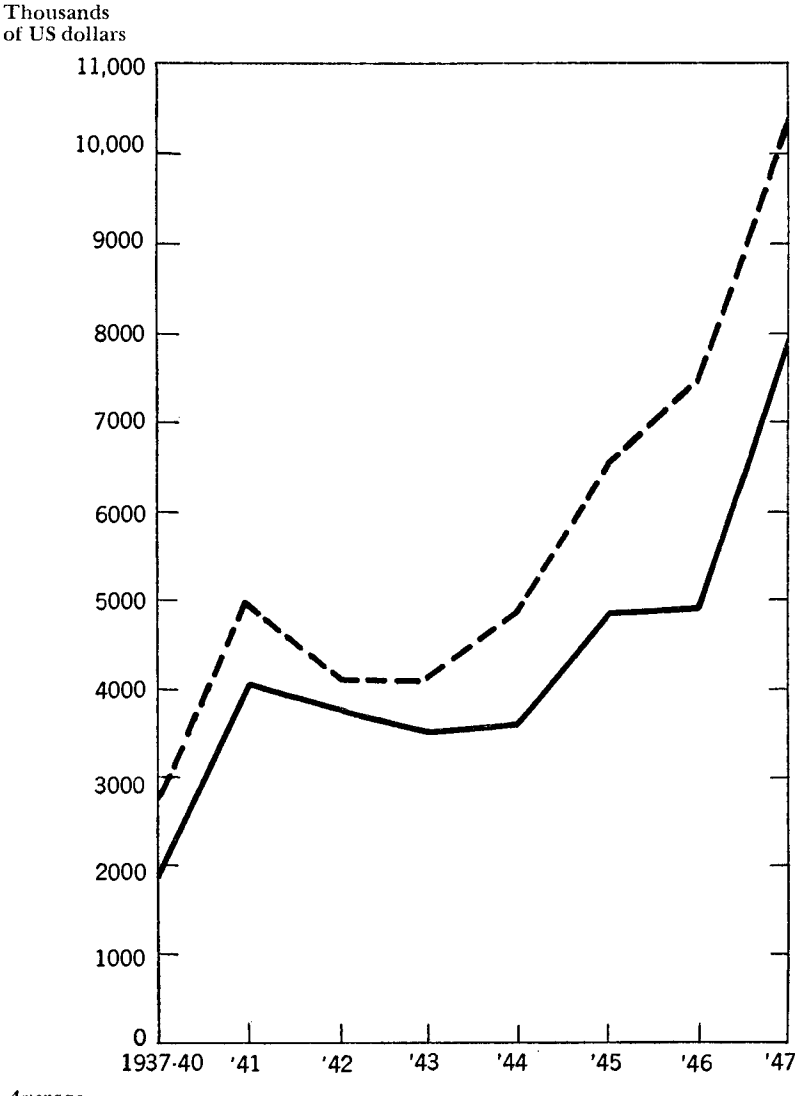
Next in importance are calcium and lead arsenate used against cotton pests. In some countries the new organic insecticides, especially benzene hexachloride and chlordane, are gaining in importance of late, particularly against the locust, as in Argentina, Uruguay, El Salvador, Costa Rica and Guatemala.

Almost all countries import every year small quantities of calcium cyanide, potassium cyanide and carbon disulphide for use against the leaf-cutting ants and arsenical dips for the eradication of cattle tick. Carbon disulphide is the most common fumigant in use on grains in storage. Methyl bromide has been introduced in several countries but is not yet

[4] See section 2, chapter 5 of this report.

CHART IV-1

United States exports of pesticides to Latin America, 1937-1940 to 1947



Average

For agricultural use————

All uses— — — — — — — — —

Source. Foreign Commerce and Navigation of the United States. United States Department of Commerce, 1937-1947.

TABLE IV-1

Value of United States exports of pesticides for agricultural use to Latin-American nations, 1937-1947

(In thousands of U.S. dollars)

	Average 1937-1940	*1941*	*1942*	*1943*	*1944*	*1945*	*1946*	*1947*
Calcium arsenate	230	271	281	483	176	245	264	461
Calcium cyanide	[a]	[a]	9	34	41	38	[a]	[a]
Chloropicrin	[a]	[a]	12	6	3	[a]	[a]	[a]
Copper Sulphate	1,295	2,492	3,058	2,254	2,564	2,869	2,867	3,941
Lead arsenate	109	778	65	366	403	694	254	475
Nicotine sulphate ...	27	52	26	52	17	17	28	56
Paradichlorobenzene .	[a]	[a]	[a]	[a]	[a]	19	20	40
Paris green	[a]	[a]	29	75	67	87	[a]	[a]
Petroleum oil sprays..	6	7	7	20	27	31	25	57
Pyrethrum flowers, dust and extracts	[a]	96	37	8	1	82	116	23
Rotenone (derris) ...	[a]	[a]	9	—	—	—	—	—
Seed disinfectants ...	[a]	1	19	32	44	44	18	73
Miscellaneous insecticides and fungicides[b]	241	311	227	247	320	706	1,270	2,840
Totals	1,908	4,008	3,779	3,577	3,664	4,832	4,862	7,966

Source. For the period 1937-1946, *World Trade in Commodities,* U.S. Department of Commerce. For 1947, *Foreign Commerce and Navigation of the United States,* U.S. Department of Commerce.

[a] Not specified separately in export statistics.

[b] Item "Miscellaneous insecticides and fungicides" includes the following products: arsenical dips, arsenical dust, Bordeaux mixture, copper arsenate, lime sulphur, London purple, benzene hexachloride, DDT, carbon disulphide, weed killers, etc.

DDT, although used in large quantities by health departments to combat disease-carrying insects (especially malarial mosquitoes), is little used for agricultural purposes.

Despite the great increase in imports of insecticides, the Latin-American nations are still using quantities which are much too small to make possible effective control of the pests now known.

Pesticides are usually imported in concentrates. The preparation from them of diluted concentrations is a growing industry in Latin America, as is domestic production of pesticides, particularly in the more industrialized countries. Mexico manufactures small quantities of DDT and is one of the chief producers of white arsenic in the world. Brazil produces part of its BHC requirements; the arsenicals and carbon disulphide locally manufactured are almost enough to satisfy domestic needs; copper sulphate is also manufactured but not in sufficient quantities to meet the internal demand.

Argentina produces a substantial part of the pesticides locally used. It manufactures lead arsenate, lime sulphur, petroleum oil sprays, BHC, carbon disulphide, and about a third of its sulphur requirements. Small quantities of nicotine sulphate are also produced. In January 1949, the Government issued a decree declaring the production of DDT to be of national importance. It was included among the products requiring an import licence, and the importation of benzene and chlorobenzene, the only raw materials for the manufacture of DDT which are not produced within the country, was made duty free.

Latin-American countries are at the same time the source of a substantial portion of the raw materials used by the United States for the manufacture of the pesticides which they later import (see table IV-2). From 1934 to 1941, Mexico supplied 67 per cent of the arsenic trioxide (white arsenic) imported by the United States. During 1942-1946 this percentage rose to 85 per cent.

TABLE IV-2

United States imports of Latin-American raw materials for the manufacture of insecticides, 1937, and 1941-1946

	Quantity (thousand lbs.)	*Value (thousand dollars)*
1937	24,840	801
1941	22,282	925
1942	32,896	1,291
1943	36,336	1,623
1944	28,458	2,003
1945	39,421	2,699
1946	38,542	3,235

Source. World Trade in Commodities, US Department of Commerce.

During the war when the sources of supply for derris in the Far East were cut off, Peru and Brazil became the main suppliers of rotenone-bearing materials. Venezuela, the only source for sebadilla seed, exports every year around 200,000 pounds of this product to the United States.

The Joint Working Party did not find anywhere evidence of an accumulation of pesticide reserves. If demand should suddenly expand present stocks could not possibly meet it. Various countries have felt the consequences: El Salvador, for instance, had to import large quantities of benzene hexachloride by air at extra-high freight charges in order to get the insecticide in time to meet the latest locust invasion.

Latin America makes use of all kinds of equipment, from the simple cloth bag for hand dusting to the most powerful modern pumps, spray-

ers turbines mounted on jeeps or jeep-trucks, and airplanes and helicopters fitted for dusting operations. Nevertheless, the amount of modern equipment to be found in the region is still relatively small. The best equipment is in the possession of Governments which have organized campaigns against the locust, and of the main cotton and banana producers. However, except where there exists an opposite tradition, most Latin-American countries are not making full use of the means they have at hand. One of the chief reasons, again, is the scarcity of experts in entomology and plant pathology.

Almost all Governments have created, within their ministry of agriculture, a department devoted to pest control. As a rule, such a department imports, directly, pesticides and equipment (especially hand) and distributes them at cost to farmers. In some countries, such as Venezuela, where transportation is very expensive, the State absorbs this cost. Some departments place power equipment and skilled personnel at the farmers' disposal charging only for the cost of the insecticide. Whenever a national emergency has arisen, as the locust migrations, Governments have taken the initiative and borne the expense incurred by the campaign, as in Argentina, Uruguay, Brazil and El Salvador. In Mexico, the *Departamento de Defensa Agrícola* of the *Dirección General de Agri cultura* has organized regional agricultural committees on pest control made up of *ejidatarios* and a representative from the *Banco de Crédito Ejidal* and of the Ministry of Agriculture. These committees import all pesticides needed, duty free. The *Banco Ejidal* makes the money available and the Department gives technical help and provides the necessary equipment.

It is worth mentioning the degree of international co-operation in pest control which has been developed in Central America. The Ministers of Agriculture of the five Central American Republics and of Mexico met at San Salvador in May 1947, to unite for the control not only of locusts—which at that time threatened to destroy their crops—but of other pests of an international character. The conference resolved to create an *Instituto de Sanidad Vegetal y Animal* to be financed by 1 per cent of the yearly fiscal budgets of the signatory countries. Although this institute has not yet crystallized, the same countries organized shortly thereafter, as a result of the conference, the *Comite de Lucha Contra la Langosta, Centro America-México* with headquarters at San Salvador. International co-operation through this committee has been effective. Mexico has supplied equipment and insecticides; Guatemala has sent insecticides, Honduras has contributed funds. In addition to financing most of its own domestic campaign, El Salvador fought the locust in Nicaragua and provided Costa Rica with equipment and insecticides.

Argentina, Brazil, Uruguay, Paraguay and Bolivia have signed a treaty for locust control and established the *Comite Interamericano Permanente Antiacridiano.* Mexico and the United States have closely co-operated in

the eradication of hoof-and-mouth disease and the black fly, Colombia has given help to Ecuador in the locust campaign. The results of all these joint efforts have been positive and encouraging.

4. CONCLUSIONS AND SUGGESTIONS

Substantial planted crops and harvested foodstuffs are lost every year by Latin America because of insects. Nevertheless, the region makes little use of pesticides and until recently there was no clear notion in most countries of the losses sustained nor of ways and means of avoiding them.

Pesticides are available in Latin America, but certain factors retard their use. Among these are: lack of adequate agricultural extension services, scarcity of experts, lack of basic research, and the disparity between the prices received by farmers and those charged for pesticides. In the next few years Latin America can expect better and more practical results from effective pest control on grain in storage than from the use of pesticides in the field.

The evaluation of future needs for pesticides is very difficult. The Joint Working Party had at its disposal few quantitative data on which to base its judgment. It is necessary to add to these the multiple variables controllable by man as well as those which arise from the behaviour of known pests and the possible appearance of new types.

Imports of pesticides will probably continue to expand during the next 4 years. The total use of insecticides may not reflect an increase as great as in the agricultural field alone. This is because of the fairly heavy use of DDT in the field of public health. The main agricultural increase will come from the greater use of the new organic insecticides.

The increase in the use of pesticides will principally affect those crops already making extensive use of them. They will have very little effect on the production of basic foodstuffs.

In the light of the foregoing, the Joint Working Party brings to the attention of the Governments the following:

A. The establishment of adequate extension services would contribute most to an increase in the use of pesticides for the basic foodstuffs in Latin America. The training of personnel in sufficient numbers and the exchange of technicians would also bring positive results.

B. Any measures taken to correct the year-to-year variations in the price of cereals would contribute greatly toward the increased use of pesticides on these crops.

C. Stock-piling of pesticides in certain countries would effectively help to meet emergencies.

D. There is urgent need in each country for studies of the adaptation of various pesticides and equipment.

E. International co-operation in pest control, which up to now has given positive results, should be continued. It would be beneficial to take steps to organize and initiate the *Instituto de Sanidad Vegetal Centro-America-México,* which was proposed by the first Conference of Ministers of Agriculture of Central America and Mexico, in May 1947.

CHAPTER V

Storage

1. GENERAL CONSIDERATIONS

Latin America lacks grain storage facilities to an alarming degree, although for many years it has had exportable surpluses of agricultural products in tropical conditions which are conducive to the rapid propagation of pests.

Until recently the majority of Latin-American Governments did not sufficiently realize the possibilities nor the usefulness of warehouses. The consequences have been grave; losses caused by insects, rodents and fungi have been very high. Additionally, crop fluctuations and sudden price variations have consequences as serious as those caused by the material losses themselves. Lack of storage facilities especially where transportation is inadequate can be considered one of the principal causes for the comparatively low production of grains in tropical regions.

2. LOSSES DUE TO LACK OF STORAGE FACILITIES

In El Salvador and Guatemala it is estimated that lack of adequate storage facilities and of effective measures against insects and fungi cause losses of approximately 25 per cent of harvested maize, rice and pulses.[1] Losses of maize in Honduras run as high as 50 per cent [2] and in Nicaragua, 30 per cent.[3] In Costa Rica, losses are estimated at 45 per cent of harvested cereals in spite of the pest control efforts made recently by the Government.[4] The *Consejo Racional de Producción de Costa Rica* has lost, during the last 5 years, through infestation of imported grains in storage, approximately $US 325,000; and between December 1946 and September 1948 more than $US 100,000 worth of pulses bought locally.[5]

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[1] *Dirección General de Agricultura de Guatemala* and *Banco Hipotecario de El Salvador* (General Agricultural Administration of Guatemala and Mortgage Bank of El Salvador).

[2] FAO, Summary of Proceedings, International Meeting on Infestation of Foods, London, August 1947, page 7.

[3] *Ministerio de Agricultura de Nicaragua* (Ministry of Agriculture of Nicaragua).

[4] *Dirección General de Agricultura de Costa Rica* (General Agricultural Administration of Costa Rica).

[5] Report of the Costa Rican delegation to the meeting at Palmira, Colombia, February 1949.

Ecuador incurred a total loss during 1947 and 1948 of over two million pounds of flour imported from the United States and Canada, owing to poor storage conditions and lack of pest control methods.[6] During 1947, Venezuela lost $US 16 million worth of maize, pulses, rice, coffee and sesame. It has been estimated that 82 per cent of these losses were due to insects, 15 per cent to rodents and 3 per cent to fungi.[7] During the same period, Colombia lost $US 11,400,000 through infestation of badly stored maize, rice, wheat and pulses.[8] In Haiti, annual losses of wheat, maize, rice and oats in storage are estimated to be approximately 47 per cent[9] of the total.

Losses decrease substantially in more temperate countries such as Chile, Argentina and Uruguay, and in the high areas which are unsuitable to insects and other pests. Nevertheless, even here the damages are considerable. Chile, for example, lost, from its 1947-1948[10] crop, $US 38 million, and Uruguayan losses amount officially to 14 per cent of the cereals harvested. Losses incurred through lack of appropriate storage facilities and insufficient use of fumigants amount to at least 20 per cent of the basic foodstuffs available for consumption.

3. OBJECTIVES OF GRAIN STORAGE

Adequate storage facilities fulfil various economic functions in addition to diminishing food losses. Many areas of Latin America pass suddenly from a period of relative abundance at harvest time to one of acute shortage at the end of the crop year. This has found expression in common language: in Honduras, for example, when fortune or luck turns against one, it is commonly said of him that "his June has arrived" *(ya le han llegado los Junios)*.[11]

With the deficiencies in present warehousing, it is practically impossible, especially in the tropical areas, to maintain satisfactory working stocks throughout the year. Stocks are scattered—in the hands of the subsistence farmers or of the middlemen who keep the grain until the preharvest period for speculative purposes. This situation leads to enormous seasonal price fluctuations: prices double and sometimes triple in the densely populated areas within the same crop year. In El Salvador, for example, the price of beans varies within the year from approximately $US 0.06 to $US 0.16 per pound.

Such difficulties could be obviated by an adequate storage system. Three aspects of the question will be examined here: working stocks, famine reserves and buffer stocks.

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[6] Data of the *Ministerio de Economía del Ecuador* (Ministry of Economics of Ecuador).

[7] Report of the Venezuelan delegation to the meeting at Palmira, Colombia, February 1949.

[8] Report of the Colombian delegation to the meeting at Palmira, Colombia.

[9] FAO, Summary of Proceedings, International Meeting on Infestation of Food, London, August 1947, page 7.

[10] Study sent by the Government of Chile to the meeting at Palmira, Colombia.

[11] June is the month of acute shortages preceding the harvest.

Properly managed reserves of storable products like maize, wheat, pulses, oats, barley, sorghum, rye, etc., could make a substantial contribution toward the improvement of the food situation in Latin America. The establishment of working stocks would serve the following purposes:

(i) All countries would satisfy their needs including:
  (*a*) The maintenance of normal distribution and shipping; and
  (*b*) The building up of reserve against crop fluctuations.
(ii) Importing countries would also be in a position to build reserves against variations in external supply; while
(iii) Exporting countries would be able to make provisions to maintain their foreign markets.

Reserves against famine could be established as supply conditions permit, to be used not only nationally, but internationally whenever needed. It would be reassuring for this continent and for the world as a whole to know that Latin America possessed reserves sufficient to meet almost any series of crop failures or natural catastrophes.

Price stabilization operates through an agency empowered to buy any quantity of the product offered at the established floor price and to sell any amount demanded at the established ceiling price. In times of abundance the organization buys in great quantities and accumulates reserves, thus avoiding a sharp fall of prices, while in times of scarcity it allows the reserves to flow out in order to prevent prices from going through the ceiling. As consumption fluctuates, producers are permitted to market their products uninterruptedly. As production fluctuates, the reserve ensures uninterrupted supply to consumers. The three kinds of reserves outlined could be held in the same place in each country but they would be available separately to serve each of these different purposes.

4. THE PRESENT SITUATION

Although information on the capacity and condition of storage facilities is not complete, it can be said generally that on the whole warehouses and granaries are insufficient in number and capacity as well as in other respects, including technique.

A. Grain Storage

The representatives of all the countries attending the meeting on conservation of grain in storage, held in Palmira, Colombia, during the latter part of February 1949, under the auspices of the Colombian Government and FAO, stressed present deficiencies.

For purposes of this analysis, Latin America can be divided into: (*a*) the tropical countries, and (*b*) Argentina, Uruguay and Chile.

(*a*) Storage methods, as used in temperate areas, are practically unknown in the tropics. Facilities are generally unsatisfactory in the consuming centres but even worse in the production centres. Wheat or rice mills, and in some cases, important urban commercial firms, have fairly adequate warehouses using pest control methods. Some Governments or semi-governmental organizations have also constructed suitable storage facilities. Moreover, knowledge of food waste is spreading rapidly in nearly all the important towns; silos are being built and studies made to provide these centres with modern storage facilities. On farms and in villages, however, grain is still stored in wooden containers, fibre bags and steel drums, in rooms made suitable for piling sacks and in small granaries or silos of sheet-iron reinforced with steel hoops. In certain parts of Brazil, a primitive structure (called a *paiol*) resembling a wooden hut, is built on stilts above the ground. The *paiol* is effective against domestic animals and rodents but hardly against insects. Very few of these are sufficiently air tight for fumigation.

Insects affecting grains in storage are not controlled scientifically. Farmers and merchants employ such primitive empirical methods as: smoke, lime, sulphur fumes, ashes, heating in the sun, storage in dry cold climates, and rapid sale. Sheet-iron silos or special chambers permit fumigation with carbon disulphide. Some modern plants are gradually introducing methyl bromide. Rodent control is ensured primarily by cats, traps and baits containing strychnine or arsenic.

Drying is particularly important in the tropics since high moisture content unfits harvested grains for storage. Nevertheless, only in wheat and rice mills, and in the first modern equipped elevators, is this done. The farmer generally exposes his grain to the sun but seldom succeeds in reducing the moisture content enough to ensure effective storage.

The areas of high altitude in the tropics have scarcely any food preservation problems: the central plateau of Mexico, the highlands of Ecuador and Peru and the Bolivian altiplano. Here the cold and dry air permits even perishable goods to be kept for a long time.

Losses are the most serious in Central America. Only Costa Rica possesses modern storage plants. In San Jose, there are eighteen silos with a capacity of 500 short tons each; two warehouses (total capacity 1,200 short tons); two fumigation chambers (capacity 410 short tons) equipped to use methyl bromide; an unloading chamber (160 short tons) and a drying chamber. The Government has also established, in co-operation with the Inter-American Technical Service for Agricultural Co-operation, a plant at Limon to dry 2,000 short tons of maize per annum. The results have been so satisfactory that the establishment of a chain of similar plants is now under consideration.[12] Noteworthy in this country is the

[12] Furnished by the delegation of Costa Rica at the meeting at Palmira, Colombia, February 1949.

experimental work carried out by the Inter-American Institute of Agricultural Sciences at Turrialba, for drying grains in sacks and storage in small steel granaries.

In El Salvador, the only warehousing facilities are those of the *Almacenes Generales de Depósito* of the *Banco Hipotecario* and of the *Cajas de Crédito Rural.* The *Banco Hipotecario* owns a series of small metal silos with a total capacity of 3,500 short tons. The plant is fairly well equipped but by no means adequate to meet present needs. Warehouses in the villages are managed by the *Cajas de Crédito Rural* which place at the disposal of farmers small sheet-iron granaries for air-tight storage of cereals. Both facilities utilize carbon disulphide for fumigation. In 1943, the *Banco Hipotecario* projected the building of four elevators with a total capacity of 60,000 short tons, but sufficient funds were not available. The Ministry of Agriculture has since initiated the construction of a plant for 10,000 short tons in San Salvador to be in use, it is hoped, within a year.[13]

Guatemala lacks appropriate warehouses, but the *Instituto de Fomento de la producción,* recently established, has, as one of its principal objectives, the establishment of such facilities. Efforts have been made in Honduras and Nicaragua to improve present conditions but for various reasons the goals set have not been reached. Plans are under consideration for the installation of three elevators in different parts of Panama.

Ecuador, Paraguay, Haiti and Bolivia have no warehousing system, or other storage facilities. However, rice mills and wheat mills as well as the principal distributors of grain have warehouses with sufficient space to meet their own needs.

In Mexico, Cuba, the Dominican Republic, Peru and Colombia the problem of warehousing is due primarily to the absence of organizations to extend facilities for the conservation of grain. Conditions here are not as precarious as in some other countries, and the consciousness of food wastage, of the losses incurred, and of the need to establish adequate warehousing systems, is spreading. In Mexico, insects particularly are prevalent in the lowlands. The Joint Working Party visited several warehouses in Mexico City and noted that the stored grain was in good condition. The *Nacional Reguladora y Distribuidora* is the only institution with modern warehousing facilities. However, even their structures are not properly equipped for ventilation, lighting and fumigation nor provided with means adequate to regulate temperature and reduce humidity.[14] Government plans to improve present conditions had not been financed at the time of the visit.

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[13] *Banco Hipotecario de El Salvador,* 1948.

[14] Preliminary report of the *Dirección General de Agricultura Mexicana* (General Agricultural Administration of Mexico) to the meeting at Palmira, Colombia.

In Peru, the *Ministerio de Agricultura,* the *Junta Nacional de Fomento de la Producción Alimenticia,* the *Dirección de Abastecimientos,* the *Sección de Muelles y Almacenes Fiscales del Ministerio de Hacienda,* the *Caja de Depósitos y Consignaciones* and the *Corporación Amazonica* have endeavoured to improve warehousing facilities, sometimes in co-operation with SCIPA. Present facilities consist of warehouses and fumigation chambers totalling 17,320 square metres. Silos for imported grains exist in Bellavista. It is expected that SCIPA will shortly construct a grain warehouse in Pacasmayo, with a capacity of 25,000 sacks.[15]

The *Instituto Nacional de Abastecimientos* and the *Federación de Cafeteros* own the best warehouses in Colombia, but these lack modern facilities and sufficient capacity. The *Instituto Nacional* is building, at Bogota, a group of sixteen silos with a capacity of 4,000 metric tons. It is expected that within five years similar silos will be built in Menangue, Medellin and Calli.[16]

Great progress has been made in the conservation of stored food in Brazil, although wheat, rice, maize and pulses are still stored mainly by private enterprises. In Rio de Janeiro, four fumigation chambers use methyl bromide. Construction of an elevator with a capacity of 30,000 short tons is under way. It will have six vacuum fumigating chambers with a capacity of 450 sacks of 60 kg. each, as well as a vacuum chamber in which two railway freight cars may be treated at the same time, and an electric plant for the sterilization of sacked grains. Total treating capacity will be 17,500 sacks daily. In Brazil, fumigation with methyl bromide for maize, rice and beans in ship holds has been practised for several years; the first experimental sacking took place in Rio de Janeiro in April 1946. Since then more than 100 ships, carrying grain in sacks or bulk, have been fumigated at Rio de Janeiro, Santos, Recife, Cabedelo and Fortaleza.[17] The Salte Plan gives considerable importance to the problem and provides for the building of storage quantities totalling 749,000 tons capacity.

Venezuela has shown great interest in the problem. At the end of 1948, it was estimated that government-owned granaries could store some 57,500 metric tons. The *Corporación Venezolana de Fomento* and the *Banco Agrícola y Pecuario* are building modern plants to be controlled by a semi-governmental organization called the *C.A. de Silos.* The corporation has contracted to buy twelve groups of silos with a total capacity of 32,488 metric tons which will be placed in the production centres to be finished by the end of 1950. The Ministry of Agriculture is also building simple granaries and setting up properly fitted petroleum tanks to help small farmers. This programme, when completed, will make it possible to increase the storage by approximately 20,000 metric tons.

[15] Data supplied to the Joint Working Party by SCIPA, Lima, November 1948.
[16] Report of the Colombian delegation to the meeting at Palmira, Colombia.
[17] Rangel, J. F., *Fumigation of grain on ships in Brazil,* 1949.

The Department of Plant Health in the Ministry of Agriculture owns a fumigation chamber of 600 cubic feet; another of 1,100 cubic feet is being built in Puerto Cabello. Fumigation chambers are under consideration for the ports of La Guaira, and Maracaibo, with capacities of 4,000 cubic feet and 2,000 cubic feet, respectively.[18]

(*b*) Storage facilities are more abundant in the temperate areas. In the principal centres in Chile, Argentina, and Uruguay, climatic conditions are less favourable for the propagation of pests and attention has been given for a longer time to the problems of food conservation. In Argentina, particularly, progress has been made in the conventional types of warehouses and also in research. Real contributions have been found in modern techniques, some of which may be applicable to other Latin-American countries.

In Chile, the total warehouse capacity is not known, but it is generally realized that it is not large enough. Not all warehouses are built in such a way as to control effectively the pests. Wheat and rice mills, however, have warehouses with a capacity sufficient for their own needs. The Institute of Agricultural Economy (*Instituto de Economía Agrícola*), which controls the warrant warehouses, stored 156,300 metric tons of wheat, rice, oats, barley and pulses in 1948. Valparaiso has one large fumigation chamber which is operated at normal pressure. The Government is building four plants, for drying and storing wheat, in the south of the country. Private enterprises are building plants especially for the warehousing of rice.[19]

Most warehouses in Uruguay are constructed of corrugated iron. Although fumigation with methyl bromide is commonly practised, most of the available facilities for grain storage are technically inadequate, as well as of insufficient capacity. Following Argentina's example (see below) the Uruguayan Government authorized 1 million Uruguayan pesos for construction of cement-lined, underground silos, in Nueva Palmira, Dolores and Fray Bentos. Those at Nueva Palmira are now ready to store 30,000 tons of wheat from the last crop.[20]

In Argentina, the enormous quantity of unmarketable surpluses accumulated during the war and the scarcity of sacking and storing space forced the Government and private institutions to study grain conservation methods. The Ministry of Agriculture, through the *Comisión de Conservación de Cereales,* evolved a new storage method which has the advantage of being both adequate and cheap: cement-lined underground silos. Each silo is built to hold 550 metric tons of wheat of a specific

[18] Data of the *Corporación Venezolana de Fomento* (Venezuelan Development Corporation) 1948.

[19] Study sent by the Government of Chile to the meeting at Palmira, Colombia.

[20] *Subterranean Silos of New Palmira, Uruguay,* work presented by J. S. Siecola to the meeting at Palmira, Colombia, February 1949.

weight of 78. The walls are made of earth containing 60 per cent of sand to which 10 per cent of Portland cement is added, and are subsequently coated with a solution of asphalt and finally of lime. When the silo has been filled, it is covered with sisalkraft paper. On top of this, rattan matting is placed and then another layer of paper with metal screening coated with insulating paint. A layer of straw about 40 cm. thick is added and finally a layer of two metres of earth. The grain, in its respiration, exhausts the oxygen in the airtight silo: without oxygen all insect life soon ceases.

The underground silos are easy to construct and the initial cost is low. Only simple equipment is needed. It should also be pointed out that this type of storage is very specialized, being suited to dead bulk storage of surplus grain for several years. The cost of continual handling, as in grain terminals, would become prohibitive and the hermetic feature would be lost. A limiting factor in the use of this type of storage is the ground water level which must always remain 25 feet below the surface.

The results obtained so far have been excellent. Out of 680,000 tons thus stored, losses have been one half of one per cent, with no change in the quality of the grain. The Joint Working Party was presented with samples of wheat stored in plants in Capitan Sarmiento and Canada de Gomez in 1941 and 1942 which showed no signs of insects and looked recently harvested.

The total capacity of the Argentine underground silos is 847,300 tons (1,540 silos in 10 plants). In addition, terminal stations located in twelve different ports have a total capacity of 828,600 tons. The capacity of elevators located in various centres of production is approximately 500,000 tons. The Government is planning to build eight terminal stations with total capacity of 600,000 tons and forty elevators in the centres of production with a total capacity of 360,000 tons.[21]

B. Cold Storage

Storage of perishable goods, so necessary in tropical climates, hardly exists. In the urban centres, commercial firms generally have cold storage facilities but only to satisfy their own needs; there are no such facilities for the majority of producers. Cuba is a noteworthy exception. Here there exists a network of warehouses with cold storage facilities available to farmers, built by the *Comisión de Fomento Nacional* located in each province. Total capacity is approximately 312,000 cubic feet.[22]

In Venezuela, at the end of 1948, the total cold storage capacity for the use of farmers was estimated at 7,780 metric tons, while needs for

[21] Data supplied to the Joint Working Party by the *Servicio de Silos Subterráneos* (Subterranean Silos Service), Buenos Aires, 1949.

[22] Report on Work Accomplished by the *Comisión de Fomento Nacional* (National Development Commission), Cuba, 1948.

this type of storage were estimated to be 30,000 metric tons. The *Corporación Venezolana de Fomento* and the *Banco Agrícola y Pecuario* are planning to build cold storage warehouses with a capacity of 22,000 tons, to be completed in about four years.[23]

Governments have given particular attention to the conservation of meat and potatoes. Colombia plans to build a refrigerating plant for potatoes in Bogota (capacity 3,000 metric tons);[24] one is also proposed in Tunja where the climate is cold and dry. In Costa Rica, the Government is contemplating a small refrigerating plant, for potatoes, in San Jose. In Paraguay, facilities for storing meat are good; the Government is building, in Asuncion, a refrigerating plant for the conservation of other products.

Special attention has been given in Brazil to cold storage, particularly for meat and dairy products. The Salte Plan provides for the building of freezing plants in twenty-one localities with a total capacity of 174,950 tons at an estimated cost of 794 million cruzeiros.

In Chile, Uruguay and Argentina, cold storage facilities for meat are almost adequate, but not for potatoes. For example, in Chile it is estimated that 12,000 tons of potatoes are lost every year owing to inadequate warehousing—especially in the south.

In many countries, the hot climate and lack of cold storage are among the principal causes for the low development of fisheries and the low consumption of fish. It appears that the greatest progress would be made at this point by the establishment of complicated and costly plants for the quick freezing of fish (see chapter VII).

5. IMPEDIMENTS TO THE DEVELOPMENT OF ADEQUATE WAREHOUSING

Countries with a tropical climate are confronted with the following serious difficulties:

(*a*) Neither farmers nor consumers are sufficiently conscious of waste of food;

(*b*) Funds are insufficient to meet construction and operational costs of warehouses;

(*c*) The extent of crop losses caused by insects, rodents and fungi is not sufficiently known;

(*d*) Technical personnel in many cases are not available;

(*e*) Research, especially on drying, storing and pest-control methods, is insufficient;

[23] Data supplied to the Joint Working Party by the *Corporación Venezolana de Fomento* (Venezuelan Development Corporation).

[24] *Instituto Nacional de Abastecimientos* (National Supply Institute), Colombia 1949.

(*f*) The cost of installation and equipment is too high;

(*g*) Lack of building materials, the inadequacy of domestic credit, shortage of foreign exchange are further impediments. Plants already in operation in tropical areas face the following problems:

(i) Moisture content in most grains is very high, and drying increases the cost of storage;

(ii) The numerous varieties of grains and rather complex spontaneous hybridization result in different qualities, colours and sizes. This makes the use of silos complicated and difficult while the quantities available in each variety are too small to justify the filling of a silo;

(iii) Most of these countries handle grain in sack; this results in expensive handling charges and increases costs.

6. CONCLUSIONS AND SUGGESTIONS

The Joint Working Party feels that lack of storage facilities in Latin America, especially in tropical countries, is a problem of utmost gravity necessitating the immediate attention of Governments and close international co-operation. The construction of adequate grain storage warehouses would give the quickest returns in the way of improvement of the Latin-American diet. Availability of food would increase by more than 20 per cent without any expansion of the present area under cultivation, any modernization of production methods or any importation of costly agricultural requisites.

The Joint Working Party feels that it would be appropriate to undertake to:

A. Make producers and consumers aware of the waste of food.

B. Establish inexpensive storage units on the small farms as well as in the centres of production.

C. Build modern warehouses in the most important centres of production and consumption.

D. Train technical personnel for the conservation of food in storage.

E. Make a detailed study of losses of grain due to insects, rodents and fungi.

F. Study the most effective systems of drying, storage and pest-control.

G. Make available to all countries information on the most advanced methods available.

H. Build up reserves of grain, and make funds available to price stabilization organizations, once adequate silos and warehouses are built.

CHAPTER VI

Programmes for Increasing the Area under Cultivation

Programmes for increasing the cultivated area necessarily affect the future demand for agricultural requisites. This is particularly true for irrigation or drainage projects, where fairly intensive forms of land-use are employed and the demand for agricultural requisites, per hectare, will be greater than the average for the country concerned. If the magnitude of such programmes is considered in relation to areas already under cultivation, it is possible to assess their future significance in terms of requirements for agricultural requisites.

Opportunities for the expansion of the cultivated area of Latin America are considerable. Most countries have water resources which are only partly utilized and large areas of land suitable for reclamation and irrigation, as well as other regions where needs for transportation, credit, land clearing, and health measures are clearly indicated.

Nowhere in Latin America does there exist an opportunity comparable to the opening up of the prairies of the United States and Canada, the Argentinian pampas or the Australian plains. Opportunities for expansion in Latin America, almost without exception now, require heavy capital expenditures and co-ordinated government action to make settlement possible.

Should the limited amounts of capital available be devoted to increasing the cultivated area or to raising yields on land already farmed? A thorough comparative study is required of the values of investment in improved seeds, more fertilizers or pesticides, better transportation services, better extension services, better credit facilities, on the one hand, against the investment needed for irrigation, drainage and colonization to obtain extra production for a given investment on the other.

1. IRRIGATION AND DRAINAGE

The best information available estimates 6 million hectares of irrigated land[1] representing nearly 10 per cent of the cultivated area. Probably one-half of this was under irrigation at the beginning of the century. Certain pre-European civilizations in Latin America had under irriga-

[1] See column 2 of the table in appendix C.

tion areas which were large even by today's standards. The development of a sense of public responsibility and governmental organizations for the study and execution of large scale irrigation and drainage works is relatively new.

There is considerable evidence that this upsurge of interest in the development of each nation's irrigation potential may usher in a period of rapid expansion in the irrigated areas.

(*a*) Present Irrigated Area

Mexico, Peru, Chile and Argentina having developed irrigation on an extensive scale, now possess 90 per cent of the irrigated area of the whole region.

Mexico. Mexico, because of the scanty rainfall throughout all but a small part of the country and as a result of more than 20 years' work, now has the largest area under irrigation in Latin America.

From 1926 to the end of 1946 the *Comisión Nacional de Irrigación* (now the *Secretaría de Recursos Hidráulicos*) provided irrigation for 858,000 hectares. Of this, 462,000 represent new land brought under irrigation and the remainder represent improvement of primitive systems. This amounts to approximately one-half the total area of 1,700,000 hectares estimated to be under irrigation prior to the present six-year plan. Work completed in 1947 and 1948 is estimated at 300,000 hectares, making an estimated total of 2,000,000 hectares of irrigated land at the end of 1948. This is more than one-quarter of the area under cultivation.

Peru. Along the Peruvian coast, agriculture can be carried on only in the valleys of the numerous rivers which come down from the Andes to cross the desert to the Pacific. Here almost 500,000 hectares have been brought under irrigation and cultivation. On the Sierra, where the rainfall is low, and in the Montana, the irrigated area has been estimated at over 700,000 hectares. This makes a total of some 1,200,000 hectares, four-fifths of the annual area under crop.

Approximately one-half of the cultivated area of the coast has been brought under irrigation during this century, thus restoring many areas under irrigation in Incan and even pre-Incan days. Until 1920, water already available was utilized; since then government projects have reclaimed some 50,000 hectares of desert land and improved another 50,000.

Chile. In the Central Valley of Chile, extremely low rainfall and abundant water supplies have made the development of irrigation both necessary and relatively easy. In the northern zone, agriculture is entirely dependent on irrigation. In the central zone, from the province of Aconcagua to the province of Bio-Bio, irrigation becomes less essential as one moves south but most of the area, as well as hundreds of thousands of hectares of artificial and natural pastures, are under irrigation.

Total irrigated area now approximates 1,250,000 hectares of which 250,000 represent public works during the last half century.

Argentina. In contrast to other countries, irrigation in the Argentine is relatively new. In the arid and semi-arid zone of the west, at the foot of the Andes, some 340,000 hectares have been put under irrigation in what are known as the "vineyard oases," for the growing of wine-grapes, fruits and alfalfa. Large areas are under irrigation, principally for sugar-cane, in Tucuman and other oases of the north-west. Smaller projects have been developed in the low rainfall areas of northern Patagonia along the Rio Negro and its tributaries.

According to the 1933 statistics (the latest available), total area under irrigation was 912,000 hectares. With the completion of the Rio Atuel dam and other minor extensions, this may, perhaps, be increased to around 1,000,000 hectares, representing only about 4 per cent of the total cultivated area.

Other countries of South America. Although irrigation is important in some parts of Brazil, it has not been developed on so large a scale as in the countries reviewed above. The greater part of the irrigation is in connexion with rice in Rio Grande do Sul, where 126,000 hectares were irrigated in 1946-1947, based not on public reservoirs but on small private works and pumping from rivers. Some of the rice is irrigated in other states, but in much smaller proportion; exact figures are not available. In the north-east, sugar cane and rice are grown under irrigation in limited areas along rivers. Many large dams have been constructed in the drought area but these serve as reserves for stock and domestic water supply and less than 10,000 hectares are provided with irrigation.

In Venezuela, where there is a low rainfall belt to the west and east of Caracas, the irrigated area is estimated at a maximum of 100,000 hectares, representing approximately 12.5 per cent of the land under cultivation. So far 14,000 hectares have been irrigated through works constructed by the *Dirección de Obras de Riego.*

In Colombia, small privately initiated irrigation works supply water for rice, sugar cane and bananas, but the total is not large. Projects so far completed by the *Instituto de Aprovechamiento de Aguas,* irrigate approximately 7,000 hectares.

In Ecuador, the *Caja de Riego* has put 5,000 hectares under irrigation during the last four years. Bolivia has about 12,000 hectares under irrigation, of which 3,500 hectares are the result of national works now under construction and the remainder is from small local schemes.

Total irrigated area in Uruguay is estimated at 70,000 hectares, but more than 50,000 of these are for vegetable production around Montevideo. Irrigation of field crops is confined to rice and sugar cane, both recent developments. Irrigation is almost entirely by pumping. In Paraguay, irrigation is confined to rice culture, which has expanded rapidly

in recent years. During the last season about 12,000 hectares were irrigated.

Caribbean countries. The development of irrigation in the Caribbean Republics has been more extensive than in any other of the small nations of Latin America. This is particularly true of the Dominican Republic where over 50,000 hectares have been placed under irrigation through national projects and more than 30,000 hectares irrigated by privately constructed canals. The total of 85,000 hectares under irrigation represents approximately one-fifth of the cultivated area of the Republic.

In Haiti, the irrigated area totals 40,000 hectares of which approximately one-half is irrigated by foreign controlled banana and sugar companies. Some 60,000 hectares are under irrigation in Cuba, representing only a little over 3 per cent of the total cultivated area.

Central America. Here the use of irrigation is practically confined to banana plantations of the foreign owned companies, who use the overhead system extensively. What other irrigation exists, is of an extremely primitive character. For most countries there are no statistics, but the total for Central America is perhaps in the vicinity of 50,000 hectares, almost entirely for bananas.

(*b*) Current Programmes

Practically all projects at present under construction, or for which financial arrangements have definitely been completed, are scheduled to be terminated before the end of 1952, except for Argentina. Fortunately, therefore, a dividing line may be drawn between fairly realizable programmes, and those for the more distant future. The 1949-1952 programmes are summarized in columns 4-8 and 9-13 of the table attached to this report as appendix C.

Current irrigation programmes are important in all parts of Latin America, except in Central America: at least ninety-two such projects are known. Those now under construction will add nearly one million irrigated hectares. Another 300,000 hectares are to be added by projects scheduled for commencement in the near future. In total, this means a 20 per cent increase in the irrigated area of the region during four years, to cost some $US 230 million, not including Argentina.

These current programmes promise to increase substantially the agricultural production of several countries, notably Mexico. Particularly when just introduced, irrigation is applied to high value specialty crops, previously imported, sometimes altering the supply situation for these commodities in the countries concerned.

Because they bring under cultivation land capable of intensive production, and since the future use of these lands is of special interest to Governments, the use of machinery, fertilizers and pesticides in these

areas is likely to be many times the national average. As in Mexico, irrigation programmes are followed by mechanization.

Mexico. Mexico is engaged in the most ambitious irrigation programme in Latin America. The plans drawn up for the 6-year period 1947-1952 call for an increase in the irrigated area equal to 234 per cent of the new land already brought under irrigation by the *Secretaría de Recursos Hidráulicos* up to the end of 1946 and equal to 65 per cent of the total irrigated area of the country. This involves fifty-one projects designed to irrigate 1,081,000 hectares of new land and to improve the irrigation on another 66,400. The total cost is estimated at 1,459 million Mexican pesos or approximately $US 210 million. Investment is scheduled to rise from 190 million Mexican pesos in 1947 to 270 million in each year after 1950. Approximately 10 per cent will be expended for procurement of equipment and materials outside the country.

Land is to be brought under irrigation gradually, as the engineering work proceeds, as shown by the following figures:

	Thousand hectares
1947	212
1948	136
1949	172
1950	179
1951	202
1952	247

Full data are not available, but from September 1947 to August 1948, 135,000 hectares were added; during the last two years 300,000. This exceeds the total in the rest of Latin America during this period. The fact that 15 per cent of the Mexican budget is going into irrigation is the best evidence of its determination to push ahead with these plans.

It is necessary to mention, besides, the well-drilling programmes financed and promoted by the *Banco de Crédito Ejidal* and the *Banco Nacional de Crédito Agrícola,* to provide supplementary irrigation only. The former bank invested 15 million Mexican pesos in 1948 to sink twenty wells and construct canals for the irrigation of 2,000 hectares. In 1949 it proposes to invest about 100 million Mexican pesos. The latter bank has drilled several hundred wells, of enormous importance in the betterment of farming conditions on the Meseta.

Chile. The *Departamento de Riegos* has eight irrigation projects and one very small drainage project currently under construction. These will bring 67,000 hectares of new land under irrigation and improve an additional 146,000 hectares, at an approximate cost of 540 million Chilean pesos. This is part of a continuing programme to undertake new projects as finance becomes available. The Department has an annual budget of 120 million Chilean pesos, which permits an average of 7,000 hectares of new land to be irrigated per annum. An average of 3,000 hectares additional is being irrigated by private initiative.

Of these projects, four, including the drainage project, are to be finished in 1949 to bring 10,500 hectares of new land under irrigation and drain 600 hectares. Three projects are to be completed in 1950 to improve the irrigation of 36,000 hectares. One project will be finished in 1951, adding 15,000 hectares of new land. The largest of these projects which may not be completed until 1953 or 1954 will irrigate 40,000 hectares of previously unirrigated land and improve that on 110,000 hectares.

The *Departamento de Riegos* also has the budget for two other projects on which work is to commence shortly, to cost 200 million Chilean pesos. These will irrigate 32,000 hectares of new land, one-half of what may be done by the end of 1952, to be entirely completed by 1954.

Argentina. The Argentinian 5-year plan (1947-1951) provides for a programme of forty-six irrigation works and thirteen drainage and sanitation works to be undertaken, to irrigate 1,575,000 hectares. These irrigation possibilities arise out of the construction of dams for hydro-electric purposes. The area to be benefited is estimated at 6,500,000 hectares, the total investment required is 542 million Argentine pesos for irrigation and 35 million pesos for drainage.

Only nine of the irrigation projects are to be completed by the end of 1951, including four begun prior to 1947. The other five relatively small projects require only 1 to 3 years' work each. Only four of the drainage and sanitation projects will be completed by 1951. Six of the projects will not be initiated until that same year. Four irrigation projects and three drainage projects were to have been completed in 1947 or 1948, but lack of official information makes it difficult to assess the progress of the programme.

When completed, the 1,575,000 hectares would represent an increase of approximately 160 per cent in irrigated area, an increase of approximately 6 per cent in the cultivable area. Most of the new land would presumably be suitable for specialized crops. More than 1 million hectares will be in the west and the north-west, from San Rafael to Jujuy, more than doubling the irrigated area in the so-called western Argentine. Fifteen of the projects are to be undertaken in the Rio Negro-Rio Colorado region, affecting an additional 375,000 hectares, where previously the irrigated area approximated only 65,500 hectares.

Peru. Two projects currently under construction are designed to irrigate 25,000 hectares of new land on the coast and to improve irrigation on 53,000 hectares, an increase of a little over 10 per cent in the cultivated land on the coast. These projects, commenced in 1948, are expected to require three years each, provided adequate modern equipment is made available. Approximately 70 per cent of the area will be devoted to cotton and pastures. Estimated cost of these projects is 65 million soles.

Venezuela. Four irrigation works are under construction by the *Direc-*

ción de Obras de Riego to make possible the irrigation of 24,000 hectares. Two of these represent stages in larger projects, the whole representing an increase of about 25 per cent in the area under irrigation in Venezuela. The cost is estimated at 39 million bolivares.

Colombia. Four irrigation projects and two drainage projects are under construction by the *Instituto Nacional de Aprovechamiento de Aguas.* All but one of the irrigation projects are very small and will benefit 12,000 hectares. The projects are in the tierra caliente and the land will be made suitable for production of rice, maize and cotton. The drainage projects will make available 34,000 hectares of land suitable for such cool climate crops as wheat, potatoes and barley, and for grazing. The drainage works and the principal irrigation project covering 10,000 hectares are scheduled to be completed in 1949.

The *Caja de Crédito Agrario* has under its control three important irrigation projects scheduled to be commenced in 1949 and completed by the end of 1951 or early 1952. The financing of these projects, estimated to cost approximately 10 million Colombian pesos, is adequately covered by the U.S. Export-Import Bank loan under the terms of which a United States engineering company is to carry out the work. Two of the projects will bring under irrigation, at semi-tropical elevations in the Rio Magdalena valley, 30,000 hectares of land suitable for sugar cane, rice, fruits, truck crops and cattle fattening. Both regions will be able to supply Bogota with products, now brought from distant points. The other project on the Sabana de Bogota will more effectively regulate the existing water supply rather than bring new areas under cultivation. The *Caja* also provides a well-drilling service for farmers, and is sinking approximately forty wells per month.

Ecuador. Three irrigation projects under construction by the *Caja de Riego* will, when completed, irrigate approximately 41,000 hectares, at a total cost estimated at 60,000,000 sucres.

The project to irrigate 8,000 hectares on the sierra was commenced in 1945 and is approximately 60 per cent completed. Another project on the sierra for 12,000 hectares is almost half completed but work is, at present, suspended. The largest project designed to irrigate 20,000 hectares on the coast has made but very little progress so far and, in view of the finances available, it is difficult to estimate when it may be completed.

Bolivia. The *Dirección General de Riegos* is constructing two projects, one at Cochabamba and one on the Altiplano. The total area to be irrigated is 12,000 hectares; of this, 3,500 hectares are already under irrigation from the Cochabamba project. Both projects are scheduled for completion at the end of 1950 but, as they call for an annual expenditure in excess of the assured budget completion is likely to be somewhat delayed.

In addition, a 6-year programme calls for the construction of works to irrigate 39,000 hectares by 1953. Construction was to begin in 1948 but as it is dependent on additional governmental funds being made available, it cannot at present be regarded as part of a realistic immediate programme.

Brazil. The *Instituto Rio Grandense do Arroz* has plans to extend and improve the irrigation of rice in Rio Grande do Sul. One dam now under construction will irrigate 7,000 hectares, two others, which have not yet been begun, a total of 16,000.

Other projects are being prepared by the State Commission of Irrigation Works in Rio Grande do Sul for four reservoirs. The first, to be constructed at a cost of 70 million cruzeiros, will make possible the irrigation of 45,000 hectares.

Uruguay. The *Plan de Obras Públicas* (1944-1949) provided for the first irrigation projects to be constructed with public funds. These projects, four in all, are still under construction. Slightly over 3 million pesos were appropriated for them and another 3 million are needed for their completion.

Paraguay. Extension of irrigation is planned as part of the rice production programme decided on at the Baguio Rice Conference. Area under rice was to be increased to 20,000 hectares in 1948-1949, 45,000 in 1949-1950 and 75,000 in 1950-1951. It is not now expected that these goals will be met owing to lack of equipment from abroad.

Dominican Republic. Projects under construction will make possible irrigation of approximately 21,000 hectares. Of relatively simple nature, they consist only of derivation canals and do not require dams. Plans for other canals, which have not yet been commenced, are projected for the near future to irrigate an additional 54,000 hectares.

Haiti. Three small projects are under construction and are expected to be completed within a year. There is also a small well-drilling programme for irrigation of new land for sugar cultivation. The total area to be benefited by all these works will be approximately 6,000 hectares.

Plans have been prepared for a number of related projects to irrigate 26,750 hectares on the Artibonite plain. This undertaking is dependent on external finance; request for a loan has been submitted to the United States Export-Import Bank. If initiated in the near future, the project may be expected to be completed about the end of 1952.

(*c*) Long Range Prospects

Practically every country in Latin America has prospective irrigation or drainage projects, the status of which varies as regards both the extent to which they have been thoroughly studied and the prospects for their execution. Some, due to factors of time and money, represent aspirations

rather than prospects. Some have been ready, in every aspect except the financial, for decades.

There are well over 100 of these projects in Latin America, involving some 2 million hectares and approximately $US 500 million.

Peru. The *Dirección de Aguas e Irrigación,* since 1920, has made an inventory of the water resources in the drainage basins of thirty-eight of the forty-seven rivers which come down from the Andes and cross the coastal plain. These supply sufficient water to irrigate 2 million coastal hectares. Present irrigation is based principally on the tapping of the natural flow of the rivers. Realization of their full potentialities would require construction of headworks to control their flow. The *Dirección* has also classified and evaluated more than 400,000 hectares of desert soil. As a result of this work, it has drawn up fifteen additional projects for the irrigation on the coast of approximately 475,000 hectares of new land and the improvement of irrigation on 127,000 hectares, and 100,000 hectares on the sierra. The total cost of these projects is estimated at approximately 1,140 million soles.

Chile. The *Departamento de Riego* has fifty-nine projects in various stages of study, with twenty-two of them being readied for construction as the budget permits. These projects would permit of the irrigation of 200,000 hectares of new land, and require 25 to 30 years to finance. Those projects which may be regarded as long term potentialities only would provide for the irrigation of 288,000 hectares of new land.

Brazil. Only scattered information is available. The area with irrigation potentialities in Rio Grande do Sul is estimated at around 1,100,000 hectares. The Paraiba valley, the Rio Grande zone of Minas Gerais and in Goias and Ceara are regarded as suitable for extensive development of irrigated rice. Extremely large areas, estimated at up to 240,000 hectares, could be irrigated from the Rio Sao Francisco. It has been suggested that the water supply in the large dams of the drought region could provide irrigation for extensive areas. In the small areas which have been irrigated the soils are reported to have been very responsive.

The larger part of the 10,500 square miles of the former Baixada Fluminense swamplands has been drained, but much of the area has not yet been put to agricultural use. Further reclamation work and colonization of the large areas available remain to be done.

Other countries of South America. Venezuela, perhaps the only country of this group where finances are not a severely limiting factor, is at present studying a number of extremely large construction projects which would make possible the irrigation of at least 330,000 hectares. Additional studies are being made of small projects, ranging from 1,000 to 10,000 hectares each, as well as an extremely large project to affect 250,000 hectares.

The *Instituto Nacional de Aprovechamiento de Aguas,* in Colombia, has projects under consideration to irrigate 130,000 hectares, and esti

mates that 500,000 hectares could be irrigated for approximately 200 million Colombian pesos.

Ecuador has under study two projects to irrigate 64,000 hectares. Full potentialities are estimated at 300,000 hectares as a minimum.

Bolivia's six-year programme, to bring under irrigation 39,000 hectares, would have an important effect on its economy if carried into effect. Careful estimates suggest that irrigated areas of such magnitude would produce no less than 17 per cent of Bolivia's wheat requirements, 27 per cent of its sugar-cane, 75 per cent of its cotton and 100 per cent of its oil seeds, all of which now require heavy import expenditures, as well as large quantities of other crops. Additional studies have been completed on projects which could irrigate approximately 50,000 hectares, and, to be completed within the next 3 or 4 years, further projects to benefit an additional 35,000 hectares. By 1954, Bolivia may have ready, from a technical viewpoint, projects to bring under irrigation some 125,000 hectares. The *Dirección General de Riegos* estimates irrigation potentialities of the country at 250,000 hectares.

Uruguay has recently evinced a growing interest in irrigation possibilities. The *Dirección de Hidrografía* has prepared a plan for the expenditure of 25 million pesos on a programme designed to bring some 100,000 hectares under irrigation. This programme is to be developed over 10 years.

Caribbean area. The Dominican Republic has under study a four-year programme to construct several irrigation dams at a cost of between $US 20 million and $US 25 million. Plans for three or four of these are expected to be completed in 1949 when construction work may be commenced on one dam. This programme is perhaps more definite than most of the projects considered in this section but as it certainly will not be concluded before the end of 1952, it has been classified among the long range possibilities.

The irrigation potentialities of Haiti were studied in the years 1920-1925 and were assessed then at approximately 215,000 hectares. At the same time, eleven projects were drawn up for the irrigation of 50,000 hectares. The largest of these the Artibonite project, has been discussed in the previous section, but the remaining ten projects are still for the future.

In Cuba, the *Comisión de Fomento Nacional* drew up a programme in 1941 involving thirteen projects to irrigate 32,000 hectares in the summer and 10,000 hectares during the winter. These projects appear still to be only a series of technique proposals.

Central America. Irrigation proposals in Central America do not for the most part appear to have reached the stage of definite projects. In Guatemala, studies were carried out in 1928 for an irrigation project known as *Llanos de la Fragua* to irrigate approximately 16,000 hectares

of cotton and sugar-cane. One or two other very small projects have been considered but there appear to be no concrete possibilities for their realization. In El Salvador some projects are under study for irrigation in the western part of the country. Panama has recently conducted a study of the drier parts of the country and the cost of specific projects. Other than these, little information is available regarding long range prospects in Central America.

2. COLONIZATION

"Colonization" is used here to include any programme for the organized settlement of people for agricultural purposes. Colonies may be settled on land which has been made available through irrigation or drainage, but for the most part colonization programmes are directed towards opening up areas additional to those considered in the first half of this chapter. In some countries, colonization is concerned principally with the development of more or less virgin areas. In other countries, particularly Argentina and Uruguay, the term refers principally to the subdivision of large holdings for the intensification of land use.

The Working Party has not been able to make a complete and systematic survey of the possibilities for increase of cultivated area nor of government programmes or projects for colonization. The magnitude of these programmes has significance for the possible expansion of the demand for agricultural requisites.

(*a*) Colonization of Under-developed Areas

A high rate of total and rural population in relation to cultivated land is characteristic of the majority of Latin-American countries. This often gives the impression that these countries are fully settled, that an agricultural frontier or large areas of unexploited land do not exist. In Peru, for instance, there are only 0.2 hectares of crop land per inhabitant. In Colombia, Ecuador, Bolivia and in many Central-American countries the majority of the population eke out their living from small, secluded mountain valleys. In Chile the density of rural population in the settled areas is high. Brazil has a high density of rural settlement in many areas, despite its total immensity.

The impression conveyed by these high rural densities is misleading, however. The continued pressure of population has been due not so much to the non-existence of new areas, as to certain features peculiar to Latin America: the rugged topography of much of the continent, the difficulties of creating a transport network, the inaccessibility of large areas from either coast, the unhealthfulness of lowland tropical regions and the psychology and customs of the native population. As a result, unutilized land has not given rise to an expanding frontier except in Argentina

and a few other less important areas. To bring the unutilized areas of Latin America within the effective economy, is a matter beyond the power of individual initiative and requires the co-ordinated action of Governments. Settlements cannot flourish without transportation, special credit facilities, assistance in land clearing and control of disease. At the same time, such measures are far too costly to be undertaken without the assurance of settlement. The tendency, therefore, is to try to open up new areas not by infiltration but by the establishment of colonies at selected points.

In Brazil, for example, the *División de Tierras y Colonización* is responsible for the organization of colonies in undeveloped areas and the decrees issued in 1941 and 1943. Colombia has had its *Sección de Colonización y Parcelaciones* of the *Ministerio de Economía* and recently (1948) has established the *Instituto de Parcelaciones, Colonización y Defensa Forestal* as a separate organization. In Venezuela, the *Instituto Técnico de Inmigración y Colonización* has been organizing colonies in conjunction with the Ministry of Agriculture and the Agricultural Bank, since 1936. In Peru, the *Dirección de Colonización y Asuntos Orientales* was established in the 1930's. Mexico has recently created the *Comisión Nacional de Colonización*. Other countries have long promoted the settlement of outlying areas as a regular part of public lands administration. In Argentina, for instance, the *Dirección General de Tierras y Bosques* in the Ministry of Agriculture is responsible for colonization on national lands in the territories.

Nevertheless, the number of colonists settled and the area brought under cultivation through organized colonization are not impressive, especially in relation to the areas waiting to be occupied. In Colombia, for instance, four colonies have been established in such widely scattered parts as the Magdalena valley, the Llanos adjoining the border of Venezuela, and near Buenaventura. These colonies have received tools, technical advice and health measures, and are located so as to be accessible to a town market. The area available for expansion around these colonies runs usually into several hundreds of thousands of hectares, but the number of families settled and the areas brought under cultivation, to date, are small. In Ecuador, colonization has been attempted in some districts of the rich, undeveloped, subtropical lands at elevations around 1,500 metres, particularly in the district of Santo Domingo de los Colorados. Development has apparently been slow, despite the long-range potentialities of this area, largely due to the difficulty of transporting products to markets in Quito or to the coast. The four attempts at colonization of the tropical regions of Bolivia have not been successful, largely because settlers were left more or less to fend for themselves, lacking both adequate transportation and credit.

Several Central-American countries have made limited attempts to colonize sparse areas. Guatemala has established three colonies in regions

hitherto almost isolated, near the borders of Mexico, El Salvador and British Honduras. The last colony at Poptun has so far had only air communication. The colonies do not appear to show any marked expansive tendency to develop the large unutilized areas in these parts of the country. Nicaragua is now attempting to encourage settlement in undeveloped areas by free grants of government land up to a maximum of 75 acres, or 150 acres for heads of families. The law further provides that title shall lapse after 2 years unless at least twelve acres have been cultivated.

Other countries have achieved more, perhaps, but results are still small in relation to the potentialities. In Chile, the *Caja de Colonización Agrícola* has established ninety colonies during the last 20 years, comprising 3,150 individual farms, 389,000 hectares and a population in excess of 30,000. To date, a total of 117 *fundos* have been acquired with a total area of 635,000 hectares. The *Dirección de Colonización y Asuntos Orientales* in Peru has met with considerable success in its efforts to develop the Tingo Maria district in the eastern part of the country at an elevation of about 2,000 feet. Much emphasis has been placed on experimental work, and non-assisted colonists are now coming into the district. Less progress has been made in the other principal centres of the *Estaciones Centrales de Colonización* at Jaen and Villa Rica. In Brazil, under the 1941 law, lots of 20 to 50 hectares are granted free in what are known as Colonias Agrícolas. Eight of these colonies have been established with a potential area exceeding 20 million hectares. Another type, known as *Núcleos Coloniales,* are established under the 1943 law, with an aggregate area available for settlement of a little over 1 million hectares. These figures in no way indicate the area actually occupied. The *Colonias Agrícolas* have several hundred or, at the most, two or three thousand families each, and the area brought under cultivation is said to be small.

In Venezuela the work of the *Instituto Técnico de Inmigración y Colonización* had resulted in the establishment of nineteen colonies by the end of 1947 with only 7,436 hectares under cultivation. Greater progress is shown recently by the *Ministerio de Agricultura y Cría* which, since February 1946, has subdivided national lands into farms raising the total area cultivated through colonization to 73,770 hectares. The Dominican Republic has so far established 11,306 colonists on 78,000 hectares of, principally, government land. Here, the colonization programme is chiefly linked up with the development of irrigation. It is the policy of the Government to reserve 50 per cent of irrigated land for colonists where the land has not been under cultivation, and 25 per cent if it is already cultivated. The new *Comisión Nacional de Colonización* in Mexico has established no less than 368 families in forty-five colonies covering 152,000 hectares in the south of Mexico since the beginning of 1947.

Despite the widespread desire to occupy and utilize large undeveloped territories, present plans do not indicate that much more rapid progress may be expected in the future. Venezuela has, as part of its *Plan Mínimo de Producción Agrícola,* a combined land clearance, irrigation and colonization programme. Before the end of 1950, 89,000 hectares are to be cleared, largely with heavy machinery. The *Corporación Venezolana de Fomento* has a programme to establish *Comunidades Agrarias,* organized on a co-operative basis. Their principal purpose is to increase the production of basic foods, imported, such as rice, maize, vegetables and fruits. The plan calls for bringing 70,100 hectares under irrigated cultivation over a 10-year period. Fourteen of these communities have been organized.

The *Instituto de Colonización* in Colombia has been granted 10 million bolivares to establish colonies, particularly in areas at present sparsely populated, both on government lands and by purchase and subdivision of haciendas. Colonists will be provided with equipment on credit, which will also be available for house building. The farm is to be paid for over a period of twenty to thirty years. Since the capital will be a revolving fund if the colonies are successful, this programme may yet prove significant but it is still too early to judge.

Brazilian policy is to place more families in colonies already established. Bolivia has plans to establish a colony in the south-east, on the Pilcomayo river, to cultivate 16,000 hectares. It is proposed to establish agricultural processing facilities within the colony. The project appears to have little prospect of fruition in the near future, owing to lack of funds, although it was scheduled for commencement in 1948.

The *Dirección General de Tierras y Basques* in Argentina plans to subdivide 70,000 hectares in Laguna Blanca in the territory of Formosa, principally for cotton and cattle raising. Chile has a ten-year programme to clear 1,080,000 hectares with modern mechanical equipment. This land is on established farms south of Bio-Bio. The greater part of the work would be secondary clearing and would make extremely large additions to the area available for cultivation. The programme must obtain outside financial assistance to purchase equipment.

The Mexican *Comisión de Colonización* has extensive plans for a settlement and development of new areas, both in the north and in the south. The clearing of 120,000 hectares at a cost of 30 million Mexican pesos was begun in 1947. In the states of Baja California, Sonora and elsewhere in the north several colonies are proposed aggregating 308,000 hectares. In the valley of the Papaloan river in the south, some 500,000 hectares could be brought into production by adequate flood control. All of these projects face problems of finance, roads, materials and health.

(*b*) More Intensive use of Settled Areas

In a number of countries, colonization is concerned principally with

the purchase and subdivision of large estates in areas already well utilized, though by no means so intensively as under a regime of small farms.

This is particularly true in Argentina where the most important intensive settlement is administered by the *Banco de la Nación*, through voluntary or compulsory purchase of estancias for subdivision into family-size farms. Initiated in 1940, it has received new impetus during the last few years. The present colonization law makes available up to 200 million Argentine pesos, per annum, for a period of 5 years, after which the maximum grant is to be 100 million Argentine pesos. Early in 1948 it was announced that during the current presidential term approximately 2,700,000 hectares of land belonging to limited liability companies in the province of Buenos Aires, Cordoba, Santa Fe and Entre Rios would be taken over and that some 30,000 farmers would be settled within 2 or 3 years. As of the end of 1948, 2,000 families had been settled on 305,000 hectares. The land is in the best agricultural section of the Argentine. The Government provides some technical assistance and facilitates the obtaining of credit.

An organization of the provincial government of Buenos Aires is carrying out a programme which up to the end of 1946 had settled colonists on some 200,000 hectares and had an additional 158,000 hectares ready for subdivision. In mid-1947 the provincial government announced the compulsory purchase of an *estancia* of 20,000 hectares of which one-quarter was to be subdivided and sold in hundred hectare lots for dairy farming.

Programmes of this magnitude are of considerable significance. There are some 25 million hectares under varying degrees of corporate ownership-operation in Argentina not to mention the non-corporate *estancias*. The breaking up of even some of these into farms of a few hundred hectares or less, must very considerably modify land ownership and result in much more intensive utilization.

Uruguay has just established the *Instituto Nacional de Colonización* to take over, on a larger scale, work previously carried out by the *Banco Hipotecario del Uruguay*. Here, as in Argentina, colonies are established through the purchase and subdivision of *estancias*. Since 1923, some 3,000 families have been settled in twenty-six colonies totalling about 200,000 hectares. The new institute is to continue with this policy, but at a more rapid rate and also to administer colonies already established.

The immediate programme of the institute provides for the purchase of between 60,000 and 65,000 hectares in 1949, and the settlement of about 500 families on these former *estancias*. The breaking up of even some of these into farms of a few hundred hectares or less, must very considerably modify land ownership and result in much more intensive utilization.

Peru. A long range programme has not yet been formulated, due to

shortage of capital. The institute has a capital of 15 million Uruguayan pesos already largely invested in land, and is authorized to raise 20 million by the sale of government guaranteed bonds.

In Mexico, land holdings in excess of certain limits are subject to expropriation under the Constitution. The maximum areas are 100 hectares of irrigated or humid land, 200 hectares of pasture land suitable for cultivation and 300 hectares of land occupied by plantations. The policy of the Government, to make lands in excess of these amounts available for small individual farms or *ejidos,* has been in operation for many years, and continues.

In El Salvador, a programme for land subdivision has been carried out by the *División de Mejoramiento Social.* Approximately 20,000 hectares have been purchased over a long-term period and subdivided into farms which are either sold or rented. The principal defect has been that the farms are too small for any but subsistence agriculture.

Although Panama, like other Central American countries, possesses large tracts of national land not readily accessible, the land settlement programme has been concerned rather with better utilization of private farm land. Government policy is to settle small farmers on private land which is not utilized. Title remains with the owner and, as an inducement to make land available for cultivation, tax exemption is granted on all lands loaned for this purpose.

3. FACTORS IMPEDING PROGRAMMES FOR THE INCREASE OF CULTIVATED AREAS

Funds are the principal impediment to the execution of irrigation and drainage programmes in Latin America; the second is foreign exchange. Lack of modern construction equipment and shortage of technicians could be overcome if larger budgets and foreign exchange allocations were available.

Finance is also the principal obstacle to colonization. This requires very heavy initial capital investments for the many services necessary to ensure successful settlement.

Finance. Only in Mexico, Venezuela, the Dominican Republic and perhaps in Argentina may it be said that available funds bear a reasonable relationship to the projects which await construction. In all other countries, budget limitations force the construction programme to remain small in comparison to the work ready to be undertaken.

In Peru, for instance, the two projects at present under construction are financed through the sale of bonds to the value of 44 million soles, representing the estimated cost in 1945. To date only a small proportion of these bonds have been sold and estimated costs have risen to 65 million soles. The cost of the full programme planned by the *Dirección de Aguas*

e Irrigación would amount to 1,140 million soles. In relation to the financial resources made available during the past, the execution of this over-all programme would reach into the far distant future.

In Colombia, nine projects of the *Instituto de Aprovechamiento de Aguas* to irrigate approximately 35,000 hectares are suspended or delayed for lack of funds. The organization is principally dependent on a tax accruing as a result of its irrigation and drainage developments. It is able to invest only about 1 million Colombian pesos per annum for the irrigation of approximately 2,500 hectares. The institute has asked for an annual budget of 10 million Colombian pesos to undertake what it considers a practical programme.

In Ecuador, the *Caja de Riego* has been able to carry out a certain amount of work with its initial capital plus special government grants and social security funds, totalling approximately 25 million sucres. However, practically all funds have been expended and it would appear that its future operations will be determined by the annual grant from the budget, which in 1948 was 5 million sucres, plus an extremely small income from projects already completed. It does not, therefore, have the prospect of bringing under irrigation more than 2,000 or 3,000 hectares a year, on the average. Unless additional funds are made available, the present construction programme would require perhaps 10 years and the two projects under study at least 20 years to complete.

Perhaps the most severely handicapped organization, financially, is the *Dirección General de Riegos* in Bolivia. This organization depends almost wholly on taxes on imports of certain agricultural commodities, estimated to yield approximately 12 million bolivianos annually. Construction of two small projects has been continually hampered by lack of money; on the basis of present annual income, their completion would require at least 4 or 5 years more. A programme to irrigate an additional 39,000 hectares at a cost of 384 million bolivianos could not be undertaken without additional income: under present financial arrangements this would require no less than 32 years.

In Chile, the budget of 120 million Chilean pesos permits the irrigation of approximately 7,000 hectares yearly. Projects on which detailed technical studies are now being made would require 25 to 30 years to complete on the basis of this budget. In order to maintain the present ratio of irrigated lands to population in Chile, it would be necessary to bring under irrigation an average of 22,000 hectares a year. This figure is rather an overstatement, since Chile's agricultural frontier is south of the Bio-Bio, where irrigation is not required.

In general the situation in the countries not mentioned above is even worse since, for the most part, no funds at all have been made available for irrigation drainage works.

The *Instituto Nacional de Colonización* in Uruguay has a capital of

15 million Uruguayan pesos, taken over from the *Banco Hipotecario*. It is authorized to raise 20 million Uruguayan pesos more but to date only limited quantities of bonds have been sold and the sale is stated to be proving difficult. As the 1949 programme will require 12 million Uruguayan pesos, it is evident that the work will rapidly diminish without further funds, even though the capital will eventually become a revolving fund if the colonies are successful.

In Colombia, the *Instituto de Colonización* has a capital of 10 million Colombian pesos. Such a sum would be large for an annual operation but it permits of rather limited work if the investment is to be recovered within twenty to thirty years.

Foreign exchange. There is definite evidence that in several countries foreign exchange difficulties are impeding the procurement of construction equipment and thereby slowing up development programmes.

Chile, for example, finds itself severely handicapped by its inability to find the necessary exchange. The *Departamento de Riego* has a foreign exchange allocation of $US 200,000 for 1949 and $US 180,000 for 1948. This is not sufficient even to replace mechanical equipment as it wears out. The position, in this respect, is deteriorating, and machinery is being used which should be 100 per cent depreciated. The department would be willing to assign a larger proportion of its limited budget for the purchase of equipment, if foreign exchange could be allocated, but the maximum that could be spared would amount to $US 500,000. If more mechanical equipment could be obtained, costs could be reduced very considerably, thus affecting the entire economics of irrigation and drainage. In Chile, the authorities estimate that removal of a cubic metre of earth by hand costs 30 to 40 Chilean pesos; by mechanical equipment, about 15 pesos.

The *Instituto de Aprovechamiento de Aguas* in Colombia reports that the main problem is inability to secure United States dollars. Inability to procure, except in very small numbers, essential bulldozers, excavators, trucks and air compressors has held up construction.

In Colombia, difficulties in the procurement of piping and well-casing have seriously handicapped the well-drilling programme of the *Caja de Crédito Agrario*. Only four of its six well-digging rigs are functioning, and that at partial capacity, because needed equipment cannot be obtained. The *Caja* attempted, during 1947 and again in 1948, to procure some 2,000 tons of piping and well-casing but received only 500 tons, nearly all of it early in 1947. In the third quarter of 1948, only 35 tons were obtained. The *Caja* has therefore had to confine itself to certain areas and to refuse—or postpone—a considerable proportion of requests even in these areas.

Chile has had great difficulty in obtaining well-drills for testing purposes. Prices for equipment are frequently changed after an order has

been placed, necessitating another application for foreign exchange, by which time prices have sometimes changed again. The *Departamento de Riego* had, last year, to re-order three times for this reason. A list is attached of the machinery needed for the construction of five future irrigation projects which are now under study. This list totals approximately $US 2 million.

Bolivia has also prepared a list of equipment needed for its six year irrigation programme. This list includes processing and land clearing equipment for the establishment of a colony in conjunction with the irrigation project on the Rio Pilcomayo.

Mexican estimates of machinery and equipment needs (not including construction materials) totals 207,015,000 Mexican pesos (equivalent to approximately $US 42 million at the time the plan was prepared). Presumably some of this equipment would be available domestically and it is to be noted that most of the total foreign expenditure of 145,890,000 Mexican pesos would be for the purchase of machinery. Mexico has also prepared a list of machinery necessary for conservation in the irrigation districts and for mechanization of crops on land put under irrigation.

In Peru, most of the equipment at the disposal of the *Dirección de Aguas e Irrigación* is considerably depreciated and inadequate for any large-scale work. In the main, it is needed for the large amount of normal repair and maintenance which must be done each year. The mechanical equipment and materials, not available locally, which would be required for the two projects at present under construction would cost about $US 1,300,000. Eight of the smaller projects which could be constructed within the next three or four years, would require an additional $US 1,111,000.

The *Dirección de Distritos de Riego* in the Dominican Republic possesses a considerable amount of mechanical equipment (including twenty-six excavators), yet present irrigation programmes require an additional seven excavators and ten tractors. The *Dirección* is considering placing orders for an additional six excavators and ten tractors. So far only two tractors have been received. This equipment does not include the requirements under the 4-year plan. Mechanical equipment, especially spare parts, is difficult to obtain. In November, at the time of the Working Party's visit, four excavators were disabled for lack of spare parts. Venezuela, on the other hand, does not seem to have had any difficulty in procuring equipment required for irrigation works.

A general idea of the extent of irrigation and drainage equipment needs in Latin America may be obtained by taking the costs of programmes actually under construction or about to be. Mexico estimates its requirements at approximately 10 per cent of the total investment and Chile at 12.5 per cent. Ten per cent, therefore, probably represents the value of equipment needs, or approximately $US 37 million.

The lack of heavy equipment, particularly for land clearance, constitutes a definite handicap. In Chile, the *Corporación de Fomento* has organized a land clearing service for farmers, whereby ten caterpillar tractors clear 750 hectares in three months. This would normally require a year's work with 640 yoke of oxen. Demand for tractors has now greatly exceeded the ability of the corporation to supply and service. In 1948, the corporation placed orders for twenty machines but received only four, diverted from Palestine. They are not hopeful of receiving more than three or four in 1949. In Brazil, the colonization programme has been delayed by inability to secure sufficient bulldozers and certain other types of mechanical equipment, as also in Venezuela.

Technical personnel. In countries with long experience in irrigation, as in Chile, the shortage of engineers and other technicians arises from the fact that salaries and conditions of government service are not so attractive as in private firms. In countries where large scale irrigation is relatively new, there is a real need for technicians, as in Venezuela, and the Dominican Republic. In Colombia, one of the contract obligations of the United States firm responsible for supervising projects of the *Caja de Crédito Agrario* is to train technicians and engineers.

Utilization of new lands for maximum production. Irrigation and drainage work or the placement of colonists is only the first step to increased production.

After irrigation, for instance, the farmer has to learn not only how to use water, but also to change the whole range of his farming practices to acquaint himself with new crops, better methods of cultivation and fertilization, and previously unknown equipment and supplies. Intensive exploitation must take the place of extensive exploitation, since heavier investments per unit-area are now represented. The cost of production per hectare rises as well as the cash outlay required. All this means that, left to himself, the farmer will adjust slowly to the new possibilities and neither he nor the nation will reap the full benefits of the investment made. In the drought area of Brazil, it takes more than 10 years to put irrigated land into maximum production, whereas it should actually be possible in 2 years.

In Chile, the maximum contribution which irrigation could make is not fully exploited partly as a result of large land holdings, partly of the need for increased credit and intensive production methods. In Peru, "irrigation implies not only the building of canals and dams but the creating in the desert of all the institutions and material facilities of a modern community,"[2] including new or additional marketing and transportation facilities.

In Ecuador, irrigation was made available for 2,000 hectares in the Portoviejo district late in 1947, but the farmers did not respond as ex-

[2] *Irrigation in Peru.* C. W. Sutton.

pected. Formerly the growth was burned and seed sown directly, but after irrigation it was necessary to plow properly. Farmers were quite unacquainted with this procedure and had neither the necessary implements nor the means to buy them. The *"Caja de Riego"* in collaboration with the *Ministerio de Economía* and the *"Banco de Fomento"* thereupon put into operation the following programme:

(i) A farm machinery pool organized and at the disposal of farmers;
(ii) Special agricultural credit facilities;
(iii) A demonstration plot using irrigated water;
(iv) Placing technical advisor in the district;
(v) Supply of water free during 1948.

The "supplementary" services and expenditures needed for successful colonization are likely to be even more extensive when the district is entirely new. Farmers must be furnished draft power, equipment, tools and materials, special credit facilities, technical advice, and ideally, an experimental and demonstration farm. Above all, the colony must have facilities for the storage, transport and marketing of its produce.

4. CONCLUSIONS AND SUGGESTIONS

The principal "shortcomings" in programmes for increasing the area under cultivation in Latin America, are finance and equipment.

In view of the limited capital available for agricultural development, it is imperative that it be conserved in every possible way. Investment should be made only after careful survey of alternatives; and projects elected should be carried through to a successful conclusion. Thereby every initial capital fund may become a revolving and, if possible, an accumulating fund which continues to fructify the economy, and make possible the development of Latin America's immense agricultural resources.

Greater use of mechanized equipment would make possible more rapid and economical construction and land clearance, than is possible with hand labour. Authorities responsible for these classes of work are everywhere anxious to expend a larger share of their resources on machinery and equipment. This is partly due to costs and partly because of the difficulty of obtaining sufficient labour. Increased mechanization, therefore, appears desirable, because it: (1) speeds the work; (2) saves labour; (3) lowers costs. Opportunity to obtain more mechanical equipment is therefore very important for bringing additional areas under cultivation.

(*a*) Financial Requirements

The Working Party does not attempt to make recommendations with regard to the financing of projects or programmes for the expansion of cultivated area. It considers that this would not only be beyond its scope,

but would require much fuller information than it possesses. It is however, impressed with the need for reliable data on investment requirements for the various projects to expand the cultivated area in Latin America. These data should include costs of expansion projects, and costs of improved crop and livestock yields for purposes of comparative analyses of investment requirements and probable benefits. Such information is basic for an intelligent investment programme in agriculture, irrespective of the source of the financing.

It is recognized that this cannot be done hurriedly, that it requires the co-operation of the countries concerned, and that it is of interest jointly to several international organizations, including the FAO, ECLA and the International Bank.

It is suggested that the international agencies concerned should undertake as soon as practicable, for countries interested and in conjunction with a representative of each, a systematic investigation of the investment requirements of the various proposals for promotion of agricultural production in Latin America.

(*b*) Co-ordinated Approach to Projects

Land reclamation or colonization involves more than engineering works or movement of people. If such projects are to be successful agriculturally, the implications for agricultural credit, public health, transportation, foreign exchange, extension work, equipment and co-operative marketing must be taken into account. Every project if properly planned, will ultimately make demands on some, or all, of the organizations responsible for these matters, as well as upon their budgets. Failure to meet one of these demands may lead to only partial success or even failure; the sums invested may be lost or recovered only over a long period.

Therefore, a co-ordinated approach to all projects is of the utmost importance.

It is suggested that Governments, before undertaking any land reclamation or colonization project, should give consideration to all the budget implications which contribute to this success and should foresee and provide for these expenditures when the project is commenced.

(*c*) Foreign Exchange Allocations for Equipment

There is, of course, no point in purchasing equipment unless projects are adequately financed so as to guarantee continuance of the construction work. But, given this condition, it seems desirable that greater emphasis should be placed on enabling responsible bodies to obtain the modern mechanical equipment needed to do the job efficiently and economically.

It is suggested that, where foreign exchange is, at present, a restricting factor, Governments should consider the possibilities for increasing the allocation for equipment needed for land reclamation projects.

(*d*) Equipment Needs

Much fuller information is required on new equipment needed for construction and maintenance of irrigation works and land clearing, during the next few years. Lists of anticipated equipment needs would be of great assistance for supplying countries and suppliers. Such advance information to manufacturers would benefit the importing countries by increasing their prospects for obtaining machinery and other equipment when needed.

Furthermore, many of the Governments of Latin America are particularly interested in proper utilization of areas to be made available for cultivation through government programmes. In future years a considerable proportion of government imports of farm equipment are likely to be for the purpose of supplying such areas. Forward estimates of these needs would be useful.

Estimates in both cases could be drawn up on two bases: (1) a minimum list, indicating the items and numbers which could be paid for out of the normal budget and the normal allocation of foreign exchange within this budget; (2) a supplementary list of machinery and equipment desired if conditions (including external credits) permit of additional purchases.

It is suggested that Governments prepare, for the information of the FAO and ECLA, minimum, and supplementary lists for equipment required in connexion with irrigation, drainage, colonization and land clearing programmes for the years 1949-1952.

CHAPTER VII

Fisheries[1]

1. THE PRESENT FISHING SITUATION

Needs for Expansion

Many Latin-American countries have vast coast-lines, but their production of fish is small compared with the major fishery countries of the world. Tables VII-1 (production in Latin America), VII-6 (comparison of production), and VII-5 (examples of fish production in some countries) show that all twenty countries, with about 135,000 active fishermen, together landed 421,702 tons of fish in 1947, while a small country like Iceland, for example, with about 6,300 fishermen produced 477,152 tons in the same year. A considerable part of the catch may not be recorded and many of the fishermen listed may be only part-time. Nevertheless, these comparisons demonstrate that the fishermen of Latin America desperately need more equipment, better boats and more efficient methods.

Improved utilization of fishery resources would increase food production and also greatly improve the protein-poor diet of these countries. It would create new industries and new means of improved livelihood for the population.

Possibilities for Expansion

Table VII-1 (production in Latin America) shows that good possibilities exist for such an expansion.

Thus, Brazil, in production, has increased from about 103,000 tons before the war to 122,000 tons in 1947; Argentina from 50,000 tons to 65,000. Both represent an approximate 15 per cent increase, in spite

[1] While considerable work has been done in surveying the agricultural situation of Latin America, only a few surveys or studies have been made in the fisheries field. Certain basic information was important because the general aspects of the fishing industries in Latin America were not included in the recent economic survey carried out by the Economic Commission for Latin America.

It was not possible for the assigned fishery specialist to visit all the countries covered by this report. The lack of detailed studies in this field makes this report only tentative in many of its conclusions.

of the serious difficulties confronting the consumption of fish in both countries.

In Chile, production increased relatively much more, from 32,000 tons to 60,000 or about 90 per cent. This was due partly to a meat shortage and also to efforts by both government agencies and the industry. Similar efforts in Venezuela resulted in an increase from 18,000 tons to 64,000 or more than 250 per cent.

Even greater increases were attained in Mexico where production rose from 13,000 tons before the war to 54,000 in 1947, or more than 300 per cent. In Peru the increase was from 5,000 to 31,000 tons or more than 500 per cent, partly in greatly increased exports but also a considerable increase in home consumption.

It may, therefore, be said that co-ordinated action by the individual Government, and by Governments acting in concert has very good potentialities for increased production and consumption of fish in Latin America.

Relationship between Production and Consumption

The present organization of the fishing industry is such that the acquistion of requisites alone will not suffice. An increase is indicated in consumption together with a corresponding development of the distribution system, increased exports, and the creation of processing industries.

One example may be cited of an individual who built and equipped an excellent vessel to land a considerable amount of valuable fish. A good demand for fresh fish exists but the *entrepreneur* now finds that operation of his boat will not be economic without an ice-plant, a transportation system to the best markets, and a retail distribution plan. All this requires a very considerable outlay and it is doubtful whether one individual can do it all.

Another example, that of the Government of Guatemala, is of interest here. It plans to acquire suitable boats and to establish a special distribution system. At the same time, it will acquire proper storage facilities and introduce fishery products into the diet in Government institutions, camps, etc. It is felt that such a plan is much more likely to succeed if it encompasses the entire problem from production through consumption.

Difficulty in Stating Needs

Every official and expert interviewed expressed the opinion that there exists in every country a considerable number of requisites which, if put into proper use, could be used to help increase fishery production. However, until general problems of financing, education, etc., are solved, such requisites could not be effectively utilized.

2. GENERAL FACTORS AFFECTING THE DEVELOPMENT OF FISHERIES

While fish production and utilization can be increased considerably in Latin America, shortages of equipment are a limiting factor, mainly in countries having foreign exchange difficulties. The main difficulty is lack of sufficient markets or, in a few cases, lack of sufficiently productive fishing grounds.

Marine Fishery Resources

Need for research. In most parts of Latin America, very little is known about potential fishery resources which renders considerable research work necessary before any large investment can be made in fishery development, although, of course it is not necessary to know exactly the resources before proceeding.

The production of fish in Latin America, including inland waters, has increased from 243,652 tons before the war to 421,702 tons in 1947, as shown in table VII-1 (production of fish and shellfish in Latin America). It can hardly be claimed that this development has been based mainly on findings of new research, as considerable resources were previously known which could be developed.

In Argentina, Brazil and Peru the existence of considerable resources is known, but present production has had to be reduced due to lack of demand.

There are, finally, some countries especially in the Caribbean area, where the marine resources are bound to be limited. In Mexico, for instance, it seems certain that utilization of some species has already reached the saturation point, at least in certain areas. While assistance can safely be given here to the expansion of some fisheries, it seems certain that any major development would have to await demonstration of available resources.

Access to fishing grounds. The fishing laws of some countries have been a considerable hindrance to fishermen from neighbouring countries. It would seem desirable for Governments to undertake negotiations to alleviate such situations wherever possible without adverse effects on their own domestic fisheries.

Fresh Water Fishery Resources

Possibilities. Many Latin-American countries have large inland fisheries. In Argentina, for instance, the production of fresh-water fish in 1942 was 26,287 tons, while salt-water species totalled 31,342 tons. Inland fish are often particularly important because they are often available where fresh fish from the ocean are not.

TABLE VII-1

Production of fish in Latin-American countries

	Production in metric tons[a]			
	Prewar[b]	*1943-44 (average)*	*1946*	*1947*
Argentina	50,369	59,447	58,183	65,133
Bolivia	700[c]	700[c]	700[c]	700[c]
Brazil	103,278[d]	118,952	122,410	122,410[e]
Chile	31,787	40,174	60,943	60,026
Colombia	1,600[c]	1,600[c]	1,600[c]	1,600[c]
Costa Rica	1,450[f]	1,230[f]	2,320[f]	2,450[c e f]
Cuba	11,000[g]	7,000[g]	8,500[g]	13,500[g]
Dominican Republic	332[d]	434	249	**470**
Ecuador	1,800[c]	1,800[c]	1,800[c]	1,800[c]
El Salvador	100[c]	100[c]	100[c]	100[c]
Guatemala	135[c]	135[c]	135[c]	135[c]
Haiti	1,500[c]	1,500[c]	1,500[c]	1,500[c]
Honduras	135[c]	135[c]	135[c]	135[c]
Mexico[h]	13,139[h]	36,446[h]	55,560[h]	53,883[h]
Nicaragua	100[c]	100[c]	100[c]	100[c]
Panama	700[c]	700[c]	700[c]	850[i]
Paraguay	250[c]	250[c]	250[c]	250[c]
Peru	4,849[d]	28,496	27,657	30,778
Uruguay	3,659	3,322	3,603	3,456
Venezuela[j]	17,769[j]	49,252[j]	63,591[j]	64,426[j]
Total	243,652	350,455	408,036	421,702

[a] As far as possible, all subsistence fisheries have been excluded. Also, the total nummercial catch is probably higher than the figures covered by statistics.

[b] 1935-1939, except when otherwise indicated.

[c] Estimated.

[d] 1939 only.

[e] 1946.

[f] Landings by foreign fishermen and landings of tuna and shark excluded. Statistics are only available for fresh fish shipped from Puntarenas to San José. Landings are here calculated at 180 per cent of shipments to San José.

[g] Statistics available only for fish brought to Havana. Total landings are here calculated as 140 per cent of the amounts brought to Havana.

[h] Excluding catches by foreign fishermen in Mexican waters, but not landed in Mexican ports.

[i] Statistics available only for landings in Pacific ports. Total landings are here calculated as 110 per cent of landings in Pacific ports. The period covered is April 1948 to March 1949.

[j] Weight of salted fish has been converted to weight of fresh fish by multiplying by three.

Cold waters. While fresh waters in the tropics are generally abundant in fish, many cold streams and lakes, especially in the Andes, are very deficient. The planting here of imported or domestic fish could greatly increase the yield, as in Peru, Ecuador and Bolivia where good results have been obtained with paiche and rainbow trout. The latter, imported from North America, attained weights up to 31 kg. in four years, considerably larger than in the waters where this species originated.

For such plantings, mainly supplies of eggs are needed. Considerable government action is required, however, to carry out such programmes and to conduct research into biological conditions; otherwise, the transplanted species may not be able to develop satisfactorily or will do so at the expense of more valuable local species.

Pond cultures. There are many possibilities for fish culture where natural waters can be regulated, or in combination with irrigation projects. In Haiti, less than two square miles of well managed fish ponds could produce more food than its total marine fisheries with its 3,000 full or part-time fishermen. There are many square miles of land in Haiti well adapted to such undertakings, if the right species is obtained and the right type of feed and fertilizer is found. The establishment of such an industry is also dependent on careful and experienced management as well as persons qualified for such work.

Relative importance of fresh water fisheries. It appears that comparatively more governmental effort has been spent on inland than on marine fisheries, partly due to the recreational values of the former. It must be emphasized that if the main consideration is food production, time and effort can more profitably be spent on the development of marine fisheries.

Protection of Resources

Need for fishing regulations. Certain species such as spring lobster have been overfished almost to the point of exhaustion. It is of the greatest importance that such resources be carefully regulated by Governments. Regulations should be as few as possible and based on thorough investigation.

Water pollution. Fishery resources may be damaged or even destroyed by pollution, especially as a result of the creation of large industries such as are now being established. As existing industries resist the adoption of better water purification methods, it is preferable that they be regulated at an early stage.

Fishermen

In several Latin-American countries, devoted fishermen have earned their living by fishing for generations. They are anxious to improve their methods and equipment.

In other places however, there are those who look to fishing only when no other work is available. They are often reluctant to leave the sight of land and seldom show much interest in improving boats or gear, or in increasing their incomes. When some canneries have increased the price paid for fish, decreased fishing efforts have resulted since the same income could then be obtained in a shorter time than

previously. Education and encouragement of the immigration of foreign fishermen may serve to demonstrate new and more efficient methods.

Economic and Financial Factors

Markets. Probably the greatest difficulty for the fishing industry is the lack of sufficient markets. The large trawling operations in Argentina could easily increase their production 50 per cent if a market could be found. Similarly, tuna landings in Gallao, Peru, have been reduced from 40,000 dozen fish daily to 8,000 at certain times of the year, due to insufficient demand. On the other hand, in Chile, every time demand has been stepped up, production has kept pace.

Lack of domestic consumption. As will be seen from table VII-2 (*per capita* consumption of fishery products), Latin-American countries have

Table VII-2

Per capita consumption of fish and fishery products
(Kg.[a] per year per person)

	Prewar[b]	*1947*
Latin America:		
Argentina	4.5	3.8
Bolivia	0.4	0.4[c]
Brazil	3.0	2.9
Chile	7.2	11.2
Colombia	0.3	0.3
Costa Rica	1.4	1.3
Cuba	5.2	5.9[d]
Dominican Republic	1.4	1.4[e]
Ecuador	0.8	0.8
El Salvador	0.1	0.1
Guatemala	0.1	0.1
Haiti	1.6	0.7
Honduras	0.2	0.1
Mexico	0.4	1.7[c]
Nicaragua	0.2	0.2
Panama	3.2	2.1[e]
Paraguay	0.3	0.3
Peru	0.9	3.1[f]
Uruguay	1.9	2.3
Venezuela	5.9	14.9[c]
Other countries:		
Jamaica	—	40[g]
Norway	—	25[g]
USA	—	5[g]

[a] Most of these figures should be taken as preliminary estimates only. Fish used for subsistence is not included. No conversions have been attempted of salted or canned fish, etc. Several of the figures used for the computation of this table are estimates.
[b] Mainly 1935-1939 average.
[c] Production figure for period April 1948-March 1949 used.
[d] 1947-1948.
[e] Imports in 1947 higher than normal.
[f] As figures for exports of canned fish have not been converted to fresh fish basis, this figure is probably too high.
[g] Estimated.

a comparatively low *per capita* consumption of fish and fishery products, which in some places is almost negligible.

This is mainly due to consumers not being accustomed to the preparation and eating of fish nor aware of its nutritive value. Some are afraid of some types of fish thought to be the cause of food poisoning. Some species are highly esteemed while others, equally nourishing and palatable, cannot be sold.

This condition may partly be overcome by improvements in distribution to and presentation in, the retail outlets. Major education and propaganda programmes by government action are required here, combined with research into the nutritive value of fishery products.

Great benefit could also be derived from co-operation among Governments in this field.

Lack of export markets. As is seen from table VII-3 (imports), the import of fishery products to Latin-American countries has decreased

TABLE VII-3

Imports[a] *of fishery products*

(In metric tons)

	Prewar[b]	*1946*	*1947*
Argentina	9,897	1,133	2,960
Bolivia	650	694	700[d]
Brazil	11,793[c]	10,308	15,855
Chile	332	99	65
Colombia	1,045	776	2,047
Costa Rica	546	262	578
Cuba	12,540	8,000[d]	9,000[d]
Dominican Republic	1,886	958	2,437[e]
Ecuador	491[f]	145	835
El Salvador	89[g]	85	85[d]
Guatemala	299	142	378
Haiti	3,068	428	1,814
Honduras	30[d]	24	30[d]
Mexico	1,033	1,618	1,800[d]
Nicaragua	49	62[h]	60[d]
Panama	1,166	363	793
Paraguay	75[i]	42[h]	50[d]
Peru	1,219	136	244
Uruguay	544	372	350[d]
Venezuela	3,046	396	1,000[d]
Total	49,798	26,043	41,081

[a] Total gross weight of edible fishery products. As complete statistics have not always been available and as classifications vary considerably, these figures should be considered as approximate only.

[b] 1935-1939 average, except when otherwise indicated.

[c] 1937-1939.

[d] Estimated.

[e] Considerable stock carried over to following year.

[f] 1938-1939.

[g] 1935-1937.

[h] 1945-

[i] 1936-1939.

during the last 20 years, especially in view of the 20 per cent increase in population meanwhile. As is seen from table VII-4 (exports), a considerable increase in exports of fishery products has taken place up to 1946.

Since that year, however, exports of canned, as well as total fishery, products, have decreased. Unless Governments take action to encourage the interchange, any further increase in exports cannot be achieved.

TABLE VII-4

Exports[a] of fish and fishery products

(In metric tons)

	Prewar[b]	*1943-1944 (average)*	*1946*
Argentina	2,833	6,769[c]	7,000[d]
Bolivia	[e]	[e]	[e]
Brazil	8[f]	367	1,115
Chile	168	1,546	1,682
Colombia	1	30[d]	23
Costa Rica	2,796	657	1,607
Cuba	685	780	686[g]
Dominican Republic	[e]	[e]	[e]
Ecuador	1	8[d]	47
El Salvador	1	[e]	[e]
Guatemala	[d]	[e]	[e]
Haiti	1	[e]	[e]
Honduras	20[d]	6[h]	10
Mexico	7,406[i]	10,655	18,174
Nicaragua	—	[c e]	[e g]
Panama	—	—	1[j]
Paraguay	[e]	[e]	[e]
Peru	1	2,618	10,560
Uruguay	150[d]	200[d]	220[d]
Venezuela	44	1,434	4,288
Total	14,115	25,060	45,413

[a] Total gross weights of all fishery products. As complete statistics have not always been available and as the classifications vary considerably, these figures should be considered as approximate only.

[b] 1935-1939 average, except when otherwise indicated.

[c] 1943.

[d] Estimated.

[e] Negligible.

[f] 1937-1939 average.

[g] 1945.

[h] 1944.

[i] 1935-1938 average.

[j] Exports in 1947 were 129 tons.

Retail prices. It has been repeatedly maintained that the retail prices of fresh fish are too high. Table VII-5 (prices of fish and fishery prod-

ucts) shows that in many countries, prices even for fresh fish are considerably higher than for meat and often hardly within reach of the lowest income groups.

If retail prices are to be lowered while prices to fishermen are kept constant, the cost of processing and distribution must be reduced. However, the price differential left to cover the distribution of fresh fish has more often been too small than too large. Fish is highly perishable and requires large amounts of ice. Dressing by the retailer means a considerable weight loss. The presentation of fresh fish sold at retail would considerably increase consumption, as would improved transportation. All this means additional cost. The relative cost of and profit in fish distribution is not high when compared with other countries as is seen in table VII-5 (prices of fish and fishery products).

Reduction in price through an increase in catch per production unit will require that fishing boats and methods be mechanized and improved.

Prices paid to fishermen. The income of fishermen in most Latin-American countries is generally very low, and the prices paid them should therefore be increased.

However, as table VII-5 (prices of fish and fishery products) shows, these prices are generally very advantageous compared with other parts of the world, and any increase would reduce demand. Here again, the low output per fisherman can only be improved by more efficient equipment and methods.

When fishermen are forced to rely on outfitters or middlemen for any cash outlay for gear, ice, fuel and food, they must sell their production to the outfitter at very low prices leaving themselves without an opportunity to obtain a better price on the open market. Where fishermen are required to use the outfitters' small and ill equipped boats, they must turn over 80 per cent of the total catch.

Credits. Thus, fishermen in most countries find it practically impossible to obtain credits or loans. Governments in such countries should establish credit systems for the industry, similar to those established for agriculture.

Three types of credit are needed: to assist the financing of major fishing operations or processing industries; to assist the individual fisherman, distributor or retailer to obtain engines, boats, insulated trucks and refrigeration; and to make available small short-term loans on short notice to finance fishing trips.

Venezuela, through credit arrangements, furnished fishermen with engines for their boats. Experienced fishermen who had worked as long as 30 years without being able to buy an engine, were able to pay for it in a few months through their greatly increased catches.

TABLE VII-5

Examples of prices[a] of fish and fishery products

(US dollars per kg.[b])

Country	*Rate of exchange*[b]	*Price of fresh fish paid to fishermen*	*Price of fresh fish at retail*	*Distribution "cost" in percentage of retail price*[c]	*Price of salted fish*	*Price of cheapest canned fish*	*Price of cheaper meat*	*Daily wage for common labour*
Latin America:								
Argentina	0.20	0.70–0.18	0.20–0.36	40–60	0.60–0.80[d]	0.60–1.00[e]	0.06–0.08	2.80
Bolivia	0.024	–	0.15–0.50	–	–	–	–	2.60
Brazil	0.06	0.42–0.60	(0.11) 0.60–1.10	30–45	0.90[d]	1.95[e]	0.40	1.20
Chile	0.015	0.05–0.15	0.10–0.28	45–50	0.35[e]	0.60[d]	0.38	1.20
Colombia	0.38	–	0.75–1.15	–	0.50[e]	1.45[d]	0.45	1.20
Costa Rica	0.18	0.30–0.40	0.40–0.80	35–55	1.00[d]	0.80[d]	0.30	1.40
Cuba	1.00	0.25	0.70–1.00	65	0.70–1.00[d]	0.80[d]	0.45	2.50
Dominican Republic	1.00	0.26–0.40	0.55–0.65	40–50	0.55[e]–0.65[d]	–	0.50	1.20
Ecuador	0.06	0.13–0.20	0.50–0.75	70–75	0.75[e]–1.75[d]	1.10–1.50[d]	0.35	0.90
El Salvador	0.40	0.26	0.66	–	–	–	–	1.00
Guatemala	1.00	0.26	0.66–0.75	60–65	0.90–1.35	–	0.40	–
Haiti	0.20	0.45	0.65	33	–	–	–	–
Honduras[f]	–	–	–	–	–	–	–	–
Mexico	0.15	(0.05) 0.30–0.35	(0.25) 0.85–1.10	60–75	1.80[d]	0.85[e]	0.45	1.05
Nicaragua[f]	–	–	–	–	–	–	–	–
Panama	1.00	0.10–0.25	0.45–0.75	60–75	0.50[e]–0.90[d]	0.70[d]	0.55	2.25
Paraguay	0.32	–	0.65	–	–	–	–	–
Peru	0.15	(0.06) 0.35–0.45	(0.33) 0.75–0.90	50	–	–	–	1.20
Uruguay	0.62	–	0.15–0.30	–	1.15[e]–1.60[d]	1.85[d]	0.35	2.90
Venezuela	0.33	0.33–0.65	0.65–1.20	45–55		5.00[e]	–	1.00
Other countries								
Denmark (codfish)	0.21	0.10–0.20	0.25–0.45	50–70	–	–	–	–
UK (total aver.)	4.03	0.08	0.24	67	–	–	–	–
USA								
(haddock)	–	0.06–0.08	0.15–0.25	60–70	–	–	–	–
(sardines)	–	0.07	–	–	–	–	–	–

( ) Indicates price for less esteemed species.

[a] Generally from the capital of the country. Examples are collected during the preparation of the report and are rough estimates only.

[b] As not all exchange rates are free, these figures may be somewhat misleading. However, comparison with wages and meat prices will always give indications of the trend.

[c] As prices paid to fishermen may fluctuate greatly these figures are only rough.

[d] Imported.

[e] Domestic.

[f] Not visited by fishery specialist in connexion with this report.

The effectiveness of such schemes is entirely dependent on the technical knowledge and integrity of the administrators and therefore only fully qualified experts should be employed in such organizations.

Fisheries development corporations. In countries with very small fishing industries, a government-sponsored development corporation could look after organization of all phases of production, distribution and processing.

Technical Factors

Technical knowledge. As fishing is a fairly young and fast growing industry in Latin America, there is considerable need for experienced technicians, managerial personnel and fishermen. Governments can encourage both their own nationals and persons of other nationalities to study or develop new industries.

When an outside expert is called in, a national of the country concerned working along with him will receive training, and prepare himself at the same time to utilize, more effectively, such expert aid.

Biological research. The size of fishery resources cannot be measured by the area of water concerned. The major part of any catch is chiefly secured from relatively small areas of water, such as the Dogger Bank in the North Sea, or for a particular species of fish, such as the tuna and related types in the Pacific.

Therefore, extensive biological research is much needed not only to establish the presence of different species, but also to ascertain whether their quantities and living habits are such as to make them commercially worth while. In Puerto Rico, for example, great efforts were once made to develop fisheries, but it was soon found that inshore fishing could not be developed further, as most species already showed signs of overfishing.

Experimental Fishing

Well directed biological research will have to be combined with experimental fishing. This can be done by special research vessels, or, more economically, through commercial or semi-commercial operations.

Fishery statistics. Fishery statistics are necessary for the evaluation of fishery resources; statistics regarding trade and consumption are equally necessary. Countries which now collect such statistics might well collaborate with the FAO in a study of Latin America.

Technological research. Argentina, Brazil, Chile, Peru, Mexico and Venezuela, which have important fish processing industries, require technological research for improvement of product, and development of less expensive types for consumption. Otherwise, it is felt that greater benefits would derive from the application of accepted technical methods than from basic research.

International co-operation. Research into fishery resources is faced with problems of international scope. Many species of fish move from one part of the ocean to another. The sardines fished in Venezuela breed in the territorial waters of other countries; research in Venezuela can therefore concern itself with only part of the problem.

Areas that particularly lend themselves to co-operation by means of fishery councils, international commissions, or even joint research programmes, are Central America, the Caribbean area, the south-west Atlantic and the west coast of South America.

Education. Lack of knowledge of various fishing methods, handling of fish, and operation and maintenance of boats, hampers the introduction of new methods, reduces the quality of the catch, and increases all the related costs. Fishermen's schools established in Latin America generally have proved very beneficial for only the very young. Extension programmes for active, older fishermen would also be beneficial.

Latin-American countries which have a special interest in the development of fishery resources could jointly establish education programmes, utilizing textbooks and visual aids, co-operatively.

3. PRINCIPAL SPECIFIC IMPEDIMENTS TO FISHERY PRODUCTION

Boats and Gear

Table VII-6 (production, number of fishermen, fishing boats, etc.) shows that a very large number of small boats, mostly not powered, are in use. The lack of mechanization and consequent lack of efficient mass production methods accounts for the very low output per fisherman. Attempts made to introduce large boats and mechanization have, however, sometimes been based on studies of operations in highly productive fisheries without taking account of their very considerable capital outlay and expensive operation. Regions where such operations could be carried out economically and successfully are extremely limited and they should therefore be used only where smaller and less expensive operations fail.

Venezuela attempted to introduce a type of boat which had been very efficient in southern Europe, but these proved themselves unfitted under local conditions and none of them are now in operation. Large boats from the Gulf fisheries of the United States were similarly disappointing. As a result, Venezuela now directs its attention towards the improvement of existing fisheries and mechanization of existing fleets.

Marine engines. Fishing in Latin America is, as in Denmark, mainly carried out close to the shore and would hardly benefit greatly from the introduction of large, highly mechanized vessels. Increased use of engines in locally built boats would economize on the great amount of time now spent on trips to and from the fishing grounds.

TABLE VII-6

Comparison of production, number of fishermen, fishing boats, etc., in some countries

	Year	Production in metric tons	Number of fishermen[a]	Production per fisherman in metric tons	No. of boats and other craft	No. of powered boats
Latin America:						
Argentina	1937	65,133	7,500[b]	8.7	2,000[b]	—
Bolivia	1946	700	—	—	—	—
Brazil	1946	122,410	67,884	1.8	31,283[c]	309[d]
Chile	1945	46,992	6,003	7.8	3,795	589
Colombia	1946	1,600[b]	2,000[b]	0.8[b]	1,200[b]	10[b]
Costa Rica	1947	450[e]	150[b]	3.0[b]	100[b]	10[b]
Cuba	1947	13,500	7,993[f]	1.7	2,509[f]	—
Dominican Republic	1945	342	1,211	0.3	976	—
Ecuador	1947	1,800[b]	2,500[b]	0.7[b]	1,500[b]	—
El Salvador	1946	100[b]	135[b]	0.7[b]	100[b]	—
Guatemala	1947	135[b]	200[b]	0.87[b]	100[b]	—
Haiti	1947	1,500[b]	3,000[b]	0.5[b]	1,578	—
Honduras	1946	135[b]	200[b]	0.7[b]	100[b]	—
Mexico	1943	32,991	11,000[b]	3.0[b]	4,264	—
Nicaragua	1947	100[b]	150[b]	0.7[b]	75[b]	—
Panama	1946	850[g]	529	1.6	215[b]	35[b]
Paraguay	1947	250[b]	—	—	—	—
Peru	1946	27,657	7,081	3.9	2,789	267
Uruguay	1947	3,456	364	9.5	121	31
Venezuela	1947	64,426	17,289	3.7	3,926	98
Other countries:						
Canada	1947	553,323				
	1945	624,049	67,711	9.2	31,908	12,749
Denmark	1947	205,400				
	1944	172,520	19,087	9.0	16,188	7,133
Iceland	1947	477,152				
	1941	264,818	6,287	42.1	856	763
Portugal	1946	285,569				
	1944	250,982	43,392	5.8	8,835	772
United Kingdom	1946	1,031,885				
	1937	888,592	23,752	37.4	6,514	5,726
U.S.A.	1946	1,995,827				
	1944	1,984,300	122,768	16.2	66,528	33,814

[a] It has been attempted to exclude fishermen who fish for subsistence only. Figures probably include a large number of part time fishermen.
[b] Estimates.
[c] 1938.
[d] 1948.
[e] Tuna and shark excluded.
[f] 1946.
[g] 1948.

Boats. Argentina and Chile have definite need for large boats, especially some modern trawlers which are less expensive to operate than those presently in use.

Otherwise, it may be best to concentrate on the development of fairly small, comparatively universal boats which can be operated by fishermen without much additional training and are easy to repair. Such boats can probably be built locally, and co-ordinated action between Governments is desirable to develop the best designs. The engines would probably have to be imported.

Repair facilities. When engines are introduced, spare parts, repair facilities and skilled mechanics will be necessary for their maintenance. It is therefore strongly recommended that only a few, easily operated, types of engines be introduced.

Nets and gear. Except for experimental work, best results may be obtained through improvement of the nets and gear presently in use locally. Replacements of nets and procurement of larger nets, are urgent needs, and here again, the restricting factor is the lack of buying power among fishermen and, in some countries, foreign exchange difficulties.

Net preservation. The preservation of fishing nets is often neglected in Latin-American countries, due to the lack of such preservation methods as are much more extensively used in other regions of the world.

Governments could help in the spreading of information regarding such methods and assist in the acquisition of needed materials. In Argentina, it was said that insufficient preservation of nets was due to foreign exchange difficulties. As the import of these rather inexpensive preservatives would reduce the need for imports of nets or net making materials any steps to reduce these import difficulties would benefit the fishing industry and the import situation as a whole.

Equipment for Storage and Distribution of Fresh or Frozen Fish

In most Latin-American countries with hot climates, the difficulties in the preservation and distribution of fresh fish have often been so great as to prevent such distribution.

Installation of mechanical refrigeration equipment in boats, large cold storage establishments, and mechanically refrigerated transport equipment is very costly. Such special handling in this industry will, in most cases, be very difficult to develop. Where frozen fish has been distributed in Latin America, considerable resistance has often been found, on the part of consumers, which makes it unlikely that they would be willing to pay the increased prices necessitated by high handling costs.

It is therefore believed that better results can be obtained by an improved distribution of fresh (unfrozen) fish.

Mechanical refrigeration or ice. Ideally, fresh fish should be preserved by refrigerating machinery aboard fishing vessels, by large cooler storage establishments at receiving and distribution centres, and by mechanically refrigerating transport equipment. However, to cool fish by mechanical

means is very difficult and requires a complicated procedure. It is generally much easier and cheaper to pack—and at the same time cool—fish in ice, as is done in most countries.

The extensive use made of cold storage throughout the fishery industry is mostly for the purpose of storing fish already cooled and packed in ice. In this way melting is delayed and continuous re-packing in ice is avoided. Such advantages are of less value during short periods as, for instance, in the fishing vessels or in trucks or railroad cars. In addition, maintenance of such installations requires considerable skill and care. Venezuela, therefore, bases all distribution of fresh fish on the use of vessels with insulated holds, and insulated trucks. For the cooling itself, ice is relied upon entirely. It may also be mentioned that Denmark ships large amounts of fresh fish by truck or railroad to many parts of Europe without any mechanical refrigerated transport.

Ice plants. In some Latin-American countries there is an almost complete lack of ice, even for the distribution of catch, despite the fact that hot climates require, for the transportation of fish alone, an amount of ice equivalent to the weight of the fish itself.

The production of ice is sometimes in the hands of the same middlemen who buy fish from the fishermen, leading to a monopolization of the supplies of ice and preventing an open competitive market. Governments themselves might well establish ice plants to make sufficient ice available at all times, at low cost and independent of all buying arrangements.

Equipment for preservation on board. Good results have been obtained in Cuba and Puerto Rico, by the use of live wells in fishing boats, which are inexpensive to make and very effective. It is recommended that Governments should encourage the study of this method and its applications.

Most fish will nevertheless have to be stored on board boats, without mechanical refrigeration. The ice required should be obtainable locally. A great deal could be accomplished by an educational programme to encourage fishermen to use ice, and by offering them assistance to insulate the holds of their vessels, thereby reducing ice losses.

Cold storage facilities. Ice plants should generally be combined with cold storage facilities for iced fish. Wholesalers and distributors should also be encouraged and assisted to install such facilities.

Transport facilities. Equipment for transport of iced fresh fish is badly needed in many countries. Insulated trucks, or railway cars with insulation and ice bunkers, will usually be sufficient.

For road transportation lasting two days or longer, it may be preferable to use trucks with mechanical refrigeration in order to reduce the melting of the ice.

Dependence on transport equipment. The development of the fishing industry will largely depend on the expansion of road and railroad

transport. Air transport of fresh fish has been used successfully in Latin America, especially in Colombia and Ecuador. While this method should be considered when no other means of transport is possible, it is well to keep in mind that air transport has been found to be about three times as expensive as surface transportation. This is the case even with specially chartered planes carrying fish packed without ice.

Retail facilities. Fresh fish is usually displayed for sale without ice or mechanical refrigeration. Certain countries are, at the moment, planning to improve this situation. Uruguay and Chile, for example, plan to make fresh fish available in meat markets, as these are generally much more numerous than fish stores. Uruguay plans to equip each store with a small ice-cooled cabinet from which fresh fish will be sold.

In general, stores need mechanically refrigerated cabinets, improved display tables, etc. Only the former need to be imported. Encouragement and assistance given to improved retail selling of fish and increased numbers of such outlets will expand consumption.

Processing of Fish

Possibilities. Processing industries constitute a second outlet for fish production. Table VII-7 (examples of progress in the processing of fish) shows that much progress has been made here in the last decade in Latin America. Further possibilities for development nevertheless undoubtedly exist.

Freezer storage of fish. Iced fish cannot be stored for more than one to two weeks at the utmost. Frozen fish may be kept for a considerable time, but the final product is of a rather poor quality which meets resistance from consumers and seldom returns the additional expense involved. Governments should therefore generally not encourage ventures of this kind when other possibilities can be found.

Tuna and related species stand up remarkably well under freezing. It may be possible to construct for these species a freezer and cold storage establishment which would regularize supplies both for canneries and for fresh fish consumption.

Frozen fish in consumer sized packages. The distribution of frozen fish in consumer size packages, as has been developed particularly in the United States, is a very specialized industry. The product must be packed in small packages before freezing and must be stored, transported and held in retail stores at temperatures considerably below 0° C. This generally makes for a high-priced product and requires specialized refrigeration equipment. It is therefore believed that the creation of industries of this kind could not contribute materially towards increased fish consumption in Latin America. An exception might be made for Colombia, where transport difficulties and a very hot climate make the distribution

TABLE VII-7

Examples of progress in the processing of fish

	1939	*1940*	*1941*	*1942*	*1943*	*1944*	*1945*	*1946*	*1947*
Brazil, tons canned fish exported.....	1.3	467	61	78	560	159	679	1,115	—
Cuba, number of cases of canned fish produced	—	1,777	2,252	1,721	2,776	3,594	7,000[a]	18,000[a]	—
Mexico, tons fresh fish canned.....	—	7,164	6,258	3,318	5,187	6,750	11,602	16,567	—
Peru, tons canned fish exported.....	—	—	—	40	735	915	1,754	2,653	4,618
Venezuela, tons canned fish exported.....	—	—	—	307	507	654	2,621	3,746	752
Venezuela, tons salted fish produced.....	3,896	6,242	8,635	7,612	12,774	12,812	13,089	13,541	11,718
Chile, tons canned fish produced.....	1,722	1,548	2,048	2,112	2,809	3,468	3,031	4,474	—

[a] Estimate.

of fresh fish extremely difficult, and where there is at the same time a fairly large urban population with a comparatively high buying power.

There probably exists also, a definite market for high quality frozen fish in consumer sized packages in many major Latin-American cities. Although this would hardly contribute materially towards an increased food production, it might give an impetus to new fishing activities and to exports.

Drying, salting and smoking of fish. Products processed in this way often meet the needs of Latin-American countries as they are comparatively non-perishable, easy to transport and well known to the population. Prior to the Second World War, many Latin-American countries imported large quantities of salted fish. When scarcity reduced these imports considerably during the war years, they were partly substituted for by domestic products. Further research might well lead to products which are generally accepted.

The drying of fish without salting is difficult to carry out in hot climates as is brine salting and transportation of the final product. Smoking usually contributes very little to the keeping qualities. Efforts should therefore be concentrated on study of drying and salting products most suited to local conditions and tastes.

As the consumption of dry salt fish is decreasing in many countries, efforts should undoubtedly be limited chiefly to supplying the rural and other populations where fresh fish distribution is not possible and where buying power is too low to permit canned or frozen fish. Any efforts to increase production here must be supported by consumer education.

Canning. Table VII-7 (examples of progress in the processing of fish) indicates that the production of canned fish has increased considerably in some Latin-American countries during the last year for which data are given. This increase has since stopped in most countries due partly to the fact that canneries in Argentina, Brazil and Chile have had serious difficulties in replacing badly worn machinery. A more important reason is that the canning industries have relied to a considerable extent on export markets and here they are now experiencing difficulties. While the quality of these products has not always been uniformly high, this consideration is not so significant as the lack of foreign exchange in consumer countries and related difficuties in international trade. Co-ordinated action among Governments would go far to assist the international exchange of these products.

The considerable tuna canning industry, especially in Peru, has so far found a readily available market in the United States, although this market may now be nearing its saturation point.

Table VII-5 (examples of prices of fish and fishery products, etc.) shows that the canning industry is not now able to supply products at prices low enough to make canned fish available to the lower income groups. Only in Argentina does the demand seem to be increasing. In most

countries a domestic market can undoubtedly be developed to offset to some degree the considerable quantities of canned fish, chiefly sardines, imported by many countries.

Shark industries. Many Latin-American countries plan—or desire—to develop a shark fishing industry. This was done in Argentina during the war and the production of shark liver oil rose very considerably in a few years. Several other Latin-American countries have similar possibilities to extract vitamin oil. The export market for shark liver oil has, however, deteriorated considerably in the last years, very considerably in Argentina for example. Before such an industry is founded, a careful study should be made, and plans made to utilize the other parts of the shark in addition to the liver: the flesh is generally well suited for salting and the skin for tanning.

Fish meal and oil. Many Latin-American countries have considerable possibilities for the production of fish meal and oil, even though these do not directly produce food. Many countries plan to produce fish meal from offal and waste, but this is possible only where great amounts of offal are available in one location. Otherwise the experience is likely to be that of a fish meal plant in a fishing centre in Mexico set up to utilize waste, which had to be given up because not enough raw materials were available for sufficiently long periods.

Much greater possibilities exist for the production of fish meal from fish where these occur in large amounts which, for lack of market, sufficient size and other reasons, cannot be used for human consumption. Such production can be carried out with very inexpensive equipment, such as open cookers and sun dryers. These methods have been of great advantage in the utilization of shad (sabalo) in Argentina. Similar methods are also still in extensive use, even in Norway where fish meal manufacturing technique is highly advanced. Where the presence of large amounts of fish, particularly fatty types, is known or proved by biological research, and the fish cannot be fully used for human consumption, Governments should study the possibilities of establishing a fish meal and oil industry, due consideration being given to the avoidance of possible harmful effects on other fisheries.

Factory ships. Some experts believe that the best way in which to organize fish processing industries, particularly freezing, is to build so-called factory ships on which this processing can take place. In other parts of the world, the use of such ships has proved profitable only where the distance to the fishing grounds was so great that land stations could not be used. As such conditions are seldom found in Latin America, there would be little use for such boats.

Desirability of processing industries. Consideration should be given to the question whether processing industries will divert species otherwise fit for human consumption, as has happened in Peru. The alternatives generally are not whether the fish should be used for human consump-

tion or turned into fish meal, but, more often, whether they should be used for a valuable industry or left in the sea.

Each case of this nature should be studied carefully. If an industry can pay higher prices for the fish than can the local market, then the end-product must be of high quality and of considerable value. Such products may even merit exportation, justifying imports of quantities of cheaper, but equally nourishing products.

For Peru, the advantages of having its own fish canning industry have undoubtedly more than outweighed the disadvantages. Here, as in the sardine-meal industry in California, USA, government regulations require processors to turn a certain amount of the catch into food products for local consumption.

4. CONCLUSIONS

The estimated 135,000 fishermen in Latin America land considerably less fish per year than the 6,300 fishermen of Iceland. This points to the great need for improved methods, mechanized equipment and larger gear as well as financial assistance, and the creation of a market for the resulting increased production.

These various steps are closely interrelated and the success of any development will therefore depend on the co-ordination of the action taken.

Measures of an Inter-regional Character

(1) Research into fishery resources must be undertaken through biological investigations, experimental fishing, co-ordinated collection of statistics, etc. These problems are international in scope and attempts to solve them must be co-ordinated among the various countries jointly concerned. The FAO could contribute much to such co-ordination. Areas which especially lend themselves to such co-operation are Central America, the Caribbean, the south-west Atlantic and the south-east Pacific.

(2) Some countries may have good possibilities for fish pond cultures and this offers possibilities for extensive food production. It should be studied further by joint or co-ordinated action, possibly with the assistance of the FAO.

(3) Technological research is required into fishing methods and processing adapted to the particular eating habits of the region. Here again there should be co-ordination between nations, possibly through the assistance of the FAO.

(4) Education of fishermen must be extended through special schools and extension programmes. Such work must be done nationally, but by international action textbooks, visual aids, etc., could be developed. Education of scientists, technicians and managerial personnel is needed

but seems only possible through co-operation between the nations. In both cases the FAO could assist much towards the co-ordination of efforts.

(5) Fishing laws sometimes hamper the activities of nationals from other countries. International agreements might be reached to solve some of these problems.

(6) Export of fishery products between countries will often be possible, if the necessary agreements are reached between Governments.

Measures of a National Character

(7) The action most needed is the effort to increase the market for and consumption of fishery products. This can be done mainly by Governments through nutrition research and consumers' education and propaganda.

(8) When requisites are needed, especially among fishermen, the needs are mainly due to economic inability to acquire these. Second in importance are, therefore, credit arrangements to assist fishermen, distributors and processors to get better equipment, and also special loan arrangements to make fishermen independent of outfitters.

(9) In some countries, foreign exchange difficulties hinder replacements and improvements. Any possible action that may alleviate this situation should be taken.

(10) Both landings and trade statistics need further development to make them more uniform and easier to interpret for the industry. Countries could obtain much valuable assistance in this field from the FAO and the Inter-American Statistical Institute.

(11) The effect of fishing activities on the fishery resources should be studied and proper laws should be enacted and enforced when evidence shows such action to be needed and appropriate.

(12) When large fresh water bodies offering good possibilities are deficient in fish, fish should be planted after careful study of the local conditions.

Measures of a Technical Nature

(13) Extremely few powered boats are in use in the Latin-American countries. Their use reduces time spent on trips to fishing grounds, and makes possible the utilization of larger gear and the exploitation of more distant fishing grounds. Boats can often be built locally, but better designs should be provided and engines imported.

(14) Larger and more effective gear should be provided, mostly of the type already in use locally. Conditions differ so much from those in other areas that the introduction of foreign boats, gear and methods should be made experimentally, and only after careful study. Otherwise, improvement of the gear and mechanization of boats already in use locally will probably be more effective.

(15) Ice is one of the most important requisites for a great many fisheries. In Latin America there exists an almost appalling lack of ice and knowledge of its use. One of the most effective steps would be, therefore, to assist in the establishment of ice-plants in all important fishery centres and to give instructions regarding the use of ice in fishing, storage, transportation and retailing.

(16) Ice-plants should be connected with small cooler storage facilities for iced fish. Such cooler stores will also be needed in receiving and distribution centres.

(17) Production, and, to an even greater extent, distribution must be improved. Transport equipment such as insulated trucks, railroad cars with ice bunkers and mechanically refrigerated trucks should be procured. Retail outlets should also be improved and provided with refrigerated cabinets.

(18) A limited number of fish freezing plants should be established, not for main distribution, but to provide an outlet where supplies of fish occur.

(19) The production of dried salted fish might be developed to supply rural populations.

(20) Inexpensive canned products adapted to local consumption should be developed. If a market can be created for such products, or where markets already exist, equipment for the canning industry will be required.

(21) There seem to be good possibilities for fish meal and oil production in many countries and equipment for such production will be needed.

APPENDICES

APPENDIX A

Detailed breakdown of Latin-American imports of tractors, farm machinery and equipment from the United States, 1938-1947

TABLE OF CONTENTS

TABLE I

Agricultural Machinery Exported by the United States to Latin America: 1938-47

TRACTORS

Periods	HORSE POWER												VALUE				
	TRACKLAYING TRACTORS (Carburetter type)		CATERPILLAR TRACTORS (Fuel injection type)		WHEEL TRACTORS		TOTAL		Yearly Average Exports of H.P. (000's)	Average H. P. per tractor	% OF EACH PERIOD OF THE TOTAL 1938-1947		Value (000 US. $)	% of each period of the total value exported	YEARLY AVERAGE OF EXPORTS (000 US $)		Average Price per H. P. (in $)
	Unit	HP. (000's)	Unit	HP. (000's)	Unit	HP. (000's)	Unit	HP. (000's)			Unit	HP.			Caterpillars	Wheels	
1938-1941	2,087	65.5	3,353	124.3	11,346	289.7	16,786	479.5	119.8	28.57	29.3	33.7	20,042.3	27.5	1,360	2,836	41.8
1942-1945	569	19.9	1,343	57.0	10,905	255.0	12,817	331.9	82.9	25.89	22.4	23.3	15,026.4	20.6	473	2,726	45.3
1946-1947	486	16.4	3,024	130.6	24,136	465.8	27,628	612.8	306.4	22.18	48.3	43.0	37,700.4	51.9	1,755	12,068	61.5

OTHER AGRICULTURAL MACHINERY

(000 US. $)

Periods	Sprayers	Implements of Cultivation	Harvesters	Seed Separators	Total	YEARLY AVERAGES			
						Sprayers	Implements	Harvesters	Seed Separators
1938-1941	1,376.5	10,924.0	12,749.5	1,401.1	26,450.1	343.9	2,731	3,187.3	350.3
1942-1945	1,180.4	5,844.1	2,180.0	599.0	9,811.5	295.1	1,461	547.0	149.7
1946-1947	2,845.0	9,634.0	6,561.5	815.6	19,356.1	1,172.5	4,817	3,280.5	407.8

TOTAL TRACTORS AND OTHER AGRICULTURAL MACHINERY

(000 US. $)

Periods	Tractors	Other Machinery	Total	Yearly Average
1938-1941	20,042.3	26,450.1	46,492.4	11,623.1
1942-1945	15,026.4	9,811.5	24,837.9	6,209.4
1946-1947	37,700.4	19,356.1	57,056.5	28,528.2

TABLE II

Total Number of Tractors Exported by the United States to Latin America: 1938-47

In units and U. S. dollars

Countries	1938		1939		1940		1941		1942		1943		1944		1945		1946		1947		TOTAL	
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value
Track-laying tractors (carburetter type)																						
Argentina	432	519.8	128	173.1	98	116.1	32	37.5	—	—	—	—	—	—	—	—	11	40.7	72	215.5	773	1,102.7
Bolivia	6	6.6	12	21.8	3	4.3	6	19.9	7	11.6	4	3.3	12	15.8	1	2.0	8	16.5	5	10.6	64	112.4
Brazil	59	116.7	47	79.2	21	39.4	29	61.7	3	4.7	102	582.6	5	14.8	2	8.2	9	10.0	21	42.5	298	959.8
Chile	87	165.5	63	110.2	50	91.4	32	29.0	57	97.7	—	—	—	—	—	—	24	53.0	14	22.2	337	569.0
Colombia	36	94.0	31	50.3	7	12.9	5	9.0	5	14.8	—	—	12	29.6	9	14.3	18	103.7	38	156.2	161	484.8
Costa Rica	2	3.8	10	17.6	1	1.6	11	13.9	1	0.8	3	2.4	1	3.0	15	13.6	—	—	9	11.7	53	68.4
Cuba	10	7.4	5	12.4	12	20.7	4	11.8	3	18.6	4	13.9	2	3.0	—	—	11	27.0	19	39.1	70	163.9
Dominican Rep.	6	15.3	9	16.0	1	2.7	7	2.8	—	—	3	18.0	1	3.0	—	—	—	—	2	9.0	29	66.8
Ecuador	10	17.7	24	36.6	2	4.5	4	5.0	4	3.3	—	—	3	17.7	10	22.6	13	22.3	7	11.2	77	140.9
El Salvador	—	—	2	2.9	—	—	1	0.7	—	—	—	—	—	—	2	2.0	6	10.6	6	6.6	17	22.8
Guatemala	4	5.5	12	19.1	—	—	4	5.2	3	4.0	6	35.6	—	—	—	—	—	—	—	—	29	69.4
Haiti	—	—	—	—	—	—	3	3.6	—	—	—	—	4	9.8	—	—	—	—	—	—	7	13.4
Honduras	4	14.2	2	5.2	7	13.9	—	—	1	2.8	1	16.4	—	—	—	—	—	—	1	4.1	16	56.6
Mexico	99	181.9	127	160.6	90	110.5	156	250.9	73	110.0	61	177.3	79	111.0	93	168.5	82	191.8	76	118.0	936	1,579.6
Nicaragua	3	3.4	2	5.5	—	—	—	—	—	—	—	—	—	—	2	1.8	—	—	—	—	7	10.7
Panama	—	—	1	1.1	1	6.6	5	16.1	1	1.4	—	—	—	—	—	—	—	—	—	—	8	25.2
Paraguay	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3	10.3	11	35.5
Peru	56	108.1	30	38.2	7	8.8	20	32.6	3	4.0	13	13.2	2	3.9	4	7.5	2	1.9	3	17.3	3	17.3
Uruguay	2	6.4	7	8.0	—	—	1	1.4	1	1.6	—	—	—	—	7	18.2	—	—	9	15.8	146	234.0
Venezuela	36	67.2	64	89.5	85	160.9	40	97.8	19	37.0	19	34.9	19	43.2	31	32.9	36	99.5	4	4.8	22	40.4
																			56	120.6	405	783.5
Track-laying tractors (fuel injection type)																						
Argentina	474	1,170.4	160	466.2	186	503.8	67	148.1	2	6.1	—	—	—	—	1	7.9	167	623.5	586	3,755.5	1,643	6,681.5
Bolivia	4	14.5	6	23.6	6	19.8	15	31.9	13	38.5	11	3.1	11	35.7	16	74.5	43	239.0	28	151.3	153	632.9
Brazil	148	496.8	260	700;9	146	512.2	215	749.2	48	187.4	29	132.7	30	173.5	196	844.4	361	1,622.7	572	3,294.0	1,999	8,813.8
Chile	36	97.7	66	181.3	202	417.8	216	484.5	17	37.2	1	9.7	6	43.6	27	76.8	98	489.7	109	626.8	778	2,368.1
Colombia	19	98.3	85	449.4	72	246.5	41	176.1	3	7.9	8	19.9	26	123.0	60	362.1	91	481.5	132	1,105.9	587	3,072.2
Costa Rica	13	38.9	48	249.4	—	—	27	98.2	9	27.5	5	16.8	17	37.7	22	88.4	42	133.3	26	109.6	209	707.8
Cuba	37	98.3	63	137.0	56	146.3	160	337.2	101	287.4	44	138.1	12	382.6	—	—	127	508.1	162	616.1	762	2,850.5
Dominican Rep.	12	50.3	7	29.8	8	46.4	6	12.6	1	2.2	14	47.8	11	32.9	3	20.8	24	87.4	55	359.9	141	690.1
Ecuador	12	45.9	29	101.7	17	58.0	29	86.0	2	4.1	9	36.5	9	54.4	95	329.0	70	329.7	54	288.6	326	1,333.9
El Salvador	—	—	5	19.5	2	4.0	—	—	1	4.0	—	2.6	9	31.4	17	60.0	27	84.8	22	85.6	83	291.9
Guatemala	3	15.3	9	38.5	4	20.3	4	7.8	7	55.6	9	54.0	6	17.5	9	27.4	16	54.4	25	126.6	92	417.4
Haiti	1	2.1	2	9.4	—	—	4	8.7	—	—	3	13.2	6	15.2	4	17.9	—	—	4	27.8	23	94.3
Honduras	4	17.8	8	18.1	20	38.1	7	13.0	—	—	1	5.7	3	13.4	3	14.7	23	78.1	46	208.6	115	408.5
Mexico	55	169.6	123	334.6	112	390.8	287	1,131.7	101	343.9	131	506.4	103	426.7	243	913.2	480	2,110.2	460	2,599.2	2,095	9,016.3
Nicaragua	5	21.8	8	26.9	44	160.6	12	33.8	—	—	6	20.5	5	17.9	17	49.4	19	69.9	28	145.5	144	546.3
Panama	3	9.5	5	12.8	8	41.9	12	36.6	1	4.3	11	32.7	18	72.5	15	66.3	22	80.2	30	200.6	125	557.4
Paraguay	—	—	—	—	7	38.0	—	—	—	—	—	—	—	—	4	16.8	4	20.2	10	56.9	25	131.9
Peru	133	290.2	89	189.7	43	72.4	51	124.7	31	85.6	24	55.4	27	93.0	95	328.0	76	319.5	83	430.7	654	1,960.2
Uruguay	—	—	5	14.2	75	191.1	25	55.1	—	—	25	126.4	1	2.1	1	6.8	29	85.4	39	138.1	200	619.2
Venezuela	67	293.7	127	513.7	95	383.1	119	385.4	10	52.6	1	9.0	61	397.0	112	606.2	210	1,247.4	347	2,923.4	1,139	6,811.5

(to be continued)

TABLE 11 (Continued)

Total Number of Tractors Exported by the United States to Latin America: 1938-47

In units and U. S. dollars

Countries	1938		1939		1940		1941		1942		1943		1944		1945		1946		1947		TOTAL	
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value
Wheel tractors																						
Argentina	3,441	3,185.0	827	682.7	474	307.2	426	258.8	19	15.8	—	—	—	—	72	65.2	1,967	1,015.5	5,408	7,594.4	12,634	13,124.6
Bolivia	6	8.7	11	11.3	15	13.5	75	69.5	19	21.0	58	40.7	47	48.1	56	70.3	58	62.0	45	59.4	390	404.5
Brazil	184	214.0	258	223.6	38	25.4	155	132.6	113	93.0	43	47.0	51	46.0	213	227.0	417	493.0	1,386	1,245.8	2,858	2,747.4
Chile	8	10.9	78	71.6	328	279.2	343	347.6	105	86.5	17	10.8	193	177.8	457	439.1	583	545.6	682	782.4	2,794	2,751.5
Colombia	84	70.7	153	149.3	127	118.8	147	137.5	63	63.0	127	96.6	265	278.2	541	547.4	236	282.5	614	745.3	2,357	2,489.3
Costa Rica	1	0.8	10	7.6	—	—	23	20.0	—	—	3	2.3	58	36.9	38	36.4	34	26.7	17	14.4	184	145.1
Cuba	12	10.7	11	13.4	3	1.7	22	22.8	31	24.6	16	12.2	48	37.6	142	97.7	478	460.9	1,268	1,200.6	2,021	1,882.1
Dominican Rep.	5	6.4	2	1.1	3	1.6	3	1.9	—	—	11	10.2	42	25.3	9	8.0	48	67.4	58	83.7	181	205.6
Ecuador	2	1.9	16	14.3	18	15.2	6	4.7	—	—	7	5.2	23	17.6	51	50.5	49	49.0	47	53.2	219	202.6
El Salvador	4	3.0	2	1.6	1	0.7	4	3.1	—	—	—	—	2	1.9	26	35.6	63	44.1	114	111.9	206	201.9
Guatemala	6	4.6	31	33.0	52	49.9	3	2.2	—	—	3	2.7	17	14.2	125	115.7	135	102.7	172	173.9	543	498.9
Haiti	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1.6	1	0.3	19	16.7	21	18.6
Honduras	3	6.1	3	2.2	2	2.2	6	4.1	—	—	—	—	5	4.2	10	9.2	35	23.0	53	58.1	117	109.1
Mexico	180	161.9	393	286.6	539	410.2	1,285	959.2	416	321.0	1,285	1,191.2	1,844	1,710.2	2,006	1,596.8	2,264	2,058.3	3,854	4,182.8	14,066	12,878.2
Nicaragua	3	4.0	3	2.9	19	20.5	8	7.4	—	—	—	—	11	136.0	38	39.8	36	35.1	28	34.2	146	279.9
Panama	—	—	2	1.0	2	1.5	22	8.1	4	2.1	29	9.9	16	12.4	12	8.5	13	6.5	78	50.0	178	100.9
Paraguay	18	16.3	—	—	2	0.7	—	—	—	—	—	—	—	—	4	4.3	8	4.6	12	14.3	39	49.2
Peru	259	209.2	60	40.6	28	20.7	58	53.9	55	44.2	103	76.6	169	152.3	281	314.2	175	173.7	345	379.7	1,533	1,465.1
Uruguay	72	57.8	191	170.4	233	214.4	237	197.9	126	95.2	12	7.6	111	134.6	310	304.1	307	306.5	828	837.3	2,427	2,319.8
Venezuela	45	36.1	122	92.8	100	66.2	39	17.8	35	31.0	109	120.1	366	307.9	376	345.0	519	442.7	1,702	1,624.8	3,473	3,084.4
Total number of tractors																						
Argentina	4,347	4,875.2	1,115	1,322.0	758	927.1	525	444.4	21	21.9	—	—	—	—	73	73.1	2,145	1,679.7	6,066	11,565.4	15,050	20,908.8
Bolivia	16	29.8	29	56.7	24	37.6	96	121.3	39	72.1	73	47.1	70	99.6	73	146.8	109	317.5	78	221.3	607	1,149.8
Brazil	391	827.5	565	1,003.7	205	577.0	399	943.5	164	285.1	174	762.3	86	224.3	405	1,079.6	787	2,125.7	1,979	4,682.3	5,155	12,621.0
Chile	131	274.1	207	363.1	590	818.4	591	861.1	179	221.4	18	20.5	199	221.4	484	515.9	705	1,088.3	805	1,331.4	3,909	5,715.6
Colombia	139	264.0	269	649.0	206	378.2	193	322.6	71	85.7	135	116.5	303	431.4	610	923.8	345	867.7	834	2,007.4	7,105	6,046.3
Costa Rica	16	43.5	68	274.6	1	1.6	61	70.1	10	28.3	11	21.5	76	77.6	75	108.4	76	160.0	52	135.7	446	921.3
Cuba	59	116.4	79	162.8	71	168.7	186	571.8	135	330.5	64	164.2	62	422.6	142	97.7	616	996.0	1,439	2,055.8	2,853	4,886.5
Dominican Rep.	23	72.0	18	46.9	12	50.7	16	17.3	1	2.2	28	76.0	54	61.2	12	28.8	72	154.8	115	452.6	351	962.5
Ecuador	24	65.5	69	152.6	37	77.7	39	95.7	6	7.4	16	41.7	35	89.7	156	402.1	132	392.0	108	353.0	622	1,677.4
El Salvador	4	3.0	9	24.0	3	4.7	5	3.8	1	4.0	—	2.6	11	33.3	45	97.6	86	139.5	142	204.1	306	516.6
Guatemala	12	25.4	52	90.6	56	70.2	11	15.2	10	59.6	18	92.3	23	31.7	134	143.1	151	157.1	197	300.5	664	985.7
Haiti	1	2.1	2	9.4	—	—	7	12.3	—	—	3	13.2	9	25.0	5	19.5	1	0.3	23	44.5	51	126.3
Honduras	11	38.1	13	25.5	29	54.2	13	17.1	1	2.8	2	22.1	8	17.6	13	23.9	58	102.1	100	270.8	248	574.2
Mexico	334	512.5	643	781.8	741	911.5	1,728	2,341.8	590	774.9	1,477	1,964.9	2,026	2,247.9	2,312	2,678.5	2,826	4,360.3	4,390	6,900.0	17,097	23,474.1
Nicaragua	11	29.2	13	35.3	63	181.1	20	41.2	—	—	6	20.5	16	153.9	57	91.0	55	105.0	56	179.7	297	836.9
Panama	3	9.5	8	14.9	11	50.0	39	60.8	6	7.8	40	42.6	34	84.9	27	74.5	35	86.7	111	260.9	314	692.9
Paraguay	13	16.3	—	—	9	47.7	—	—	—	—	—	—	—	—	8	21.1	12	24.8	25	58.5	67	198.4
Peru	448	607.5	179	268.5	78	101.9	129	211.2	89	133.8	140	145.2	198	239.2	380	650.7	253	495.1	439	826.2	2,333	3,679.3
Uruguay	74	64.2	203	192.6	308	405.5	263	248.4	127	96.8	37	134.0	112	136.7	318	329.1	336	391.9	871	980.2	2,649	2,979.4
Venezuela	138	379.0	313	696.0	280	610.2	198	501.0	64	120.6	189	164.0	446	148.1	519	984.1	765	1,789.6	2,105	4,668.8	5,017	10,679.4
																						99,532.0

TABLE III

Track-Laying Tractors (Carburetter Type) Exported by the United States to Latin America: 1938-47

In units and in U. S. dollars

Years	Drawbar Horsepower										Total	
	Under 35 H. P.		35 to 49 H. P.		50 to 64 H. P.		65 to 79 H. P.		80 H. P. and over			
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value
Argentina												
1938	414	482,950	15	25,605	—	—	3	11,228	—	—	432	519,783
1939	116	145,003	6	9,588	—	—	6	18,484	—	—	128	173,075
1940	95	106,719	—	—	—	—	3	9,356	—	—	98	116,075
1941	32	37,507	—	—	—	—	—	—	—	—	32	37,507
1942	—	—	—	—	—	—	—	—	—	—	—	—
1943	—	—	—	—	—	—	—	—	—	—	—	—
1944	—	—	—	—	—	—	—	—	—	—	—	—
1945	—	—	—	—	—	—	—	—	—	—	—	—
1946	3	2,971	—	—	—	—	1	8,758	7	28,000	11	40,729
1947	50	84,246	4	11,649	1	2,668	17	116,900	—	—	72	215,463
Bolivia												
1938	3	250	2	3,409	—	—	1	2,946	—	—	6	6,605
1939	5	6,538	4	7,170	—	—	3	8,089	—	—	12	21,797
1940	1	1,156	2	3,131	—	—	—	—	—	—	3	4,287
1941	1	510	3	7,102	—	—	—	—	2	12,269	6	19,881
1942	7	11,614	—	—	—	—	—	—	—	—	7	11,614
1943	4	3,320	—	—	—	—	—	—	—	—	4	3,320
1944	12	15,804	—	—	—	—	—	—	—	—	12	15,804
1945	—	—	1	2,025	—	—	—	—	—	—	1	2,025
1946	8	16,546	—	—	—	—	—	—	—	—	8	16,546
1947	4	4,419	—	—	1	6,240	—	—	—	—	5	10,659
Brazil												
1938	53	96,130	4	9,968	—	—	2	10,638	—	—	59	116,736
1939	45	74,010	2	5,192	—	—	—	—	—	—	47	79,202
1940	18	30,043	3	9,409	—	—	—	—	—	—	21	39,452
1941	23	34,973	—	—	6	26,696	—	—	—	—	29	61,669
1942	2	2,902	—	—	1	1,768	—	—	—	—	3	4,670
1943	—	—	—	—	—	—	1	4,300	101	578,303	102	582,603
1944	1	1,800	2	2,465	1	6,247	—	—	1	4,300	5	14,812
1945	1	1,575	—	—	—	—	1	6,580	—	—	2	8,155
1946	9	10,048	—	—	—	—	—	—	—	—	9	10,048
1947	18	22,917	1	2,623	2	17,000	—	—	—	—	21	42,540
Chile												
1938	85	162,341	2	3,189	—	—	—	—	—	—	87	165,530
1939	60	107,034	3	3,219	—	—	—	—	—	—	63	110,253
1940	54	79,249	6	12,203	—	—	—	—	—	—	60	91,452
1941	22	20,852	10	8,129	—	—	—	—	—	—	32	28,981
1942	57	97,704	—	—	—	—	—	—	—	—	57	97,704
1943	—	—	—	—	—	—	—	—	—	—	—	—
1944	—	—	—	—	—	—	—	—	—	—	—	—
1945	—	—	—	—	—	—	—	—	—	—	—	—
1946	15	29,273	5	8,940	4	14,743	—	—	—	—	24	52,956
1947	14	22,202	—	—	—	—	—	—	—	—	14	22,202
Colombia												
1938	23	37,335	3	10,151	—	—	10	46,524	—	—	36	94,010
1939	27	40,153	4	10,163	—	—	—	—	—	—	31	50,316
1940	4	6,009	2	4,152	—	—	1	2,752	—	—	7	12,913
1941	3	4,362	2	4,615	—	—	—	—	—	—	5	8,977
1942	5	14,777	—	—	—	—	—	—	—	—	5	14,777
1943	—	—	—	—	—	—	—	—	—	—	—	—
1944	10	11,962	—	—	—	—	1	7,831	1	9,833	12	29,626
1945	8	6,405	—	—	—	—	—	—	1	7,887	9	14,292
1946	1	1,991	7	20,700	1	4,800	2	10,103	7	66,074	18	103,668
1947	13	20,166	1	3,879	—	—	—	—	24	132,117	38	156,162

(to be continued)

TABLE III (Continued)

Track-Laying Tractors (Carburetter Type) Exported by the United States to Latin America: 1938-47

In units and in U. S. dollars

Years	Drawbar Horsepower										Total	
	Under 35 H. P.		35 to 49 H. P.		50 to 64 H. P.		65 to 79 H. P.		80 H. P. and over			
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value
Costa Rica												
1938	1	1,488	1	2,298	—	—	—	—	—	—	2	3,786
1939	10	17,653	—	—	—	—	—	—	—	—	10	17,653
1940	1	1,580	—	—	—	—	—	—	—	—	1	1,580
1941	11	13,918	—	—	—	—	—	—	—	—	11	13,918
1942	1	798	—	—	—	—	—	—	—	—	1	798
1943	3	2,442	—	—	—	—	—	—	—	—	3	2,442
1944	—	—	1	3,030	—	—	—	—	—	—	1	3,030
1945	4	3,369	11	10,185	—	—	—	—	—	—	15	13,554
1946	—	—	—	—	—	—	—	—	—	—	—	—
1947	9	11,749	—	—	—	—	—	—	—	—	0	11,749
Cuba												
1938	8	3,890	2	3,479	—	—	—	—	—	—	10	7,369
1939	4	6,718	—	—	—	—	1	5,640	—	—	5	12,358
1940	9	12,223	2	4,663	—	—	1	3,846	—	—	12	20,732
1941	—	—	1	3,042	3	8,741	—	—	—	—	4	11,783
1942	—	—	—	—	—	—	2	15,577	1	3,011	3	18,588
1943	—	—	1	1,900	3	12,000	—	—	—	—	4	13,900
1944	1	617	1	2,352	—	—	—	—	—	—	2	2,969
1945	—	—	—	—	—	—	—	—	—	—	—	—
1946	4	10,584	7	16,446	—	—	—	—	—	—	11	27,030
1947	10	11,748	5	8,246	—	—	2	11,350	2	7,800	10	39,144
Dominican Republic												
1938	6	15,310	—	—	—	—	—	—	—	—	6	15,310
1939	9	15,993	—	—	—	—	—	—	—	—	9	15,993
1940	—	—	1	2,706	—	—	—	—	—	—	1	2,706
1941	7	2,772	—	—	—	—	—	—	—	—	7	2,772
1942	—	—	—	—	—	—	—	—	—	—	—	—
1943	—	—	—	—	3	18,000	—	—	—	—	3	18,000
1944	—	—	1	3,030	—	—	—	—	—	—	1	3,030
1945	—	—	—	—	—	—	—	—	—	—	—	—
1946	—	—	—	—	—	—	—	—	—	—	—	—
1947	—	—	1	3,200	1	5,815	—	—	—	—	2	9,015
Ecuador												
1938	9	13,669	—	—	—	—	1	4,078	—	—	10	17,747
1939	23	32,470	—	—	—	—	1	4,173	—	—	24	36,643
1940	1	1,358	—	—	—	—	1	3,178	—	—	2	4,536
1941	4	5,064	—	—	—	—	—	—	—	—	4	5,064
1942	4	3,276	—	—	—	—	—	—	—	—	4	3,276
1943	—	—	—	—	—	—	—	—	—	—	—	—
1944	—	—	—	—	1	2,328	—	—	2	15,420	3	17,748
1945	3	2,283	6	12,521	—	—	—	—	1	7,793	10	22,597
1946	12	18,942	—	—	1	3,329	—	—	—	—	13	22,271
1947	7	11,206	—	—	—	—	—	—	—	—	7	11,206
El Salvador												
1938	—	—	—	—	—	—	—	—	—	—	—	—
1939	2	2,930	—	—	—	—	—	—	—	—	2	2,930
1940	—	—	—	—	—	—	—	—	—	—	—	—
1941	1	704	—	—	—	—	—	—	—	—	1	704
1942	—	—	—	—	—	—	—	—	—	—	—	—
1943	—	—	—	—	—	—	—	—	—	—	—	—
1944	—	—	—	—	—	—	—	—	—	—	—	—
1945	2	1,968	—	—	—	—	—	—	—	—	2	1,968
1946	6	10,622	—	—	—	—	—	—	—	—	6	10,622
1947	6	6,637	—	—	—	—	—	—	—	—	6	6,637

(to be continued)

TABLE III (Continued)

Track-Laying Tractors (Carburetter Type) Exported by the United States to Latin America: 1938-47

In units and in U. S. dollars

Years	Drawbar Horsepower										Total	
	Under 35 H. P.		35 to 49 H. P.		50 to 64 H. P.		65 to 79 H. P.		80 H. P. and over			
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value
Guatemala												
1938	—	—	4	5,544	—	—	—	—	—	—	4	5,544
1939	8	8,054	4	11,078	—	—	—	—	—	—	12	19,132
1940	—	—	—	—	—	—	—	—	—	—	—	—
1941	4	5,212	—	—	—	—	—	—	—	—	4	5,212
1942	—	—	3	3,972	—	—	—	—	—	—	3	3,972
1943	—	—	—	—	—	—	—	—	6	35,647	6	35,647
1944	—	—	—	—	—	—	—	—	—	—	—	—
1945	—	—	—	—	—	—	—	—	—	—	—	—
1946	—	—	—	—	—	—	—	—	—	—	—	—
1947	—	—	—	—	—	—	—	—	—	—	—	—
Haiti												
1938	—	—	—	—	—	—	—	—	—	—	—	—
1939	—	—	—	—	—	—	—	—	—	—	—	—
1940	—	—	—	—	—	—	—	—	—	—	—	—
1941	3	3,588	—	—	—	—	—	—	—	—	3	3,588
1942	—	—	—	—	—	—	—	—	—	—	—	—
1943	—	—	—	—	—	—	—	—	—	—	—	—
1944	—	—	4	9,760	—	—	—	—	—	—	4	9,760
1945	—	—	—	—	—	—	—	—	—	—	—	—
1946	—	—	—	—	—	—	—	—	—	—	—	—
1947	—	—	—	—	—	—	—	—	—	—	—	—
Honduras												
1938	1	2,134	—	—	—	—	3	12,082	—	—	4	14,216
1939	—	—	2	5,216	—	—	—	—	—	—	2	5,216
1940	7	13,876	—	—	—	—	—	—	—	—	7	13,876
1941	—	—	—	—	—	—	—	—	—	—	—	—
1942	—	—	1	2,800	—	—	—	—	—	—	1	2,800
1943	—	—	—	—	—	—	—	—	1	16,418	1	16,418
1944	—	—	—	—	—	—	—	—	—	—	—	—
1945	—	—	—	—	—	—	—	—	—	—	—	—
1946	—	—	—	—	—	—	—	—	—	—	—	—
1947	—	—	1	4,073	—	—	—	—	—	—	1	4,073
Mexico												
1938	74	74,724	9	16,950	—	—	16	89,282	—	—	99	180,956
1939	111	123,331	13	27,170	—	—	3	10,099	—	—	127	160,600
1940	77	86,450	9	16,957	—	—	4	7,123	—	—	90	110,530
1941	132	174,121	7	15,942	10	24,412	2	9,433	5	27,027	156	250,935
1942	64	83,100	6	6,157	1	2,500	1	10,675	1	7,564	73	109,996
1943	13	16,025	11	31,414	25	57,040	10	63,300	2	9,560	61	177,339
1944	61	65,444	16	40,418	2	5,146	—	—	—	—	79	111,008
1945	55	66,159	20	70,938	2	6,251	2	10,000	5	15,182	93	168,530
1946	58	77,038	2	6,393	10	28,516	—	—	12	79,849	82	191,796
1947	67	89,646	6	8,175	—	—	1	5,330	2	14,824	76	117,975
Nicaragua												
1938	3	3,355	—	—	—	—	—	—	—	—	3	3,355
1939	1	1,625	—	—	—	—	1	3,891	—	—	2	5,516
1940	—	—	—	—	—	—	—	—	—	—	—	—
1941	—	—	—	—	—	—	—	—	—	—	—	—
1942	—	—	—	—	—	—	—	—	—	—	—	—
1943	—	—	—	—	—	—	—	—	—	—	—	—
1944	—	—	—	—	—	—	—	—	—	—	—	—
1945	—	—	2	1,850	—	—	—	—	—	—	2	1,850
1946	—	—	—	—	—	—	—	—	—	—	—	—
1947	—	—	—	—	—	—	—	—	—	—	—	—

(to be continued)

TABLE III (Continued)

Track-Laying Tractors (Carburetter Type) Exported by the United States to Latin America: 1938-47

In units and in U. S. dollars

Years	Drawbar Horsepower										Total	
	Under 35 H. P.		35 to 49 H. P.		50 to 64 H. P.		65 to 79 H. P.		80 H. P. and over			
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value
Panama												
1938	—	—	—	—	—	—	—	—	—	—	—	—
1939	1	1,072	—	—	—	—	—	—	—	—	1	1,072
1940	—	—	—	—	—	—	1	6,572	—	—	1	6,572
1941	1	798	2	4,510	—	—	—	—	2	10,800	5	16,108
1942	1	1,369	—	—	—	—	—	—	—	—	1	1,369
1943	—	—	—	—	—	—	—	—	—	—	—	—
1944	—	—	—	—	—	—	—	—	—	—	—	—
1945	—	—	—	—	—	—	—	—	—	—	—	—
1946	—	—	—	—	—	—	—	—	—	—	—	—
1947	3	10,304	—	—	—	—	—	—	—	—	3	10,304
Paraguay												
1938	—	—	—	—	—	—	—	—	—	—	—	—
1939	—	—	—	—	—	—	—	—	—	—	—	—
1940	—	—	—	—	—	—	—	—	—	—	—	—
1941	—	—	—	—	—	—	—	—	—	—	—	—
1942	—	—	—	—	—	—	—	—	—	—	—	—
1943	—	—	—	—	—	—	—	—	—	—	—	—
1944	—	—	—	—	—	—	—	—	—	—	—	—
1945	—	—	—	—	—	—	—	—	—	—	—	—
1946	—	—	—	—	—	—	—	—	—	—	—	—
1947	1	2,313	—	—	2	15,000	—	—	—	—	3	17,313
Peru												
1938	43	76,247	12	23,066	—	—	1	8,780	—	—	56	108,093
1939	30	38,217	—	—	—	—	—	—	—	—	30	38,217
1940	7	8,833	—	—	—	—	—	—	—	—	7	8,833
1941	14	19,650	—	—	6	12,938	—	—	—	—	20	32,588
1942	3	4,013	—	—	—	—	—	—	—	—	3	4,013
1943	13	13,222	—	—	—	—	—	—	—	—	13	13,222
1944	—	—	2	3,932	—	—	—	—	—	—	2	3,932
1945	4	7,506	—	—	—	—	—	—	—	—	4	7,506
1946	2	1,902	—	—	—	—	—	—	—	—	2	1,902
1947	9	15,750	—	—	—	—	—	—	—	—	9	15,750
Uruguay												
1938	—	—	1	2,140	—	—	1	4,282	—	—	2	6,422
1939	7	8,061	—	—	—	—	—	—	—	—	7	8,061
1940	—	—	—	—	—	—	—	—	—	—	—	—
1941	—	—	1	1,382	—	—	—	—	—	—	1	1,382
1942	1	1,591	—	—	—	—	—	—	—	—	1	1,591
1943	—	—	—	—	—	—	—	—	—	—	—	—
1944	—	—	—	—	—	—	—	—	—	—	—	—
1945	7	18,230	—	—	—	—	—	—	—	—	7	18,230
1946	—	—	—	—	—	—	—	—	—	—	—	—
1947	4	4,806	—	—	—	—	—	—	—	—	4	4,806
Venezuela												
1938	32	50,420	2	2,692	—	—	2	14,099	—	—	36	67,211
1939	57	71,209	5	10,447	—	—	2	7,890	—	—	64	89,546
1940	50	64,080	20	39,714	—	—	15	56,493	—	—	85	160,287
1941	26	33,164	7	16,160	2	5,429	—	—	5	42,038	40	97,791
1942	14	18,796	—	—	3	7,287	—	—	2	10,946	19	37,029
1943	11	13,607	7	18,073	1	3,090	—	—	—	—	19	34,860
1944	—	—	12	23,256	6	12,066	1	7,888	—	—	19	43,210
1945	25	23,162	6	9,785	—	—	—	—	—	—	31	32,947
1946	12	20,492	20	67,431	4	11,622	—	—	—	—	36	99,545
1947	43	59,966	1	1,525	10	39,168	—	—	2	20,000	56	120,659

Source: Foreign Commerce and Navigation of the United States, 1938 to 1947.

TABLE IV

Track Laying Tractors (Fuel Injection Type) Exported by the U. S. to Latin America: 1938-47

In units and U. S. dollars

Years	Drawbar Horsepower										Total	
	Under 35 H. P.		35 to 49 H. P.		50 to 64 H. P.		65 to 79 H. P.		80 H. P. and over			
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value
Argentina												
1938	180	395,167	239	556,024	—	—	55	219,261	—	—	474	1,170,452
1939	54	139,662	66	146,626	—	—	40	179,886	—	—	160	466,174
1940	55	89,527	80	192,522	—	—	51	221,803	—	—	186	503,852
1941	50	84,282	9	13,754	1	3,092	—	—	7	40,962	67	148,090
1942	—	—	2	6,084	—	—	—	—	—	—	2	6,084
1943	—	—	—	—	—	—	—	—	—	—	—	—
1944	—	—	—	—	—	—	—	—	—	—	—	—
1945	—	—	—	—	—	—	—	—	1	7,923	1	7,923
1946	42	75,915	44	141,996	34	143,751	8	44,619	39	217,192	167	623,473
1947	49	115,091	108	835,755	93	426,302	19	126,829	317	2,251,525	586	3,755,502
Bolivia												
1938	1	2,342	3	12,186	—	—	—	—	—	—	4	14,528
1939	3	6,651	1	3,707	—	—	2	13,250	—	—	6	23,608
1940	—	—	2	7,841	—	—	4	12,010	—	—	6	19,851
1941	13	22,985	1	2,790	—	—	—	—	1	6,143	15	31,916
1942	5	8,840	4	9,829	2	9,569	—	—	2	11,253	13	39,491
1943	7	13,907	2	4,799	1	4,453	—	—	1	9,982	11	33,141
1944	5	9,698	2	4,860	1	3,000	3	18,107	—	—	11	35,665
1945	3	5,919	5	22,622	—	—	2	9,982	5	35,978	16	74,501
1946	10	31,641	5	14,427	12	78,845	1	5,487	15	108,582	43	238,982
1947	3	7,614	8	26,464	6	30,246	3	17,896	8	69,119	28	151,339
Brazil												
1938	36	53,545	56	136,466	—	—	56	306,825	—	—	148	496,836
1939	121	242,997	83	201,180	—	—	56	256,732	—	—	260	700,909
1940	48	115,557	34	88,878	—	—	64	307,788	—	—	146	512,223
1941	60	101,153	16	36,735	46	139,134	14	46,486	77	425,650	215	749,158
1942	8	14,866	12	28,156	6	20,568	2	9,064	20	114,754	48	187,408
1943	2	3,990	4	14,339	14	67,392	—	—	9	46,988	29	132,709
1944	6	11,725	2	5,589	5	27,164	—	—	17	129,023	30	173,501
1945	25	51,991	51	129,451	38	191,237	14	76,670	62	395,032	190	844,381
1946	79	168,148	73	209,811	62	270,406	27	146,962	120	827,382	361	1,622,709
1947	121	253,642	87	312,839	100	501,526	18	102,422	246	2,223,620	572	3,394,031
Chile												
1938	—	—	33	81,425	—	—	3	16,316	—	—	36	97,741
1939	18	40,942	44	114,040	—	—	4	26,281	—	—	66	181,263
1940	119	224,938	76	181,413	—	—	7	41,420	—	—	202	447,771
1941	72	135,063	127	283,087	12	37,258	—	—	5	29,111	216	484,519
1942	15	29,386	—	—	2	7,860	—	—	—	—	17	37,246
1943	—	—	—	—	—	—	—	—	1	9,742	1	9,742
1944	—	—	1	2,353	—	—	—	—	5	41,289	6	43,642
1945	9	18,949	12	32,149	3	14,164	—	—	3	11,580	27	76,842
1946	15	32,698	23	64,453	20	95,386	8	45,834	32	251,355	98	489,727
1947	17	45,783	50	200,162	15	62,405	8	44,257	19	174,223	109	526,830
Colombia												
1938	6	11,293	1	5,475	—	—	12	82,497	—	—	19	99,265
1939	14	36,298	24	91,287	—	—	47	321,791	—	—	85	449,376
1940	23	55,240	31	108,596	—	—	18	82,653	—	—	72	246,489
1941	5	11,974	15	42,830	15	72,375	4	22,877	2	17,088	41	167,144
1942	1	1,940	—	—	2	5,946	—	—	—	—	3	7,886
1943	—	—	7	16,478	1	3,427	—	—	—	—	8	19,905
1944	—	—	4	11,152	5	16,475	—	—	17	95,952	26	123,589
1945	5	10,440	7	19,451	10	37,795	8	38,085	30	256,374	60	362,145
1946	11	21,250	24	82,281	18	94,326	6	34,262	32	249,407	91	481,526
1947	23	57,198	26	100,388	45	244,606	21	115,543	67	588,140	182	1,105,875

(to be continued)

TABLE IV (Continued)

Track Laying Tractors (Fuel Injection Type) Exported by the U. S. to Latin America: 1938-47

In units and U. S. dollars

Years	Drawbar Horsepower										Total	
	Under 35 H. P.		35 to 49 H. P.		50 to 64 H. P.		65 to 79 H. P.		80 H. P. and over			
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value
Costa Rica												
1938	4	4,400	4	8,940	—	—	5	25,532	—	—	13	38,872
1939	—	—	11	26,909	—	—	37	222,484	—	—	48	249,393
1940	—	—	—	—	—	—	—	—	—	—	—	—
1941	16	19,111	5	6,115	5	7,373	—	—	1	3,573	27	36,172
1942	5	6,977	—	—	—	—	—	—	4	20,490	9	27,467
1943	1	1,802	1	2,522	—	—	—	—	3	12,513	5	16,837
1944	13	28,208	4	9,471	—	—	—	—	—	—	17	37,679
1945	7	14,811	11	28,157	4	15,419	—	—	—	—	22	58,387
1946	17	42,070	16	47,369	9	43,890	—	—	—	—	42	133,329
1947	3	7,982	15	51,492	4	23,784	—	—	4	26,345	26	109,603
Cuba												
1938	13	18,910	19	56,726	—	—	5	22,663	—	—	37	98,299
1939	35	54,001	23	59,440	—	—	5	23,511	—	—	63	136,952
1940	25	41,102	23	50,746	—	—	8	54,448	—	—	56	146,296
1941	93	146,626	49	106,627	9	26,960	3	13,882	6	43,122	160	337,217
1942	56	102,034	20	45,902	13	46,826	—	—	12	92,677	101	287,439
1943	—	—	41	116,000	2	14,438	—	—	1	7,632	44	138,070
1944	6	11,846	4	10,620	—	—	—	—	2	15,684	12	38,150
1945	—	—	—	—	—	—	—	—	—	—	—	—
1946	28	60,373	65	192,446	16	71,720	9	54,274	19	129,291	137	508,104
1947	27	71,970	77	284,694	34	187,851	4	23,103	20	248,458	162	816,076
Dominican Republic												
1938	1	1,600	5	20,230	—	—	6	28,510	—	—	12	50,340
1939	1	1,536	3	6,678	—	—	3	21,662	—	—	7	29,776
1940	1	1,775	1	2,600	—	—	6	41,995	—	—	8	46,370
1941	6	12,626	—	—	—	—	—	—	—	—	6	12,626
1942	1	2,150	—	—	—	—	—	—	—	—	1	2,150
1943	1	2,397	4	8,784	—	—	—	—	9	36,678	14	47,859
1944	2	3,809	6	14,116	—	—	—	—	3	14,944	11	32,869
1945	—	—	—	—	—	—	—	—	3	20,758	3	20,758
1946	5	11,797	15	58,850	4	16,808	—	—	—	—	24	87,455
1947	6	14,410	13	46,268	12	72,768	—	—	24	226,481	55	359,927
Ecuador												
1938	1	1,059	7	19,897	—	—	4	24,086	—	—	12	45,942
1939	9	15,089	13	40,256	—	—	7	46,360	—	—	29	101,705
1940	6	11,179	6	19,901	—	—	5	26,905	—	—	17	57,985
1941	11	20,228	9	24,333	1	3,271	4	21,200	4	16,938	29	85,970
1942	1	2,242	1	1,878	—	—	—	—	—	—	2	4,120
1943	3	7,059	1	2,541	2	8,154	—	—	3	18,784	9	36,538
1944	—	—	4	12,127	—	—	—	—	5	31,293	9	43,420
1945	14	29,347	51	147,313	20	85,985	4	22,983	6	43,417	95	329,045
1946	9	19,909	23	74,506	21	101,798	3	15,837	14	117,622	70	329,672
1947	8	22,332	14	52,510	24	130,567	1	8,500	7	74,649	54	288,558
El Salvador												
1938	—	—	—	—	—	—	—	—	—	—	—	—
1939	—	—	2	5,546	—	—	—	—	3	13,940	5	19,486
1940	1	1,674	1	2,376	—	—	—	—	—	—	2	4,050
1941	—	—	—	—	—	—	—	—	—	—	—	—
1942	—	—	—	—	1	3,998	—	—	—	—	1	3,998
1943	—	—	1	2,616	—	—	—	—	—	—	1	2,616
1944	2	3,823	1	2,727	6	24,909	—	—	—	—	9	31,459
1945	1	1,195	—	—	11	43,751	5	15,017	—	—	17	59,964
1946	6	15,356	16	47,913	5	21,569	—	—	—	—	27	84,838
1947	7	18,727	6	21,173	9	45,679	—	—	—	—	22	85,579

(to be continued)

TABLE IV (Continued)

Track Laying Tractors (Fuel Injection Type) Exported by the U. S. to Latin America: 1938-47

In units and U. S. dollars

YEARS	DRAWBAR HORSEPOWER										TOTAL	
	Under 35 H. P.		35 to 49 H. P.		50 to 64 H. P.		65 to 79 H. P.		80 H. P. and over			
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value
Guatemala												
1938	—	—	1	2,196	—	—	2	13,099	—	—	3	15,295
1939	3	5,164	3	9,575	—	—	3	23,774	—	—	9	38,513
1940	1	1,925	1	3,011	—	—	2	15,350	—	—	4	20,286
1941	3	5,175	1	2,600	—	—	—	—	—	—	4	7,775
1942	—	—	—	—	—	—	—	—	7	55,599	7	55,599
1943	—	—	—	—	4	22,849	3	18,957	2	12,146	9	53,952
1944	1	1,855	4	11,199	1	4,486	—	—	—	—	6	17,540
1945	2	3,608	5	12,094	—	—	1	5,725	1	5,949	9	27,376
1946	4	7,868	11	31,701	1	3,754	—	—	—	—	16	43,323
1947	4	10,275	12	45,648	3	14,515	1	9,585	5	46,538	25	126,561
Haiti												
1938	1	2,145	—	—	—	—	—	—	—	—	1	2,145
1939	—	—	—	—	1	1,888	1	7,548	—	—	2	9,436
1940	—	—	—	—	—	—	—	—	—	—	—	—
1941	2	4,049	2	4,670	—	—	—	—	—	—	4	8,719
1942	—	—	—	—	—	—	—	—	—	—	—	—
1943	—	—	2	6,196	—	—	—	—	1	7,042	3	13,238
1944	1	2,440	3	7,320	—	—	1	5,468	—	—	5	15,228
1945	1	2,575	—	—	1	4,058	1	5,508	1	5,757	4	17,898
1946	—	—	—	—	—	—	—	—	—	—	—	—
1947	—	—	2	6,644	—	—	—	—	2	21,165	4	27,809
Honduras												
1938	—	—	1	3,874	—	—	3	13,926	—	—	4	17,800
1939	4	6,690	4	11,425	—	—	—	—	—	—	8	18,115
1940	17	28,314	2	5,494	—	—	1	4,284	—	—	20	38,092
1941	6	10,020	1	2,955	—	—	—	—	—	—	7	12,975
1942	—	—	—	—	—	—	—	—	—	—	—	—
1943	—	—	—	—	1	5,712	—	—	—	—	1	5,712
1944	—	—	1	2,793	1	4,706	1	5,877	—	—	3	13,376
1945	1	5,897	—	—	1	4,094	—	—	1	4,722	3	14,713
1946	4	8,867	16	52,524	3	17,692	—	—	—	—	23	79,083
1947	8	24,241	31	120,705	2	14,730	—	—	5	48,887	46	208,563
Mexico												
1938	22	43,030	20	60,069	—	—	13	66,511	—	—	55	169,610
1939	34	63,152	27	72,871	—	—	62	198,558	—	—	123	334,581
1940	38	50,142	21	51,538	—	—	53	289,147	—	—	112	390,827
1941	72	128,049	58	138,208	29	118,582	13	59,555	115	586,980	287	1,131,674
1942	32	57,092	18	45,214	16	61,625	8	11,500	27	167,883	101	343,914
1943	18	47,136	32	82,983	29	132,265	11	65,484	41	268,555	131	596,423
1944	34	63,786	22	60,263	—	—	17	101,555	30	201,119	103	426,723
1945	49	89,881	79	217,688	40	152,673	15	75,819	60	377,142	243	913,203
1946	76	134,276	119	369,821	89	366,589	27	153,613	169	1,085,929	480	2,110,228
1947	62	152,320	96	350,897	114	563,588	30	188,298	158	1,344,141	460	2,599,244
Nicaragua												
1938	1	2,857	1	3,904	—	—	3	15,000	—	—	5	21,761
1939	—	—	5	11,430	—	—	3	15,498	—	—	8	26,928
1940	14	25,395	6	20,926	—	—	24	114,292	—	—	44	160,613
1941	4	6,774	4	10,338	4	16,707	—	—	—	—	12	33,819
1942	—	—	—	—	—	—	—	—	—	—	—	—
1943	—	—	3	7,157	3	13,326	—	—	—	—	6	20,483
1944	—	—	3	9,566	2	8,380	—	—	—	—	5	17,946
1945	1	2,436	14	38,432	1	3,675	1	4,888	—	—	17	49,431
1946	2	5,425	13	43,814	4	20,688	—	—	—	—	19	69,927
1947	2	4,835	12	30,833	4	30,143	2	16,650	8	63,076	28	145,537

(to be continued)

TABLE IV (Continued)

Track Laying Tractors (Fuel Injection Type) Exported by the U. S. to Latin America: 1938-47

In units and U. S. dollars

Years	Drawbar Horsepower										Total	
	Under 35 H. P.		35 to 49 H. P.		50 to 64 H. P.		65 to 79 H. P.		80 H. P. and over			
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value
Panama												
1938	2	4,813	—	—	—	—	1	4,695	—	—	3	9,508
1939	—	—	1	2,540	—	—	4	10,233	—	—	5	12,773
1940	1	2,180	2	5,697	—	—	5	34,023	—	—	8	41,900
1941	—	—	7	21,943	4	10,549	—	—	1	4,123	12	36,615
1942	—	—	—	—	—	—	—	—	1	4,280	1	4,280
1943	—	—	6	14,988	5	17,754	—	—	—	—	11	32,742
1944	5	11,998	4	13,069	2	6,388	—	—	7	41,090	18	72,545
1945	—	—	3	8,133	6	21,775	—	—	6	36,366	15	66,274
1946	4	11,112	9	29,613	9	39,512	—	—	—	—	22	80,237
1947	3	7,348	5	18,576	4	23,338	2	11,459	16	139,905	30	200,626
Paraguay												
1938	—	—	—	—	—	—	—	—	—	—	—	—
1939	—	—	—	—	—	—	—	—	—	—	—	—
1940	—	—	—	—	—	—	7	38,037	—	—	7	38,037
1941	—	—	—	—	—	—	—	—	—	—	—	—
1942	—	—	—	—	—	—	—	—	—	—	—	—
1943	—	—	—	—	—	—	—	—	—	—	—	—
1944	—	—	—	—	—	—	—	—	—	—	—	—
1945	—	—	2	4,873	—	—	—	—	2	11,883	4	16,756
1946	—	—	2	6,360	2	13,791	—	—	—	—	4	20,151
1947	1	2,550	2	6,001	4	21,584	1	6,778	2	20,000	10	56,913
Peru												
1938	21	34,950	104	216,807	—	—	8	38,437	—	—	133	290,194
1939	22	38,969	54	99,163	—	—	13	51,559	—	—	89	189,691
1940	28	40,876	13	26,607	—	—	2	4,922	—	—	43	72,405
1941	21	32,241	28	85,301	—	—	2	7,177	—	—	51	124,719
1942	9	15,836	9	22,501	12	44,013	1	3,295	—	—	31	85,645
1943	4	7,375	20	48,014	—	—	—	—	—	—	24	55,389
1944	2	3,943	10	24,962	14	48,367	—	—	1	5,730	27	83,002
1945	14	29,347	51	147,313	20	85,985	4	22,983	6	43,417	95	329,045
1946	12	31,526	29	94,674	23	110,361	2	10,360	10	72,615	76	319,536
1947	5	13,657	38	165,624	34	187,016	—	—	8	64,426	85	430,723
Uruguay												
1938	—	—	—	—	—	—	—	—	—	—	—	—
1939	1	2,480	4	11,771	—	—	—	—	—	—	5	14,251
1940	22	40,660	51	141,903	—	—	2	8,570	—	—	75	191,133
1941	2	4,206	13	30,457	10	20,437	—	—	—	—	25	55,100
1942	—	—	—	—	—	—	—	—	—	—	—	—
1943	6	14,055	—	—	13	76,500	3	17,400	3	18,409	25	126,364
1944	—	—	1	2,149	—	—	—	—	—	—	1	2,149
1945	—	—	—	—	—	—	—	—	1	6,754	1	6,754
1946	12	24,903	11	31,582	4	15,950	—	—	2	13,000	29	85,435
1947	10	25,440	19	63,982	8	35,089	—	—	2	13,628	39	138,139
Venezuela												
1938	10	10,814	10	30,882	—	—	37	242,993	—	—	57	293,689
1939	26	46,755	39	119,603	—	—	62	347,381	—	—	127	513,739
1940	32	67,692	11	29,477	—	—	52	285,975	—	—	95	383,144
1941	28	48,281	36	77,982	22	72,509	3	14,537	30	172,087	119	385,396
1942	—	—	1	2,397	5	13,975	—	—	4	36,178	10	52,550
1943	—	—	—	—	—	—	—	—	1	8,961	1	8,961
1944	8	13,347	—	—	7	30,890	1	6,500	45	346,257	61	396,994
1945	5	1,804	31	120,333	23	93,499	12	59,719	41	330,803	112	606,158
1946	11	22,346	42	135,672	62	310,582	8	36,290	87	742,486	210	1,247,376
1947	18	47,444	37	130,187	90	662,105	14	86,232	188	1,997,433	347	2,923,401

Source: Foreign Commerce and Navigation of the United States, 1938 to 1947.

TABLE V

Wheel Tractors Exported by the United States to Latin America: 1938-47

In units and U. S. dollars

Years	Garden tractors		1 plough		2 ploughs		3 ploughs		4 ploughs		Total	
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value
Argentina												
1938	—	—	22	14,886	—	—	1,116	880,809	2,303	2,289,268	3,441	3,184,963
1939	—	—	20	11,663	—	—	482	355,854	325	315,152	827	682,669
1940	4	897	9	3,289	65	37,414	127	109,426	269	156,186	474	307,212
1941	4	780	151	28,871	61	34,802	15	12,688	195	181,623	426	258,764
1942	2	2,034	—	—	—	—	15	10,633	2	3,170	19	15,837
1943	—	—	—	—	—	—	—	—	—	—	—	—
1944	—	—	—	—	—	—	—	—	—	—	—	—
1945	—	—	—	—	—	—	32	25,166	40	40,025	72	65,191
1946	131	31,623	42	27,419	347	271,862	267	272,970	280	411,485	1,067	1,015,359
1947	1,744	2,249,079	1,020	1,438,023	806	1,167,523	890	1,177,788	948	1,561,937	5,408	7,594,350
Bolivia												
1938	—	—	1	4,644	—	—	5	4,041	—	—	6	8,685
1939	—	—	1	500	—	—	8	8,632	2	2,135	11	11,267
1940	5	1,301	—	—	—	2,971	9	8,532	1	711	15	13,515
1941	—	—	10	5,364	18	13,267	43	45,848	4	5,035	75	69,514
1942	—	—	1	600	—	—	15	15,351	3	5,079	19	21,030
1943	—	—	3	1,391	41	26,637	13	11,574	1	1,114	58	40,716
1944	—	—	9	5,391	5	3,764	20	20,076	13	18,841	47	48,072
1945	—	—	4	2,586	13	12,401	25	31,180	14	24,098	56	70,265
1946	—	—	4	3,468	49	52,028	5	6,509	—	—	58	62,005
1947	8	2,410	2	1,603	2	2,451	24	34,543	9	18,429	45	59,436
Brazil												
1938	—	—	5	3,674	—	—	121	96,346	58	113,935	184	213,955
1939	—	—	10	5,301	—	—	176	132,198	72	86,134	258	223,633
1940	2	476	4	2,163	8	8,888	10	9,279	4	4,558	28	25,364
1941	23	5,368	33	23,387	25	23,780	30	29,382	44	50,637	155	132,554
1942	—	—	3	1,513	10	6,671	60	45,882	40	38,987	113	93,053
1943	—	—	2	2,120	6	14,691	3	2,610	32	27,557	43	46,978
1944	2	399	8	4,165	9	7,577	17	16,755	15	17,507	51	46,403
1945	—	—	—	—	64	60,114	58	54,002	91	112,916	213	227,032
1946	119	27,685	51	30,329	144	133,128	27	30,152	76	271,740	417	493,034
1947	525	133,179	80	56,862	341	348,678	243	293,870	197	413,174	1,386	1,245,763
Chile												
1938	—	—	4	2,536	—	—	3	5,295	1	3,055	8	10,886
1939	—	—	27	14,464	—	—	39	38,146	12	19,042	78	71,652
1940	8	1,494	64	34,197	70	54,492	108	107,561	78	81,414	328	279,178
1941	—	—	14	6,034	15	12,186	269	267,248	45	62,129	343	347,597
1942	—	—	33	18,730	43	36,560	24	24,634	5	6,578	105	86,502
1943	—	—	—	—	17	10,799	—	—	—	—	17	10,799
1944	—	—	2	2,141	91	68,665	68	64,111	32	42,912	193	177,829
1945	—	—	77	48,034	79	64,636	84	84,561	217	241,890	457	439,121
1946	24	7,412	47	35,427	239	199,609	103	102,400	170	200,726	583	545,574
1947	88	36,043	235	226,151	116	127,273	98	127,209	145	265,736	682	782,412
Colombia												
1938	—	—	5	2,786	—	—	79	67,958	—	—	84	70,744
1939	—	—	11	7,253	—	—	78	63,946	64	78,113	153	149,312
1940	3	1,069	14	5,977	14	11,821	56	50,734	40	49,232	127	118,833
1941	1	399	10	4,342	22	17,051	74	69,337	40	46,409	147	137,538
1942	1	75	6	3,386	5	3,828	41	36,354	10	19,334	63	62,977
1943	—	—	—	—	48	24,572	66	56,159	13	15,864	127	96,595
1944	—	—	6	2,982	21	14,980	74	71,519	164	188,724	265	278,205
1945	—	—	41	24,010	67	48,904	206	193,734	227	280,763	541	547,411
1946	24	8,930	5	3,917	48	41,280	72	72,619	87	155,751	236	282,497
1947	71	20,075	30	19,701	101	100,807	257	339,028	155	265,649	614	745,260

(to be continued)

TABLE V (Continued)

Wheel Tractors Exported by the United States to Latin America: 1938-47

In units and U. S. dollars

Years	Garden tractors		1 plough		2 ploughs		3 ploughs		4 ploughs		Total	
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value
Costa Rica												
1938	—	—	—	—	—	—	1	768	—	—	1	768
1939	—	—	1	431	—	—	9	7,120	—	—	10	7,551
1940	—	—	—	—	—	—	—	—	—	—	—	—
1941	—	—	3	1,496	15	12,326	5	6,182	—	—	23	20,004
1942	—	—	—	—	—	—	—	—	—	—	—	—
1943	—	—	—	—	—	—	3	2,269	—	—	3	2,269
1944	6	1,270	13	6,573	20	14,329	19	14,749	—	—	58	36,921
1945	—	—	7	4,191	19	19,847	12	12,391	—	—	38	36,429
1946	8	2,582	12	7,159	8	8,536	6	8,405	—	—	34	26,682
1947	5	2,050	2	1,371	9	9,267	1	1,769	—	—	17	14,457
Cuba												
1938	—	—	5	4,142	—	—	5	4,660	2	1,862	12	10,664
1939	—	—	1	205	—	—	3	2,224	7	11,003	11	13,432
1940	1	278	1	454	—	—	1	931	—	—	3	1,663
1941	5	1,773	2	1,271	11	14,923	4	4,890	—	—	22	22,857
1942	—	—	—	—	13	7,263	16	15,572	2	1,683	31	24,538
1943	1	1,271	3	2,483	7	4,670	5	3,783	—	—	16	12,207
1944	—	—	—	—	20	14,855	28	22,773	—	—	48	37,628
1945	—	—	7	4,307	67	43,821	65	44,727	3	4,818	142	97,673
1946	20	5,523	4	2,946	396	334,151	40	45,402	18	72,852	478	460,874
1947	99	33,611	63	43,712	782	640,350	245	343,810	69	139,093	1,258	1,200,576
Dominican Republic												
1938	—	—	1	454	—	—	2	2,275	2	3,719	5	6,448
1939	—	—	2	1,087	—	—	—	—	—	—	2	1,087
1940	—	—	2	872	1	777	—	—	—	—	3	1,649
1941	3	1,936	—	—	—	—	—	—	—	—	3	1,936
1942	—	—	—	—	—	—	—	—	—	—	—	—
1943	—	—	—	—	10	8,772	—	—	1	1,409	11	10,181
1944	24	11,346	—	—	16	11,656	1	1,099	1	1,204	42	25,305
1945	—	—	—	—	5	4,514	4	3,447	—	—	9	7,961
1946	2	487	24	15,621	8	7,465	14	43,869	—	—	48	67,442
1947	—	—	2	1,273	8	8,699	48	73,754	—	—	58	83,726
Ecuador												
1938	—	—	1	1,107	—	—	1	833	—	—	2	1,940
1939	—	—	5	2,732	—	—	8	5,958	3	5,600	16	14,290
1940	6	1,836	—	—	6	4,955	4	4,052	2	4,350	18	15,193
1941	—	—	2	1,050	1	728	3	2,971	—	—	6	4,749
1942	—	—	—	—	—	—	—	—	—	—	—	—
1943	—	—	—	—	3	2,103	4	3,115	—	—	7	5,218
1944	—	—	5	3,069	8	5,712	10	8,799	—	—	23	17,580
1945	—	—	14	10,026	13	11,630	20	23,383	4	5,605	51	50,544
1946	12	3,788	7	4,248	19	16,554	7	9,019	4	6,452	49	40,061
1947	5	1,647	14	8,082	11	15,873	14	22,147	3	5,453	47	53,202
El Salvador												
1938	—	—	—	—	—	—	3	2,141	1	888	4	2,029
1939	—	—	—	—	—	—	2	1,653	—	—	2	1,635
1940	—	—	—	—	1	745	—	—	—	—	1	745
1941	1	310	—	—	—	—	1	738	2	2,096	4	3,144
1942	—	—	—	—	—	—	—	—	—	—	—	—
1943	—	—	—	—	—	—	—	—	—	—	—	—
1944	—	—	—	—	—	—	2	1,940	—	—	2	1,940
1945	10	15,382	—	—	1	1,121	15	19,147	—	—	26	35,650
1946	8	3,719	7	5,085	22	16,966	16	18,325	—	—	53	44,095
1947	18	5,386	3	2,519	52	52,254	13	23,480	28	28,248	114	111,887

(to be continued)

TABLE V (Continued)

Wheel Tractors Exported by the United States to Latin America: 1938-47

In units and U. S. dollars

YEARS	GARDEN TRACTORS		1 PLOUGH		2 PLOUGHS		3 PLOUGHS		4 PLOUGHS		TOTAL	
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value
Guatemala												
1938	—	—	1	746	—	—	3	2,398	1	1,440	5	4,584
1939	—	—	3	1,264	—	—	28	31,734	—	—	31	32,998
1940	—	—	2	963	50	48,968	—	—	—	—	62	49,931
1941	—	—	—	—	2	1,397	—	—	1	833	3	2,230
1942	—	—	—	—	—	—	—	—	—	—	—	—
1943	—	—	1	610	1	672	—	—	1	1,409	3	2,691
1944	—	—	1	539	16	13,676	—	—	—	—	17	14,215
1945	20	13,780	1	675	76	72,073	28	29,204	—	—	125	115,732
1946	29	14,445	4	2,482	86	67,110	16	18,707	—	—	135	102,744
1947	41	31,831	2	1,493	75	77,535	23	35,064	31	27,958	172	173,881
Haiti												
1938	—	—	—	—	—	—	—	—	—	—	—	—
1939	—	—	—	—	—	—	—	—	—	—	—	—
1940	—	—	—	—	—	—	—	—	—	—	—	—
1941	—	—	—	—	—	—	—	—	—	—	—	—
1942	—	—	—	—	—	—	—	—	—	—	—	—
1943	—	—	—	—	—	—	—	—	—	—	—	—
1944	—	—	—	—	—	—	—	—	—	—	—	—
1945	—	—	1	1,600	—	—	—	—	—	—	1	1,600
1946	1	332	—	—	—	—	—	—	—	—	1	332
1947	7	3,570	7	4,353	2	3,023	3	5,774	—	—	19	16,720
Honduras												
1938	—	—	1	452	—	—	1	986	1	4,667	3	6,105
1939	—	—	—	—	—	—	3	2,156	—	—	3	2,156
1940	—	—	—	—	—	—	2	2,215	—	—	2	2,215
1941	2	364	—	—	2	1,966	1	720	1	1,038	6	4,088
1942	—	—	—	—	—	—	—	—	—	—	—	—
1943	—	—	—	—	—	—	—	—	—	—	—	—
1944	—	—	2	1,026	3	3,149	—	—	—	—	5	4,175
1945	2	1,934	2	1,664	2	1,515	2	1,472	2	2,668	10	9,253
1946	25	14,916	3	1,521	—	—	7	6,514	—	—	35	22,951
1947	5	2,781	10	7,228	21	22,936	7	9,220	10	15,915	53	58,080
Mexico												
1938	—	—	10	5,389	—	—	109	95,124	61	61,415	180	161,928
1939	—	—	46	10,344	—	—	187	135,810	160	140,440	393	286,594
1940	7	1,288	80	35,612	114	72,110	172	144,052	186	157,115	539	410,177
1941	26	8,821	128	58,736	425	257,455	451	334,139	255	250,000	1,285	959,151
1942	3	1,515	49	30,639	206	142,064	56	48,423	102	98,310	416	320,951
1943	11	12,225	12	7,182	592	412,824	377	357,933	293	401,042	1,285	1,101,206
1944	4	668	181	92,600	375	270,347	828	812,735	456	533,860	1,844	1,710,210
1945	—	—	306	173,164	881	611,631	577	534,565	242	277,428	2,006	1,596,788
1946	230	74,812	262	180,864	931	732,333	616	631,202	225	439,112	2,264	2,058,323
1947	230	87,381	533	466,623	1,811	1,723,514	908	1,192,528	372	712,634	3,854	4,182,780
Nicaragua												
1938	—	—	—	—	—	—	1	800	2	3,212	3	4,012
1939	—	—	—	—	—	—	3	2,868	—	—	3	2,868
1940	1	1,460	3	1,895	5	5,014	10	12,110	—	—	19	20,479
1941	—	—	3	2,073	1	511	4	4,857	—	—	8	7,441
1942	—	—	—	—	—	—	—	—	—	—	—	—
1943	—	—	—	—	—	—	—	—	—	—	—	—
1944	—	—	—	—	1	860	4	3,887	6	8,854	11	13,601
1945	—	—	—	—	6	5,050	25	25,691	7	9,041	38	39,782
1946	4	1,077	5	3,293	10	8,692	17	22,044	—	—	36	35,106
1947	1	457	5	3,987	14	15,376	8	14,345	—	—	28	34,165

(to be continued)

TABLE V (Continued)

Wheel Tractors Exported by the United States to Latin America: 1938-47

In units and U. S. dollars

Years	Garden tractors		1 plough		2 ploughs		3 ploughs		4 ploughs		Total	
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value
Panama												
1938	—	—	—	—	—	—	—	—	—	—	—	—
1939	—	—	2	1,005	—	—	—	—	—	—	2	1,005
1940	—	—	1	463	—	—	1	1,000	—	—	2	1,463
1941	14	3,746	8	4,318	—	—	—	—	—	—	22	8,064
1942	—	—	4	2,126	—	—	—	—	—	—	4	2,126
1943	18	6,589	10	2,643	1	670	—	—	—	—	29	9,902
1944	—	—	4	1,959	11	9,614	1	802	—	—	16	12,375
1945	—	—	7	3,887	1	708	3	3,057	1	889	12	8,541
1946	10	3,107	—	—	1	1,152	2	2,254	—	—	13	6,513
1947	48	9,251	9	6,864	9	8,573	6	9,439	6	9,826	78	49,953
Paraguay												
1938	—	—	—	—	—	—	2	1,787	11	14,515	13	16,302
1939	—	—	—	—	—	—	—	—	—	—	—	—
1940	—	—	—	—	—	—	—	—	2	9,698	2	9,698
1941	—	—	—	—	—	—	—	—	—	—	—	—
1942	—	—	—	—	—	—	—	—	—	—	—	—
1943	—	—	—	—	—	—	—	—	—	—	—	—
1944	—	—	—	—	—	—	—	—	—	—	—	—
1945	—	—	—	—	—	—	1	866	3	3,480	4	4,346
1946	6	2,080	—	—	—	—	1	1,223	1	1,307	8	4,610
1947	—	—	2	2,406	3	2,552	4	4,632	3	4,722	12	14,312
Peru												
1938	—	—	25	13,702	—	—	49	33,105	185	162,404	259	209,211
1939	—	—	22	10,991	—	—	32	21,889	6	7,672	60	40,552
1940	—	—	5	2,081	14	9,527	9	9,071	—	—	28	20,679
1941	2	2,033	11	7,044	9	6,769	26	25,088	10	12,994	58	53,928
1942	—	—	7	3,564	30	23,328	13	11,223	5	6,079	55	44,194
1943	1	200	2	2,195	68	44,087	26	23,844	6	6,253	103	76,579
1944	—	—	6	3,732	56	42,966	63	56,490	44	49,095	169	152,283
1945	—	—	2	1,321	64	68,945	80	87,290	115	156,665	281	314,221
1946	18	5,124	2	1,534	50	43,938	85	93,586	20	29,507	175	173,689
1947	41	14,389	29	16,708	136	155,404	128	176,886	9	16,289	345	379,676
Uruguay												
1938	—	—	—	—	—	—	68	48,433	4	9,383	72	57,816
1939	—	—	—	—	—	—	82	64,409	109	106,040	191	170,449
1940	—	1,385	7	3,795	18	12,218	94	89,022	114	107,934	233	214,354
1941	5	1,676	7	3,715	56	33,483	102	85,215	67	67,758	237	191,877
1942	4	1,122	12	5,919	23	15,247	52	39,193	33	33,775	126	95,256
1943	—	—	2	1,264	10	6,355	—	—	—	—	12	7,619
1944	—	—	—	—	18	15,895	28	30,453	85	88,243	111	134,591
1945	—	—	27	16,349	65	45,768	85	80,378	133	161,620	310	304,115
1946	31	7,349	14	9,207	113	88,534	58	63,944	91	137,480	307	306,514
1947	67	27,006	91	57,025	373	335,578	218	279,333	79	128,360	828	837,302
Venezuela												
1938	—	—	7	4,380	—	—	38	31,712	—	—	45	35,092
1939	—	—	35	22,567	—	—	81	62,252	6	8,032	122	92,851
1940	6	1,960	24	11,786	52	37,769	17	13,669	1	1,001	100	66,185
1941	—	—	39	17,819	—	—	—	—	—	—	39	17,819
1942	1	515	—	—	17	13,464	14	13,853	3	3,135	35	30,967
1943	3	604	12	6,392	107	75,250	40	31,160	7	6,673	169	120,079
1944	3	1,827	8	3,640	126	85,106	223	209,966	6	7,339	366	307,878
1945	—	—	19	10,660	115	82,228	213	219,121	29	32,875	376	344,984
1946	103	30,849	142	117,799	140	122,183	103	120,868	31	51,040	519	442,739
1947	773	339,803	171	147,146	298	324,374	314	454,080	146	359,376	1,702	1,624,779

Source: Foreign Commerce and Navigation of the United States, 1938 to 1947.

TABLE VI

Total Exports of Agricultural Machinery from the United States to Latin America: 1938-47

(In thousand dollars)

Countries	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1938 to 1947
Sprayers											
Argentina	68.5	40.4	20.2	9.6	6.6	0.1	0.6	4.0	78.1	324.5	552.6
Bolivia	0.4	2.0	1.6	5.6	0.4	0.7	1.3	0.3	6.0	6.7	25.0
Brazil	6.9	9.8	3.5	5.8	4.5	8.5	1.1	8.4	41.0	150.2	239.7
Chile	8.2	14.6	25.8	59.9	6.8	20.2	19.4	53.7	36.8	46.2	291.6
Colombia	47.3	29.7	67.4	19.7	3.9	6.2	8.2	25.0	130.0	174.4	511.8
Costa Rica	1.4	1.9	1.1	17.9	29.5	0.7	2.8	8.0	7.0	109.9	180.2
Cuba	16.0	15.3	73.0	42.8	13.7	11.1	23.6	28.0	58.5	54.4	336.4
Dominican Rep.	0.6	0.6	1.0	0.9	0.5	2.1	0.6	6.8	25.5	30.8	69.2
Ecuador	1.8	1.2	7.8	7.2	0.6	2.2	3.2	1.4	6.6	8.6	40.6
El Salvador	0.4	1.6	0.4	2.3	—	1.0	2.8	4.4	11.8	45.4	70.1
Guatemala	12.4	3.4	8.5	19.0	2.9	0.8	6.5	18.0	9.9	11.3	92.7
Haiti	3.0	2.3	3.8	23.1	30.4	1.7	0.5	0.9	1.0	4.7	71.4
Honduras	7.4	2.0	5.6	14.7	0.4	0.4	3.3	26.0	38.0	16.1	113.9
Mexico	77.3	39.4	128.6	197.8	323.6	28.6	110.4	118.1	240.6	239.0	1,503.4
Nicaragua	0.1	0.1	3.8	0.5	0.4	0.2	0.6	0.9	5.9	6.7	19.2
Panama	3.2	2.0	3.0	6.5	11.2	7.6	8.3	3.0	34.6	10.6	90.0
Paraguay	—	0.0	0.3	1.0	2.6	—	—	3.2	—	0.7	7.8
Peru	6.8	10.3	7.9	13.7	4.4	3.4	11.6	15.1	37.1	74.9	185.2
Uruguay	1.6	5.2	17.3	10.0	6.3	3.5	3.8	9.7	37.7	132.0	227.1
Venezuela	20.7	24.6	24.3	23.2	8.4	23.4	30.9	26.7	—	91.8	274.0
											4,901.9
Implements of cultivation											
Argentina	2,926.2	1,037.2	689.4	177.1	63.5	—	—	0.2	189.7	1,217.7	6,301.0
Bolivia	6.0	9.1	18.3	32.2	25.6	36.1	25.1	11.1	11.0	15.6	190.1
Brazil	358.5	289.0	135.7	125.2	44.7	90.2	135.7	125.1	192.9	766.1	2,263.1
Chile	115.0	93.0	296.9	278.1	91.4	9.6	104.1	183.6	159.7	328.0	1,658.5
Colombia	94.4	91.4	106.0	134.2	59.4	50.2	105.4	59.8	100.2	261.7	1,062.7
Costa Rica	5.4	7.4	9.0	6.7	0.9	6.2	17.9	21.2	13.1	21.8	109.6
Cuba	35.6	53.8	36.7	136.9	138.4	61.8	69.0	73.8	141.9	451.8	1,199.7
Dominican Rep.	27.4	31.7	16.5	10.1	10.3	20.0	95.0	29.3	42.4	47.7	330.4
Ecuador	11.4	26.9	18.0	19.9	10.9	10.1	10.3	18.8	85.2	65.7	277.2
El Salvador	6.0	7.8	4.5	4.2	2.1	1.4	8.0	14.4	25.7	62.8	136.9
Guatemala	12.5	6.6	3.8	6.2	1.0	6.1	6.4	6.4	21.3	39.5	109.8
Haiti	1.8	2.4	5.7	6.4	0.1	0.9	6.2	1.4	5.4	4.9	35.2
Honduras	7.4	2.0	2.5	3.5	1.6	2.6	5.5	5.0	9.0	21.8	61.9
Mexico	348.0	350.4	367.9	854.3	411.6	545.9	1,107.4	920.3	1,259.5	2,054.2	8,219.5
Nicaragua	1.6	11.0	30.5	12.6	1.1	6.1	11.8	18.7	19.9	33.9	147.2
Panama	4.9	1.2	1.5	14.7	15.8	10.0	26.3	11.6	9.8	13.2	109.1
Paraguay	3.1	1.2	—	0.1	0.2	18.0	19.0	39.0	65.8	13.8	150.1
Peru	113.4	105.7	90.1	72.6	38.8	28.5	65.2	40.0	79.5	199.8	833.6
Uruguay	166.0	111.0	157.8	99.0	73.8	92.2	40.4	34.7	87.9	263.0	1,125.8
Venezuela	64.6	128.0	139.1	127.0	54.4	77.4	154.3	97.8	537.1	704.0	2,081.7
											26,402.1
Harvesting machinery											
Argentina	4,486.4	3,090.5	1,652.0	364.7	148.4	—	—	120.5	425.4	2,152.1	12,446.0
Bolivia	4.3	3.5	4.1	13.2	3.4	11.0	1.1	3.8	11.4	3.9	59.7
Brazil	58.4	57.7	43.3	40.0	11.7	13.4	16.9	12.2	50.9	163.8	468.3
Chile	71.3	92.9	262.3	470.8	45.7	36.0	162.5	213.8	314.3	668.4	2,338.0
Colombia	25.3	41.6	32.6	56.3	16.5	33.1	34.8	50.8	69.3	160.7	521.0
Costa Rica	1.6	2.4	3.6	8.8	1.1	0.7	5.2	6.1	13.5	28.2	71.2
Cuba	8.8	19.9	14.0	33.5	17.7	17.0	24.8	3.8	34.8	133.9	308.2
Dominican Rep.	0.9	7.0	3.0	1.5	1.6	0.2	2.4	7.8	7.4	16.0	47.8
Ecuador	4.0	6.8	7.6	3.9	0.8	4.6	4.7	16.4	13.5	29.7	92.0
El Salvador	0.1	1.2	1.0	0.6	0.0	0.5	—	0.4	0.8	12.2	16.8
Guatemala	6.0	3.6	3.4	4.9	1.2	1.0	1.8	3.6	2.4	17.5	48.4
Haiti	0.4	0.4	0.4	0.5	0.1	0.6	0.1	0.2	1.3	5.5	9.5
Honduras	2.2	2.0	3.3	4.5	1.1	—	0.8	2.4	8.4	23.5	48.2
Mexico	157.3	302.4	188.5	276.7	205.0	75.8	157.4	270.6	660.4	727.5	3,021.6
Nicaragua	0.8	0.3	2.5	2.8	1.0	1.6	1.7	4.3	10.7	12.5	38.2
Panama	3.2	3.7	5.0	7.7	2.8	1.6	1.3	9.8	3.9	31.0	70.0
Paraguay	0.1	0.1	0.1	0.2	—	—	0.9	2.2	—	2.2	5.8
Peru	17.2	11.4	6.7	10.3	4.9	3.7	6.7	3.6	20.5	45.3	130.3
Uruguay	265.6	108.7	163.3	98.2	157.4	5.2	7.2	108.0	98.8	471.0	1,483.4
Venezuela	16.9	16.2	23.1	21.5	3.1	17.6	28.5	33.8	3.8	105.1	274.6
											21,491.0

(to be continued)

TABLE VI (Continued)

Total Exports of Agricultural Machinery from the United States to Latin America: 1938-47

(In thousand dollars)

Countries	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1938 to 1947
Seed separators											
Argentina	248.8	94.6	92.3	90.8	1.4	—	—	—	12.1	10.3	550.3
Bolivia	19.9	4.6	7.0	3.6	—	4.5	1.3	—	5.1	0.2	46.2
Brazil	61.2	29.2	15.8	14.6	25.1	9.2	5.8	3.2	43.2	187.1	394.4
Chile	54.7	34.6	95.2	67.6	1.8	2.4	14.2	88.3	52.7	101.5	513.0
Colombia	12.8	10.7	11.3	12.1	0.3	6.5	9.0	9.3	15.5	40.0	127.5
Costa Rica	0.6	0.6	0.4	0.8	0.2	0.4	2.0	—	0.4	—	5.4
Cuba	7.9	3.1	4.1	8.4	34.6	60.3	20.2	4.0	6.7	31.2	180.5
Dominican Rep.	4.1	0.4	0.4	2.1	1.4	0.2	8.8	0.4	1.4	5.4	24.7
Ecuador	3.7	2.4	5.6	2.9	0.7	8.6	1.9	4.7	16.6	4.5	51.6
El Salvador	1.4	0.1	0.8	1.3	0.2	1.2	0.6	10.3	—	9.5	25.9
Guatemala	1.5	0.5	0.8	0.3	0.3	0.5	2.3	—	1.6	3.1	10.9
Haiti	0.5	0.1	0.0	0.0	—	0.1	1.1	—	—	1.3	3.1
Honduras	0.1	1.0	0.1	0.5	0.0	—	0.1	—	1.5	1.6	4.9
Mexico	47.2	59.1	52.2	82.5	29.9	35.8	55.5	30.2	94.8	102.6	589.8
Nicaragua	0.1	0.2	0.4	1.9	0.3	4.3	0.5	—	2.0	6.2	15.9
Panama	0.0	0.2	0.6	2.5	4.5	14.4	—	—	1.6	1.2	25.0
Paraguay	0.1	—	—	—	—	—	0.8	2.9	—	3.8	7.6
Peru	5.8	9.2	4.1	10.1	1.8	1.1	21.0	4.8	14.5	18.5	89.9
Uruguay	33.6	3.3	18.2	6.1	2.2	0.9	2.5	3.8	0.7	75.4	
Venezuela	1.4	6.0	11.0	7.4	0.8	4.3	24.5	4.9	—	13.4	73.7
											2,815.7
Total											
Argentina	7,729.9	4,268.7	2,453.9	642.2	219.9	0.1	0.6	194.7	795.2	3,704.6	19,849.9
Bolivia	30.6	19.2	31.0	54.6	29.4	52.2	28.8	15.2	33.5	26.4	321.0
Brazil	485.0	385.7	198.3	185.5	86.0	171.3	159.5	143.9	228.0	1,267.2	3,365.5
Chile	249.2	235.1	679.3	876.4	145.7	68.2	300.2	539.4	563.5	1,144.1	4,801.1
Colombia	179.8	173.4	217.3	222.3	80.1	96.0	157.4	144.9	315.0	636.8	2,223.0
Costa Rica	9.0	12.3	14.1	34.2	31.7	8.0	27.9	35.3	34.0	159.9	366.4
Cuba	38.3	92.1	127.8	221.6	204.4	150.2	137.6	109.6	241.9	671.3	2,024.8
Dominican Rep.	33.0	39.7	20.9	14.6	13.8	22.5	106.9	44.1	76.7	99.9	472.1
Ecuador	20.9	37.3	39.0	33.9	13.0	25.5	20.1	41.3	121.9	108.5	461.4
El Salvador	7.9	10.7	6.7	8.4	2.3	4.1	11.4	30.0	38.3	129.9	249.7
Guatemala	32.4	14.1	16.5	30.4	5.4	8.4	17.0	31.0	35.2	71.4	261.8
Haiti	5.7	5.2	9.9	30.0	30.6	3.3	7.9	2.5	7.7	16.4	119.2
Honduras	17.1	7.0	11.5	23.2	3.1	3.0	9.7	33.4	56.9	63.0	227.9
Mexico	629.8	751.3	737.2	1,411.3	970.1	686.1	1,430.7	1,339.2	2,255.3	3,123.3	13,334.3
Nicaragua	2.6	11.6	37.2	17.8	2.8	12.2	14.6	23.9	38.5	59.3	220.5
Panama	11.3	7.1	10.1	31.4	31.3	33.8	35.9	24.4	49.9	56.0	294.0
Paraguay	3.3	1.3	0.4	1.3	2.8	18.0	20.7	47.3	55.8	20.5	171.4
Peru	143.2	136.6	108.8	106.7	49.9	36.7	103.5	63.5	151.6	338.5	1,239.0
Uruguay	466.8	228.2	356.6	213.3	239.7	101.8	54.2	156.2	228.2	866.7	2,911.7
Venezuela	103.6	172.8	197.5	179.1	71.7	122.7	238.3	163.1	540.9	913.3	2,703.0
											55,617.7

TABLE VII

Sprayers and Implements of Cultivation Exported by the United States to Latin America: 1938-47

(in units and U. S. dollars)

Years	SPRAYERS Hand & Power		IMPLEMENTS OF CULTIVATION (1)											
	TOTAL		PLOUGHS		HARROWS		CULTIVATORS		PLANTERS		DRILLS & SEEDERS		OTHERS (2)	TOTAL
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Value	Value
Argentina														
1938	1,046	68,533	10,352	787,405	4,391	241,633	3,255	158,134	4,272	257,812	4,705	860,891	620,310	2,926,185
1939	413	40,360	3,684	260,511	2,145	111,697	1,392	71,859	730	72,873	1,109	149,196	371,034	1,037,172
1940	394	20,256	2,297	227,401	889	54,895	333	18,839	543	61,589	562	67,920	258,506	689,450
1941	341	9,628	679	20,411	151	9,508	215	9,334	111	8,708	89	15,691	113,424	177,076
1942	275	6,626	230	5,478	—	—	89	996	1	88	10	2,933	54,015	83,510
1943	13	105	—	—	—	—	—	—	—	—	—	—	—	—
1944	34	554	—	—	—	—	—	—	—	—	—	—	—	—
1945	514	4,046	—	—	—	—	—	215	—	—	—	—	—	215
1946	18,340	78,115	1,431	46,523	875	21,562	744	35,693	417	14,931	262	58,988	12,015	189,712
1947	8,731	324,466	1,996	346,086	3,309	155,432	672	95,843	698	72,433	2,177	468,840	78,949	1,217,683
Bolivia														
1938	399	433	173	3,773	6	599	11	233	11	366	3	433	583	5,987
1939	1,312	1,961	261	4,826	31	2,159	3	589	3	114	6	748	634	9,070
1940	2,018	1,592	497	7,095	137	7,546	27	479	10	523	8	1,083	1,566	18,292
1941	4,801	5,640	550	14,740	79	9,764	8	1,378	4	888	18	3,594	1,910	32,254
1942	18,251	410	54	11,216	55	7,049	49	2,013	9	1,378	1	302	3,692	25,650
1943	849	672	409	14,964	115	13,637	7	972	10	2,800	20	2,650	50	36,073
1944	2,556	1,268	1,210	14,924	58	5,088	6	883	2	481	5	1,009	3,002	25,087
1945	15	304	80	3,021	19	1,701	4	800	47	3,837	9	1,740	—	11,099
1946	16,912	5,954	16	2,634	37	5,362	1	113	5	497	11	176	2,186	10,968
1947	416	6,733	24	4,802	9	1,625	100	1,726	18	3,934	24	3,405	63	15,555
Brazil														
1938	513	6,922	5,053	152,926	1,743	106,188	2,490	23,726	730	18,033	173	7,557	52,097	358,527
1939	6,852	9,858	3,737	119,889	957	62,972	4,997	43,820	499	12,605	87	5,512	54,198	288,996
1940	9,321	3,519	1,836	49,904	383	24,276	1,985	19,337	229	5,583	42	3,242	33,347	135,689
1941	379	5,804	1,056	28,960	944	33,191	2,662	13,950	11	1,359	114	3,469	44,276	125,205
1942	390	4,467	596	18,674	291	10,831	138	1,727	14	441	83	777	15,269	44,709
1943	760	8,494	712	23,887	995	45,754	1,933	14,694	298	5,753	209	1,164	—	90,252
1944	157	1,143	878	42,287	1,299	61,639	2,284	18,576	420	10,001	191	3,047	39	135,683
1945	1,082	8,463	872	25,516	1,033	51,438	2,254	18,324	557	14,134	101	5,732	—	125,144
1946	17,333	60,966	831	56,962	859	33,235	2,288	35,979	261	13,000	379	7,354	23,410	192,940
1947	9,616	120,164	4,079	208,705	2,208	229,313	6,711	130,882	1,845	59,855	972	26,417	110,924	766,096
Chile														
1938	14,114	8,197	1,126	37,104	363	24,848	233	5,171	4	396	276	29,349	18,151	115,019
1939	22,736	14,606	205	21,976	334	25,887	188	4,473	5	381	163	21,259	19,077	93,253
1940	26,582	25,790	600	122,951	695	84,973	215	22,315	—	—	292	43,703	22,111	296,053
1941	41,268	59,915	611	129,219	721	77,493	246	8,730	2	257	104	17,680	47,806	278,095
1942	5,333	6,771	140	39,547	54	7,526	54	2,312	—	—	170	20,289	21,720	91,394
1943	17,007	20,182	19	2,936	61	3,318	310	2,777	—	—	18	390	217	9,838
1944	49,714	19,444	176	37,836	294	37,930	111	1,531	—	—	168	26,845	—	104,142
1945	726	53,695	303	67,227	660	69,694	226	5,404	—	—	259	41,300	—	183,625
1946	75,300	38,756	601	68,581	242	28,158	279	5,970	52	11,390	300	30,335	15,291	159,725
1947	1,868	46,228	718	116,298	730	98,497	259	12,822	33	4,131	547	94,398	1,862	328,008
Colombia														
1938	30,776	47,305	679	37,897	170	22,784	158	11,258	38	4,339	35	4,118	13,964	94,360
1939	71,759	29,725	965	41,616	168	25,663	112	5,161	21	1,088	42	4,735	12,270	91,433
1940	76,420	67,381	980	48,446	183	28,001	186	4,793	22	1,849	32	2,557	20,252	105,998
1941	32,705	19,740	909	56,952	214	33,537	109	10,285	35	4,978	76	4,441	24,024	134,217
1942	19,223	3,911	381	23,470	99	17,886	20	1,711	14	2,553	56	5,961	7,849	59,439
1943	22,893	6,224	697	34,861	72	7,023	79	3,639	13	1,447	20	2,894	287	50,151
1944	15,732	8,245	343	57,375	250	40,113	113	2,961	13	2,364	20	2,334	291	105,438
1945	2,227	24,973	261	52,881	—	—	—	—	25	3,403	29	3,484	—	59,768
1946	141,146	130,033	344	51,522	194	31,645	39	6,464	41	4,833	38	2,782	2,961	100,207
1947	7,665	174,399	716	116,161	448	87,612	595	18,721	81	12,594	194	19,155	16,436	261,679

(1) Includes both animal and motor traction.

(2) Other cultivating implements and parts.

(to be continued)

TABLE VII (Continued)

Sprayers and Implements of Cultivation Exported by the United States to Latin America: 1938-47

(in units and U. S. dollars)

Years	Sprayers Hand & Power		Implements of Cultivation (1)											
		Total	Ploughs		Harrows		Cultivators		Planters		Drills & Seeders		Others (2)	Total
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Value	Value
Costa Rica														
1938	4,916	1,414	81	1,662	9	327	4	1,133	3	224	3	182	1,892	5,420
1939	11,842	1,908	107	4,071	14	666	16	835	2	33	10	531	1,244	7,380
1940	6,208	1,112	105	5,478	13	1,382	4	444	2	167	2	284	1,250	9,005
1941	6,211	17,869	101	4,133	7	695	43	692	2	72	3	366	718	6,676
1942	990	29,522	2	679	2	245	—	—	—	—	—	—	24	948
1943	336	718	65	1,954	39	2,822	44	751	2	203	7	382	119	6,231
1944	6,107	2,821	77	8,863	54	4,233	100	2,646	59	1,770	2	360	44	17,916
1945	197	8,034	155	11,263	35	4,997	39	1,610	20	1,931	12	359	1,042	21,202
1946	5,195	6,968	82	3,702	54	6,540	12	1,517	4	352	3	898	59	13,068
1947	11,709	109,868	49	10,148	34	5,351	42	2,691	11	1,488	10	1,098	—	21,776
Cuba														
1938	67,805	15,970	196	8,491	82	4,791	90	2,796	38	1,941	—	—	17,579	25,598
1939	98,491	15,291	1,173	17,136	76	7,505	119	4,690	26	705	6	1,028	22,728	53,787
1940	64,848	72,969	200	15,295	28	3,427	37	2,145	14	349	7	686	14,790	36,692
1941	141,611	42,778	529	59,168	75	15,698	186	8,296	27	2,072	21	2,925	47,771	136,920
1942	62,501	13,733	974	48,620	89	19,475	262	9,367	23	1,849	29	5,073	54,130	138,414
1943	22,955	11,106	440	39,265	36	8,899	43	1,359	128	5,602	30	5,605	59	61,789
1944	70,774	28,641	329	25,021	87	21,711	225	8,733	117	12,552	24	3,257	2,642	68,966
1945	1,686	27,985	342	44,655	120	9,219	85	13,648	32	2,232	46	4,007	—	73,761
1946	111,263	58,503	697	66,882	199	33,965	149	12,740	39	5,049	17	2,528	20,736	141,900
1947	2,323	54,457	1,073	250,708	526	91,532	433	38,505	89	11,974	54	13,194	45,922	451,835
Dominican Republic														
1938	2,065	659	155	19,441	6	1,174	59	1,193	35	685	2	408	13,520	27,421
1939	2,283	636	272	12,965	27	2,436	32	992	33	630	14	1,444	13,214	31,711
1940	3,573	964	302	5,913	6	684	22	333	38	596	2	365	8,572	16,463
1941	1,785	925	240	4,887	13	358	38	413	18	301	3	84	4,038	10,081
1942	2,755	480	419	5,254	78	890	156	531	65	941	—	—	2,718	10,334
1943	255	2,073	688	13,107	43	2,616	210	2,363	79	1,842	—	—	79	20,007
1944	2,391	651	2,134	38,933	662	16,993	566	6,037	190	1,625	510	31,213	178	94,979
1945	8,054	6,632	992	21,223	22	5,238	1	178	120	2,196	2	282	179	29,299
1946	11,036	25,496	956	25,441	27	15,038	29	305	—	—	3	65	607	42,456
1947	22,387	30,816	1,211	38,228	39	4,811	118	973	99	2,566	4	1,108	—	47,686
Ecuador														
1938	3,199	1,794	19	5,011	25	4,127	2	237	1	202	15	414	1,387	11,378
1939	2,178	1,173	136	13,664	62	8,153	18	1,882	1	185	2	437	2,622	26,936
1940	1,977	7,772	31	6,114	23	3,627	26	1,236	2	39	8	492	5,478	17,986
1941	32,706	7,252	149	9,030	36	5,202	25	2,201	2	304	3	345	2,830	18,912
1942	871	636	61	4,737	2	3,934	1	11	—	—	1	87	2,102	10,871
1943	1,300	2,194	41	3,236	37	4,483	13	240	9	405	7	1,748	—	10,112
1944	10,077	3,177	26	5,199	68	3,208	70	1,759	1	119	—	—	—	10,285
1945	120	1,356	42	4,640	131	11,249	16	799	1	125	7	1,977	—	18,790
1946	5,753	6,605	536	63,995	80	16,819	2	244	6	743	9	1,485	1,891	85,177
1947	794	8,580	90	22,177	107	35,022	5	955	—	—	15	5,642	1,953	65,749
El Salvador														
1938	1,243	410	50	2,205	8	549	20	557	4	700	2	413	1,534	5,958
1939	4,313	1,648	163	2,077	6	465	119	2,567	8	649	1	164	1,897	7,819
1940	1,195	380	125	1,488	3	468	48	971	2	428	—	—	1,209	4,544
1941	4,307	2,312	95	991	3	221	91	1,064	2	221	—	—	1,688	4,185
1942	540	81	86	874	—	—	62	549	2	149	—	—	564	2,136
1943	2,497	1,011	84	706	2	24	65	540	4	84	—	—	—	1,354
1944	1,796	2,839	213	5,120	2	310	156	1,099	6	595	13	332	525	7,981
1945	13,536	4,371	132	6,415	22	3,209	75	1,992	9	1,973	10	680	140	14,409
1946	2,494	11,755	90	9,047	42	7,489	106	5,533	10	1,577	38	266	1,697	25,709
1947	7,519	45,494	328	26,094	101	23,539	49	8,821	29	3,897	—	—	414	62,765

(1) Includes both animal and motor traction.
(2) Other cultivating implements and parts.

(to be continued)

TABLE VII (Continued)

Sprayers and Implements of Cultivation Exported by the United States to Latin America: 1938-47

(in units and U. S. dollars)

Years	SPRAYERS Hand & Power		IMPLEMENTS OF CULTIVATION (1)											
		TOTAL	PLOUGHS		HARROWS		CULTIVATORS		PLANTERS		DRILLS & SEEDERS		OTHERS (2)	TOTAL
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Value	Value
Guatemala														
1938	4,448	12,385	159	2,361	2	266	30	250	1	360	1	24	9,233	12,484
1939	7,892	3,397	109	2,067	8	1,140	32	659	6	196	—	—	2,518	6,580
1940	5,124	8,522	119	2,017	11	165	5	552	—	—	1	40	1,026	3,800
1941	4,216	19,005	170	1,938	6	1,506	45	470	—	—	—	—	2,297	6,211
1942	538	2,903	—	—	—	—	—	—	—	—	—	—	985	985
1943	4,613	750	92	2,991	10	2,069	55	581	6	100	13	284	49	6,065
1944	1,308	6,466	154	2,050	21	1,707	24	1,081	13	656	40	514	420	6,428
1945	13,813	17,976	167	3,545	3	157	52	2,548	—	—	—	—	149	6,399
1946	7,159	9,864	235	11,217	18	2,610	66	5,970	5	406	18	544	539	21,286
1947	10,443	11,300	354	22,685	41	6,354	88	5,695	26	3,958	3	828	—	39,520
Haiti														
1938	1,744	3,030	6	120	11	770	—	—	—	—	2	37	882	1,809
1939	1,438	2,309	2	34	13	1,175	4	597	—	—	—	—	634	2,440
1940	1,572	3,803	12	3,142	5	1,671	4	57	—	—	—	—	875	5,745
1941	2,002	23,126	3	2,316	3	938	—	—	—	—	—	—	3,111	6,365
1942	729	30,353	—	—	12	75	—	—	—	—	—	—	—	75
1943	1,114	1,672	—	—	13	855	—	—	—	—	—	—	—	855
1944	645	484	1	1,925	16	4,270	—	—	—	—	—	—	—	6,195
1945	4,396	903	1	285	—	—	—	—	—	—	7	76	1,045	1,406
1946	2,874	961	16	3,475	6	1,791	1	168	—	—	—	—	—	5,434
1947	4,830	4,716	28	2,124	10	1,130	15	1,494	1	128	—	—	—	4,876
Honduras														
1938	6,261	7,426	11	948	2	165	53	695	1	109	1	56	5,558	7,431
1939	5,639	2,044	10	271	—	—	4	72	—	—	1	240	1,380	1,963
1940	5,321	5,640	4	550	4	452	5	456	4	385	—	—	667	2,510
1941	6,163	14,712	26	1,058	1	167	6	697	2	213	—	—	1,409	3,544
1942	1,499	384	—	—	14	1,483	16	124	—	—	—	—	24	1,631
1943	1,410	448	62	2,439	—	—	23	162	1	17	—	—	—	2,618
1944	1,636	3,319	9	444	12	1,922	60	2,752	4	375	—	—	—	5,493
1945	9,494	26,022	8	3,033	3	825	4	276	1	155	5	735	39	5,063
1946	13,249	37,958	36	3,099	9	1,256	13	1,497	5	383	—	—	2,802	9,037
1947	5,650	16,102	58	6,404	53	7,896	34	3,120	12	1,316	5	1,049	—	21,785
Mexico														
1938	78,500	77,275	14,722	155,344	975	46,584	1,833	35,508	476	22,648	223	25,107	62,814	348,005
1939	11,842	39,428	12,501	174,574	1,075	54,149	2,924	29,953	460	13,794	132	13,497	64,499	350,457
1940	119,138	128,608	8,019	159,247	1,201	61,972	2,190	35,763	709	18,512	122	10,979	63,212	367,885
1941	295,979	197,846	22,983	349,924	2,389	134,138	7,173	110,821	2,480	54,793	257	26,825	178,026	854,327
1942	149,976	323,580	9,894	180,639	1,206	57,481	3,059	61,853	399	13,885	324	6,028	91,726	411,612
1943	17,351	28,584	7,582	319,297	1,810	141,353	4,464	47,333	853	18,827	363	13,128	5,953	545,891
1944	32,733	110,408	13,707	487,868	5,510	339,098	5,007	164,336	1,462	66,800	413	30,001	19,349	1,107,452
1945	3,781	118,119	—	404,658	3,281	169,869	7,492	192,481	2,577	124,556	456	28,606	—	920,260
1946	154,611	240,520	13,407	477,703	4,086	336,388	5,292	147,443	2,022	94,800	661	41,706	161,454	1,259,494
1947	7,176	238,909	22,332	850,393	1,188	520,830	5,482	227,039	1,761	134,784	951	65,443	255,742	2,054,186
Nicaragua														
1938	124	147	40	635	11	509	27	229	4	106	—	—	130	1,609
1939	549	106	193	4,442	38	3,050	97	1,800	11	1,053	—	—	855	11,000
1940	819	3,795	160	8,966	76	6,524	105	6,919	72	5,080	—	—	2,455	30,544
1941	2,404	472	120	5,290	13	2,084	23	3,228	14	920	—	—	1,114	12,636
1942	1,285	444	1	675	—	—	16	163	5	106	1	21	105	1,070
1943	1,366	219	40	413	39	2,822	132	2,210	14	455	—	—	161	6,071
1944	1,321	641	109	4,051	43	3,712	10	2,585	47	1,359	2	95	—	11,795
1945	2,144	879	13	3,795	29	6,438	226	3,057	22	1,605	1	185	3,597	15,677
1946	13,041	5,913	22	4,152	23	5,604	40	6,648	13	1,746	10	302	1,421	19,873
1947	14,932	6,669	46	7,828	57	10,690	35	6,453	22	2,594	24	6,374	—	33,939

1) Includes both animal and motor traction.
2) Other cultivating implements and parts.

(to be continued)

TABLE VII (Continued)

Sprayers and Implements of Cultivation Exported by the United States to Latin America: 1938-47

(in units and U. S. dollars)

Years	SPRAYERS Hand & Power		IMPLEMENTS OF CULTIVATION (1)											
		TOTAL	PLOUGHS		HARROWS		CULTIVATORS		PLANTERS		SEILLS & SEEDERS		OTHERS (2)	TOTAL
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Value	Value
Panama														
1938	5,191	3,165	1	7	5	1,974	8	1,201	—	—	1	100	1,641	4,923
1939	8,164	1,969	8	395	4	308	1	8	—	—	—	—	534	1,245
1940	11,283	3,016	19	451	4	325	—	—	3	28	—	—	745	1,544
1941	11,754	6,474	209	4,732	140	5,287	96	1,366	31	674	30	765	1,856	14,680
1942	5,477	11,217	160	7,830	8	435	74	2,392	65	1,652	8	1,633	1,855	15,797
1943	7,950	7,629	24	1,522	155	8,221	7	225	—	—	—	—	—	9,968
1944	19,215	8,285	42	9,581	29	9,347	18	2,853	22	2,040	3	423	2,094	26,338
1945	12,023	3,049	10	9,881	25	1,374	3	230	1	57	—	—	11	11,553
1946	3,901	34,615	21	1,744	9	2,936	18	4,362	4	206	29	77	491	9,816
1947	2,908	10,594	20	3,404	21	5,216	7	1,104	3	306	14	3,215	—	13,245
Paraguay														
1938	—	—	10	2,553	—	—	—	—	8	164	48	175	234	3,126
1939	144	27	—	—	—	—	—	—	—	—	—	—	1,223	1,223
1940	609	314	—	—	—	—	—	—	—	—	—	—	—	—
1941	444	1,028	—	—	—	—	—	—	4	78	—	—	—	78
1942	600	2,550	6	61	6	136	2	12	1	19	—	—	—	228
1943	—	—	2,000	18,438	26	1,580	—	—	—	—	—	—	—	18,018
1944	—	—	2,000	16,939	31	811	150	1,238	—	—	—	—	—	18,988
1945	694	3,236	1,029	11,711	104	3,328	1,600	13,450	440	10,478	—	—	43,848	38,967
1946	—	—	—	11,902	—	—	—	—	—	—	—	—	—	55,750
1947	—	686	—	6,064	—	5,054	—	856	—	642	—	953	185	13,754
Peru														
1938	11,519	5,791	1,111	38,985	181	11,462	537	17,140	98	5,794	49	1,492	38,570	113,443
1939	6,013	10,298	892	30,319	103	4,329	374	14,976	171	5,195	12	735	50,175	105,729
1940	9,392	7,945	350	9,845	29	2,153	130	5,273	34	2,425	—	—	70,379	90,075
1941	16,900	13,692	123	9,924	117	5,853	66	3,875	1	208	35	3,162	49,389	72,611
1942	9,786	4,411	295	12,767	50	3,947	45	3,446	23	804	14	11	17,815	38,700
1943	5,878	3,406	261	15,666	71	4,797	125	4,023	70	3,943	—	—	69	28,498
1944	11,530	11,598	364	28,468	89	6,999	242	20,549	72	9,241	—	—	—	65,258
1945	1,244	15,116	680	21,502	6	776	91	13,462	81	4,275	—	—	—	40,015
1946	38,004	37,176	1,158	45,052	108	9,190	164	14,951	47	5,986	70	1,058	3,272	79,510
1947	4,451	74,902	851	108,986	267	33,941	176	31,978	243	21,668	28	4,110	9,723	199,806
Uruguay														
1938	281	1,623	1,220	91,381	116	9,011	42	2,350	32	785	130	15,520	46,810	165,857
1939	235	5,190	415	39,683	152	16,607	38	1,111	38	1,130	120	16,692	35,822	111,245
1940	622	17,344	859	53,451	230	11,860	287	7,532	42	1,547	105	13,105	40,315	157,810
1941	864	9,855	934	42,101	107	10,041	98	3,319	57	5,022	137	7,270	31,212	98,965
1942	435	6,314	262	24,231	109	8,435	143	1,971	5	834	109	18,384	19,927	73,782
1943	8	3,543	1,021	57,401	145	14,873	280	5,961	7	1,259	80	12,525	181	92,200
1944	322	3,805	540	26,996	53	3,850	80	3,237	7	699	28	5,352	274	40,408
1945	878	9,661	563	17,132	71	5,750	222	5,100	27	2,536	56	4,177	—	34,695
1946	4,484	37,720	1,144	65,278	120	8,299	236	8,039	14	2,255	15	1,250	2,748	87,869
1947	6,619	132,055	1,529	125,265	497	47,776	193	11,224	87	11,591	234	42,271	24,900	263,027
Venezuela														
1938	69,851	20,746	703	20,657	216	17,570	243	11,397	24	1,527	19	2,183	11,191	64,625
1939	99,151	24,587	821	47,568	361	36,908	371	15,690	85	5,785	56	2,175	17,875	126,001
1940	94,927	24,262	964	50,862	394	45,155	397	14,188	54	4,754	55	5,403	13,099	139,061
1941	61,271	23,233	430	51,999	236	31,453	277	15,044	43	3,283	17	3,248	22,226	126,953
1942	7,108	8,435	215	20,677	117	20,963	100	4,770	46	3,344	3	456	4,189	54,399
1943	33,994	23,389	225	19,390	177	20,925	585	23,541	113	9,680	46	3,108	787	77,431
1944	58,117	30,912	309	49,064	353	56,515	334	21,189	166	13,663	84	13,612	293	154,336
1945	2,127	26,682	403	30,937	377	44,277	398	14,540	65	6,121	64	1,888	—	97,763
1946	—	—	—	63,995	—	—	—	—	—	—	—	—	473,154	537,149
1947	—	91,795	—	188,587	—	245,055	—	122,587	—	37,840	—	14,054	95,860	703,983

Source: Foreign Commerce and Navigation of the United States, 1938 to 1947.

(1) Includes both animal and motor traction.
(2) Other cultivating implements and parts.

TABLE VIII

Harvesting Machinery Exported by the United States to Latin America: 1938-47

(in units and U. S. dollars)

Years	MOWERS		LAWN MOWERS		HAY RAKES AND TEDDERS		GRAIN HARVESTERS AND BINDERS		COMBINES OR REAPER-HARVESTERS		OTHERS (1)	TOTAL
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Value	Value
Argentina												
1938	748	51,529	801	10,901	1,319	66,170	957	365,980	2,664	3,205,380	786,452	4,486,412
1939	232	18,476	430	5,087	230	9,916	295	105,725	1,808	2,090,627	866,633	3,096,464
1940	1,065	81,378	693	14,771	380	15,794	151	52,733	671	781,731	705,643	1,652,050
1941	221	16,590	1,304	9,379	76	4,252	7	1,098	127	67,071	266,335	364,725
1942	37	3,845	642	4,099	20	640	—	—	—	—	139,798	148,382
1943	—	—	—	—	—	—	—	—	—	—	—	—
1944	—	—	—	—	—	—	—	—	—	—	—	—
1945	1,209	114,607	—	—	—	—	—	—	3	5,933	—	120,540
1946	2,157	203,371	1,791	31,708	473	32,247	4	1,696	76	154,887	1,378	425,387
1947	3,171	16,935	4,406	116,648	2,064	170,625	—	—	847	1,847,889	—	2,152,097
Bolivia												
1938	2	184	—	—	—	—	—	—	—	—	4,154	4,288
1939	—	—	5	21	—	—	—	—	2	2,553	909	3,483
1940	5	466	33	201	7	450	—	—	8	2,905	99	4,121
1941	21	2,622	42	185	—	—	2	300	10	9,725	353	13,185
1942	7	705	20	132	—	—	—	—	4	1,854	732	3,423
1943	44	3,688	2	18	—	—	—	—	17	7,107	210	11,023
1944	—	—	—	—	—	—	—	—	1	645	468	1,113
1945	25	2,365	—	—	11	495	4	925	—	—	—	3,785
1946	10	1,093	178	3,599	1	128	—	—	6	6,119	496	11,435
1947	11	1,199	30	553	—	—	—	—	2	2,127	—	3,879
Brazil												
1938	46	3,673	269	2,680	4	156	39	9,342	24	19,900	22,699	68,450
1939	118	9,626	549	3,206	16	819	42	7,685	20	18,341	17,991	67,668
1940	26	2,165	591	6,408	21	912	1	216	6	3,667	29,952	43,320
1941	106	8,697	950	23,385	11	463	1	295	6	4,883	2,285	40,008
1942	14	1,240	215	7,784	6	345	—	—	—	—	2,352	11,721
1943	124	11,183	4	1,000	19	885	1	385	—	—	—	13,453
1944	154	12,775	—	—	30	1,611	—	—	1	2,000	508	16,894
1945	50	4,458	—	—	41	1,961	—	—	6	5,806	—	12,225
1946	142	18,893	210	8,363	31	1,656	—	—	14	18,299	3,695	50,906
1947	185	26,501	901	40,691	51	6,321	—	—	83	90,302	—	163,815
Chile												
1938	95	8,835	346	1,791	55	3,053	112	23,413	11	10,785	23,432	71,309
1939	202	16,195	283	1,497	105	4,408	110	23,340	54	38,521	8,907	92,868
1940	379	34,131	565	3,063	199	8,603	192	44,622	149	145,861	25,988	262,268
1941	497	46,908	820	5,297	152	7,385	252	75,948	289	301,198	34,351	470,787
1942	101	10,831	561	3,565	29	1,800	37	10,234	1	953	18,309	45,692
1943	270	27,360	3	23	77	7,383	5	1,178	—	—	—	35,994
1944	368	36,829	—	—	207	9,810	93	24,474	91	90,587	817	162,517
1945	658	66,881	—	—	339	20,151	69	26,260	68	100,498	—	213,790
1946	907	100,271	785	9,510	299	15,008	148	43,976	102	132,306	13,218	314,289
1947	615	90,074	708	16,453	292	17,399	—	—	245	544,433	—	668,359
Colombia												
1938	31	2,242	355	3,183	5	252	10	2,388	15	10,988	6,272	25,325
1939	16	1,338	544	6,776	1	118	41	2,597	28	20,685	10,085	41,599
1940	8	669	552	6,483	2	90	2	446	22	19,881	5,028	32,597
1941	32	1,294	633	5,167	—	—	11	2,686	45	33,159	13,962	56,268
1942	4	356	125	1,834	—	—	—	—	13	11,180	3,157	16,527
1943	15	1,310	—	—	—	—	7	1,755	33	29,418	641	33,125
1944	35	3,030	1	140	—	—	2	703	36	30,887	43	34,803
1945	26	2,619	—	—	5	409	—	—	53	47,746	—	50,774
1946	44	5,455	580	20,861	11	453	2	3,907	36	38,178	425	69,279
1947	87	14,931	1,100	30,990	21	1,450	—	—	95	113,339	—	160,710

(1) Other harvesting implements and parts.

(to be continued)

TABLE VIII (Continued)

Harvesting Machinery Exported by the United States to Latin America: 1938-47

(in units and U. S. dollars)

Years	MOWERS		LAWN MOWERS		HAY RAKES AND TEDDERS		GRAIN HARVESTERS AND BINDERS		COMBINES OR REAPER-HARVESTERS		OTHERS (1)	TOTAL
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Value	Value
Costa Rica												
1938	2	230	30	1,245	—	—	—	—	—	—	83	1,558
1939	4	411	55	1,587	—	—	—	—	—	—	386	2,384
1940	6	627	156	1,990	—	—	—	—	1	403	603	3,623
1941	3	173	82	3,012	—	—	—	—	3	3,217	2,395	8,797
1942	—	—	51	1,145	—	—	—	—	—	—	—	1,145
1943	3	325	3	408	—	—	—	—	—	—	—	733
1944	25	2,567	—	—	1	132	—	—	3	2,558	—	5,257
1945	27	2,927	—	—	—	—	—	—	4	3,137	—	6,064
1946	25	2,837	78	4,572	2	259	—	—	2	1,884	3,992	13,544
1947	35	4,782	455	15,599	2	205	—	—	6	6,758	830	28,174
Cuba												
1938	8	669	386	5,325	2	99	—	—	—	—	2,763	8,856
1939	6	1,028	17	1,483	678	10,062	—	—	3	2,182	5,148	19,903
1940	22	1,751	507	7,215	—	—	1	285	4	2,194	2,509	13,954
1941	24	1,938	429	6,239	—	—	8	2,092	15	11,932	11,297	33,498
1942	56	3,228	523	4,678	—	—	7	2,412	4	3,931	3,453	17,702
1943	3	255	1	539	—	—	12	4,562	14	11,647	—	17,003
1944	40	3,771	3	505	5	215	34	11,224	15	8,131	940	24,786
1945	32	2,858	—	—	—	—	—	—	1	980	—	3,838
1946	106	12,596	693	17,076	2	166	—	—	1	2,844	2,100	34,782
1947	205	30,112	2,074	82,545	57	3,167	—	—	9	18,070	—	133,894
Dominican Republic												
1938	—	—	49	427	—	—	—	—	—	—	470	897
1939	1	60	100	744	—	—	—	—	6	5,524	721	7,049
1940	5	531	125	1,612	—	—	—	—	—	—	927	3,070
1941	1	85	48	568	—	—	—	—	—	—	890	1,543
1942	—	—	5	838	—	—	—	—	—	—	738	1,576
1943	—	—	1	155	—	—	—	—	—	—	—	155
1944	5	593	35	878	—	—	—	—	2	949	—	2,420
1945	11	1,153	2	217	—	—	—	—	4	6,222	207	7,799
1946	7	773	123	3,035	—	—	4	3,620	—	—	—	7,428
1947	9	1,179	246	8,538	—	—	—	—	2	6,327	—	16,044
Ecuador												
1938	2	135	15	235	—	—	1	326	3	3,250	48	3,994
1939	6	490	64	388	—	—	1	466	7	5,036	377	6,757
1940	1	136	18	111	—	—	1	276	3	6,242	890	7,655
1941	3	378	51	317	—	—	1	355	2	2,246	699	3,895
1942	3	363	27	193	—	—	—	—	—	—	294	850
1943	2	212	—	—	—	—	5	1,152	3	2,581	634	4,579
1944	21	2,419	1	20	—	—	2	478	2	1,637	159	4,713
1945	13	1,464	—	—	—	—	—	—	12	14,972	—	16,436
1946	5	589	12	1,015	—	—	—	—	5	11,176	716	13,496
1947	2	301	78	3,015	3	813	—	—	17	25,605	—	29,734
El Salvador												
1938	1	49	22	100	—	—	—	—	—	—	—	149
1939	—	—	63	473	—	—	—	—	1	350	405	1,228
1940	1	75	71	340	1	39	—	—	—	—	598	1,052
1941	12	43	81	335	1	150	—	—	—	—	25	553
1942	—	—	6	36	—	—	—	—	—	—	—	36
1943	—	—	1	23	—	—	—	—	1	465	—	488
1944	—	—	—	—	—	—	—	—	—	—	—	—
1945	2	217	4	102	—	—	1	50	—	—	—	369
1946	5	797	—	—	—	—	—	—	—	—	—	797
1947	19	3,827	237	5,644	4	567	—	—	—	—	2,187	12,225

(1) Other harvesting implements and parts.

(to be continued)

TABLE VIII (Continued)

Harvesting Machinery Exported by the United States to Latin America: 1938-47

(in units and U. S. dollars)

YEARS	MOWERS		LAWN COWERS		HAY RAKES AND TEDDERS		GRAIN HARVESTERS AND BINDERS		COMBINES OR REAPER-HARVESTERS		OTHERS (1)	TOTAL
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Value	Value
Guatemala												
1938	2	286	44	2,256	—	—	—	—	—	—	3,423	5,965
1939	4	318	79	2,011	—	—	—	—	—	—	1,244	3,573
1940	—	—	80	1,482	—	—	—	—	—	—	1,882	3,364
1941	13	1,516	193	2,898	3	131	—	—	—	—	390	4,935
1942	1	614	48	290	—	—	—	—	—	—	256	1,160
1943	4	866	—	—	2	107	—	—	—	—	43	1,016
1944	12	1,753	1	75	—	—	—	—	—	—	—	1,828
1945	5	505	1	41	1	44	—	—	5	5,981	—	6,571
1946	10	1,207	21	382	2	160	—	—	—	—	686	2,435
1947	3	407	341	15,473	3	275	—	—	—	—	1,325	17,480
Haiti												
1938	—	—	35	311	—	—	—	—	—	—	90	401
1939	—	—	38	406	—	—	—	—	—	—	15	421
1940	—	—	30	329	—	—	—	—	—	—	105	434
1941	—	—	51	458	—	—	—	—	—	—	15	473
1942	—	—	11	102	—	—	—	—	—	—	—	102
1943	—	—	4	644	—	—	—	—	—	—	—	644
1944	1	95	—	—	—	—	—	—	—	—	—	95
1945	—	—	1	188	—	—	—	—	—	—	—	188
1946	—	—	49	1,318	—	—	—	—	—	—	—	1,318
1947	2	1,422	113	2,874	1	1,152	—	—	—	—	90	5,538
Honduras												
1938	2	199	95	821	—	—	—	—	2	602	511	2,223
1939	2	283	38	712	2	113	—	—	—	—	920	2,028
1940	—	—	151	1,163	—	—	—	—	1	461	1,710	3,334
1941	27	317	52	944	—	—	—	—	—	—	3,253	4,514
1942	4	319	20	137	—	—	1	423	—	—	219	1,098
1943	—	—	—	—	—	—	—	—	—	—	—	—
1944	6	608	—	—	4	150	—	—	—	—	—	758
1945	6	391	150	809	—	—	—	—	1	1,202	—	2,402
1946	15	4,108	174	3,834	—	—	3	507	—	—	—	8,449
1947	30	3,999	474	19,004	4	242	—	—	—	—	277	23,522
Mexico												
1938	202	17,401	594	6,728	95	4,726	106	25,520	66	83,065	19,859	157,299
1939	122	8,287	1,302	8,325	115	4,339	53	9,865	241	243,149	28,393	302,358
1940	148	11,357	753	4,477	88	3,167	61	14,466	123	121,785	30,270	188,522
1941	498	35,388	1,016	7,504	260	10,708	102	24,134	176	155,439	43,551	276,724
1942	157	12,414	1,197	10,372	82	2,369	55	11,956	128	137,873	29,988	204,972
1943	266	16,740	20	521	179	6,927	41	7,858	40	32,613	11,122	75,781
1944	544	35,731	56	1,978	319	11,018	79	17,904	82	82,629	8,125	157,385
1945	606	45,667	—	—	370	16,452	114	18,232	235	190,283	—	270,634
1946	2,155	149,929	1,191	33,845	372	25,245	119	41,304	304	366,536	43,588	660,447
1947	692	100,951	2,180	67,741	596	46,585	—	—	348	512,257	—	727,534
Nicaragua												
1938	—	—	2	271	—	—	—	—	1	200	288	759
1939	—	—	12	61	—	—	—	—	—	—	288	349
1940	18	2,210	2	12	—	—	—	—	—	—	317	2,539
1941	13	1,776	10	202	1	39	—	—	1	525	313	2,855
1942	7	337	2	27	—	—	—	—	—	—	43	907
1943	7	1,234	5	36	—	—	1	365	—	—	—	1,635
1944	4	447	—	—	9	552	—	—	1	679	—	1,678
1945	26	2,505	—	—	2	85	—	—	2	1,722	—	4,312
1946	39	4,854	35	768	1	128	—	—	6	4,961	—	10,711
1947	44	5,994	91	1,482	10	1,017	1	516	—	—	3,499	12,508

(1) Other harvesting implements and parts.

(to be continued)

TABLE VIII (Continued)

Harvesting Machinery Exported by the United States to Latin America: 1938-47

(in units and U. S. dollars)

Years	MOWERS		LAWN MOWERS		HAY RAKES AND TEDDERS		GRAIN HARVESTERS AND BINDERS		COMBINES OR REAPER-HARVESTERS		OTHERS (1)	TOTAL
	Number	Value	Number	Value	Number	Value	Number	Value	Number	Value	Value	Value
Panama												
1938	2	188	135	1,722	—	—	—	—	—	—	1,309	3,219
1939	—	—	145	2,837	—	—	—	—	—	—	683	3,710
1940	1	233	192	3,146	—	—	—	—	—	—	1,640	5,019
1941	9	882	163	4,258	—	—	—	—	—	—	2,531	7,671
1942	4	496	110	1,705	—	—	—	—	—	—	599	2,800
1943	2	195	—	—	—	—	4	1,423	—	—	—	1,618
1944	11	979	1	300	—	—	—	—	—	—	—	1,279
1945	14	1,245	—	—	1	128	—	—	14	8,425	—	9,798
1946	8	1,002	113	2,776	—	—	—	—	—	—	90	3,868
1947	5	704	603	21,016	—	—	—	—	8	8,488	779	30,987
Paraguay												
1938	—	—	—	—	—	—	1	131	—	—	—	131
1939	—	—	3	12	—	—	—	—	—	—	62	74
1940	—	—	16	102	—	—	—	—	—	—	—	102
1941	2	228	4	15	—	—	—	—	—	—	—	243
1942	—	—	—	—	—	—	—	—	—	—	—	—
1943	—	—	—	—	—	—	—	—	—	—	—	—
1944	10	941	—	—	—	—	—	—	—	—	—	941
1945	—	—	—	—	—	—	—	—	2	2,226	—	2,226
1946	—	—	—	—	—	—	—	—	—	—	—	—
1947	—	802	—	180	—	—	—	—	—	1,226	—	2,208
Peru												
1938	1	130	194	2,009	3	142	3	916	13	12,196	1,762	17,155
1939	5	703	323	3,486	—	—	1	314	4	3,735	3,219	11,457
1940	1	151	194	2,106	—	—	1	100	4	2,686	1,624	6,667
1941	7	799	465	5,489	—	—	—	—	5	2,157	1,841	10,286
1942	—	—	15	156	6	378	—	—	6	3,956	440	4,930
1943	6	503	—	—	—	—	—	—	2	2,328	833	3,664
1944	18	2,324	1	15	—	—	—	—	5	4,388	—	6,727
1945	2	189	—	—	—	—	—	—	4	3,460	—	3,649
1946	26	4,661	10	142	17	754	—	—	14	9,253	5,695	20,505
1947	35	4,058	168	5,109	19	2,113	—	—	29	34,038	—	45,318
Uruguay												
1938	39	3,240	—	—	23	1,933	273	58,470	120	148,258	53,658	265,559
1939	25	1,995	—	—	5	342	—	—	69	89,671	16,755	108,663
1940	42	3,509	20	247	13	1,136	6	2,365	96	121,783	34,265	163,305
1941	22	2,059	128	552	11	451	60	8,792	45	57,213	29,142	98,209
1942	46	4,276	3	190	33	1,513	—	20,050	70	112,480	16,872	157,381
1943	35	3,151	—	—	6	247	—	—	—	—	1,757	5,155
1944	53	4,948	—	—	20	903	—	—	1	1,331	—	7,182
1945	57	5,122	—	—	37	1,706	—	—	56	101,220	—	108,048
1946	109	12,063	45	476	45	2,894	15	6,244	84	77,108	11,332	110,117
1947	382	49,543	303	8,545	44	5,515	—	—	251	407,362	—	470,965
Venezuela												
1938	30	3,119	452	9,664	13	927	1	361	1	983	1,880	16,934
1939	15	1,492	499	6,166	2	97	—	—	4	4,599	3,809	16,163
1940	14	1,958	549	8,446	30	319	7	3,240	9	5,686	3,453	23,102
1941	3	198	541	7,739	—	—	—	—	11	9,485	4,055	21,477
1942	—	—	287	3,953	—	—	—	—	4	1,706	2,471	8,130
1943	8	1,434	33	5,780	2	98	3	907	10	9,339	—	17,558
1944	42	5,003	107	943	2	80	15	5,915	22	16,335	222	28,498
1945	47	5,753	—	—	—	—	—	5,476	30	22,571	—	33,800
1946	—	—	—	—	—	—	—	—	—	3,844	—	3,844
1947	—	17,909	—	39,077	—	580	—	—	—	47,496	—	105,062

Source: Foreign Commerce and Navigation of the United States, 1938 to 1947.
(1) Other harvesting implements and parts.

TABLE IX

Seed Separators Exported by the United States to Latin America: 1938-47

(in units and U. S. dollars)

Years	Threshers		Corn shellers		Other separators and parts	Total
	Number	Value	Number	Value	Value	Value
Argentina						
1938	85	88,293	1,942	32,632	127,907	248,832
1939	39	37,934	426	8,363	48,319	94,616
1940	7	7,744	411	5,388	79,177	92,309
1941	—	—	5	22	90,759	90,781
1942	—	—	—	—	1,355	1,355
1943	—	—	—	—	—	—
1944	—	—	—	—	—	—
1945	—	—	—	—	—	—
1946	5	2,436	249	8,914	780	12,130
1947	—	—	488	10,319	—	10,319
Bolivia						
1938	56	18,680	22	249	1,019	19,948
1939	9	4,245	10	171	237	4,653
1940	11	2,364	96	3,343	1,313	7,020
1941	4	1,796	15	559	1,272	3,627
1942	—	—	—	—	—	—
1943	8	4,065	3	413	—	4,478
1944	1	1,050	20	290	—	1,340
1945	—	—	—	—	—	—
1946	6	4,531	—	—	632	5,163
1947	—	—	10	200	—	200
Brazil						
1938	76	50,999	80	1,086	9,161	61,246
1939	31	19,953	297	4,228	5,021	29,202
1940	1	312	206	4,220	11,244	15,776
1941	1	4,019	369	4,886	5,662	14,567
1942	30	21,661	242	3,396	54	25,111
1943	—	—	660	9,225	—	9,225
1944	4	3,015	155	2,828	—	5,843
1945	2	976	148	2,191	—	3,167
1946	52	31,394	555	6,955	4,850	43,199
1947	174	180,450	418	6,674	—	187,124
Chile						
1938	43	40,733	90	1,369	12,572	54,674
1939	25	32,207	76	1,441	989	34,637
1940	84	78,747	74	2,364	14,052	95,163
1941	43	47,893	259	6,733	12,904	67,580
1942	—	—	42	714	1,073	1,787
1943	—	—	17	2,427	—	2,427
1944	9	9,556	111	3,740	859	14,155
1945	69	85,851	86	2,448	—	88,299
1946	56	47,642	118	4,598	489	52,729
1947	71	99,972	124	1,628	—	101,500
Colombia						
1938	20	9,078	39	621	3,128	12,827
1939	7	3,222	279	5,904	1,553	10,679
1940	8	3,580	302	5,081	2,660	11.321
1941	12	7,289	2	858	3,946	12,093
1942	—	—	23	177	171	348
1943	11	5,317	32	341	856	6,514
1944	9	8,104	54	954	—	9,058
1945	3	1,121	342	8,165	—	9,286
1946	20	11,147	118	2,147	2,186	15,480
1947	53	37,932	137	2,077	—	40,009

(to be continued)

TABLE IX (Continued)

Seed Separators Exported by the United States to Latin America: 1938-47

(in units and U. S. dollars)

Years	Threshers		Corn shellers		Other separators and parts	Total
	Number	Value	Number	Value	Value	Value
Costa Rica						
1938	—	—	41	544	34	578
1939	—	—	44	639	—	639
1940	—	—	28	364	—	364
1941	—	—	29	566	237	803
1942	—	—	32	179	—	179
1943	—	—	28	448	—	448
1944	—	—	44	829	1,189	2,018
1945	—	—	—	—	—	—
1946	—	—	9	361	—	361
1947	—	—	—	—	—	—
Cuba						
1938	6	4,151	115	2,088	1,658	7,897
1939	3	1,357	75	1,140	605	3,102
1940	—	—	52	969	3,123	4,092
1941	4	2,743	191	2,256	3,399	8,398
1942	3	3,237	111	1,251	30,085	34,573
1943	36	34,528	299	3,672	22,171	60,371
1944	15	14,538	295	5,689	—	20,227
1945	—	—	187	3,976	—	3,976
1946	4	5,503	32	671	571	6,745
1947	15	21,355	444	9,838	—	31,193
Dominican Republic						
1938	4	3,037	5	83	983	4,103
1939	—	—	8	174	192	366
1940	—	—	8	104	352	456
1941	1	1,132	20	660	349	2,141
1942	—	—	68	766	677	1,443
1943	—	—	10	160	—	160
1944	5	5,623	—	—	3,264	8,887
1945	1	433	—	—	—	433
1946	—	—	33	1,353	—	1,353
1947	2	3,864	5	412	1,159	5,435
Ecuador						
1938	9	2,784	18	155	734	3,673
1939	4	1,833	14	458	75	2,366
1940	10	4,018	8	184	1,365	5,567
1941	5	1,770	14	515	641	2,926
1942	—	—	12	175	515	690
1943	15	4,717	12	191	3,744	8,652
1944	1	544	22	569	780	1,893
1945	13	3,850	30	811	—	4,661
1946	40	15,491	30	924	175	16,590
1947	1	3,230	20	1,275	—	4,505
El Salvador						
1938	—	—	6	1,158	205	1,363
1939	—	—	8	104	—	104
1940	—	—	19	808	—	808
1941	—	—	7	1,053	294	1,347
1942	—	—	2	40	164	194
1943	—	—	21	1,159	—	1,159
1944	—	—	66	608	—	608
1945	—	—	74	8,861	1,972	10,833
1946	—	—	—	—	—	—
1947	28	2,600	—	—	6,865	9,465

(to be continued)

TABLE IX (Continued)

Seed Separators Exported by the United States to Latin America: 1938-47

(in units and U. S. dollars)

Years	Threshers		Corn shellers		Other separators and parts	Total
	Number	Value	Number	Value	Value	Value
Guatemala						
1938	1	586	24	467	416	1,469
1939	—	—	—	—	463	463
1940	—	—	39	568	275	843
1941	—	—	12	157	175	332
1942	—	—	78	271	—	271
1943	—	—	28	541	—	541
1944	1	734	40	468	1,105	2,307
1945	—	—	—	—	—	—
1946	—	—	138	1,528	67	1,595
1947	3	2,299	90	369	450	3,118
Haiti						
1938	—	—	—	—	500	500
1939	—	—	1	11	59	70
1940	—	—	1	16	11	27
1941	—	—	—	—	25	25
1942	—	—	—	—	—	—
1943	—	—	—	—	94	94
1944	—	—	—	—	1,144	1,144
1945	—	—	—	—	—	—
1946	—	—	—	—	—	—
1947	1	925	—	—	380	1,305
Honduras						
1938	—	—	1	30	90	120
1939	1	867	2	124	59	1,050
1940	—	—	—	—	76	76
1941	—	—	14	72	393	465
1942	—	—	1	20	—	20
1943	—	—	—	—	—	—
1944	—	—	6	90	—	90
1945	—	—	—	—	—	—
1946	—	—	2	42	1,494	1,536
1947	84	881	—	—	765	1,646
Mexico						
1938	41	32,551	208	5,497	9,187	47,235
1939	47	49,187	179	4,088	5,811	59,086
1940	45	39,891	161	3,921	8,431	52,243
1941	78	64,275	368	7,949	10,305	82,529
1942	22	18,559	221	4,561	6,788	29,908
1943	29	28,159	275	3,841	3,835	35,835
1944	45	32,403	541	12,277	10,812	55,492
1945	30	21,971	321	8,238	—	30,209
1946	78	64,989	714	17,487	12,325	94,801
1947	56	67,097	921	35,553	—	102,650
Nicaragua						
1938	—	—	6	116	—	116
1939	—	—	4	52	189	241
1940	—	—	8	278	143	421
1941	—	—	20	628	1,312	1,940
1942	—	—	16	220	53	273
1943	1	1,238	33	827	2,240	4,305
1944	—	—	11	409	64	473
1945	—	—	—	—	—	—
1946	1	1,111	35	915	—	2,026
1947	13	1,376	—	—	4,788	6,164

(to be continued)

TABLE IX (Continued)

Seed Separators Exported by the United States to Latin America: 1938-47

(in units and U. S. dollars)

Years	Threshers		Corn shellers		Other separators and parts	Total
	Number	Value	Number	Value	Value	Value
Panama						
1938	—	—	1	27	17	44
1939	—	—	—	—	166	166
1940	—	—	2	33	556	589
1941	2	2,350	—	—	150	2,500
1942	—	—	15	56	4,422	4,478
1943	10	10,039	50	1,459	2,893	14,391
1944	—	—	—	—	—	—
1945	—	—	—	—	—	—
1946	—	—	12	205	1,442	1,647
1947	15	300	—	—	853	1,153
Paraguay						
1938	—	—	8	116	—	116
1939	—	—	—	—	—	—
1940	—	—	—	—	—	—
1941	—	—	—	—	—	—
1942	—	—	—	—	—	—
1943	—	—	—	—	—	—
1944	—	—	52	754	—	754
1945	6	2,877	—	—	—	2,877
1946	—	—	—	—	—	—
1947	—	—	—	3,780	—	3,780
Peru						
1938	9	3,698	50	1,240	880	5,818
1939	9	6,849	37	692	1,691	9,232
1940	4	2,293	26	526	1,242	4,061
1941	12	7,593	31	1,141	1,363	10,097
1942	1	519	12	270	1,034	1,823
1943	—	—	16	882	267	1,149
1944	15	18,274	26	934	840	20,048
1945	7	3,592	49	1,230	—	4,822
1946	16	11,249	30	1,509	1,767	14,525
1947	11	9,555	142	8,962	—	18,517
Uruguay						
1938	27	29,871	60	702	3,013	33,586
1939	—	—	135	2,270	1,032	3,302
1940	12	13,320	183	2,153	2,705	18,178
1941	2	2,666	168	2,477	988	6,131
1942	—	—	47	1,468	762	2,230
1943	—	—	60	870	—	870
1944	—	—	176	2,768	—	2,768
1945	—	—	218	3,769	—	3,769
1946	—	—	217	3,806	—	3,806
1947	1	716	1	30	—	746
Venezuela						
1938	—	—	109	1,264	92	1,356
1939	—	—	159	3,716	2,242	5,958
1940	2	1,276	233	6,212	3,479	10,967
1941	—	—	163	3,460	3,975	7,435
1942	—	—	64	421	329	750
1943	—	—	59	4,320	—	4,320
1944	26	14,457	53	2,163	7,976	24,596
1945	2	675	72	4,096	—	4,771
1946	—	—	—	—	—	—
1947	—	2,184	—	11,237	—	13,421

Source: Foreign Commerce and Navigation of the United States, 1938 to 1947.

TABLE X

Extent of Agricultural Mechanization in Latin America

Countries	N.° of Tractors	Total available H.P.	Average H.P. per tractor	Total area (1000 Hs.)	Area suitable for cultivation (Hs.)	Area cultivated yearly (1000 Hs).	Cultivated Area in relation to area suitable for cultivation (Percentage)	Area cultivated per tractors (Hs.)	Estimated mechanized area (1000 Hs.)	Mechanised area in relation to total cultivated area (Percentage)	Area, now under cultivation in which mechanization could be increased (1000 Hs.)
Argentina	18,777	441,125	23,5	(1) 279,202	145,185	23,232	15,0	1,237	4,097,0	18,0	11,623
Bolivia	579	15,517	25,8	107,754	—	342	—	690	20,0	5,8	116
Brazil	4,672	122,515	26,5	851,604	—	15,360	—	3,287	922,0	6,0	5,172
Chile	4,143	107,718	26,0	(1) 74,000	19,522	2,043	10,5	493	511,0	25,0	510
Colombia	2,795	80,216	28,7	113,916	19,138	2,709	14,0	969	271,0	10,0	812
Costa Rica	392	11,270	28,9	4,960	2,000	430	26,0	1,096	30,2	7,0	141
Cuba	3,515	88,578	25,2	11,100	6,500	1,970	30,3	560	261,0	13,2	881
Dominican Rep.	297	5,091	27,2	5,002	1,942	680	3,5	2,289	24,5	3,6	111
Ecuador	549	16,577	30,2	30,000	7,899	732	9,2	1,333	29,0	4,0	153
El Salvador....	298	8,114	27,1	2,200	1,200	733	61,0	2,451	29,2	4,0	190
Guatemala	531	14,197	22,5	10,888	3,900	992	25,4	1,572	62,1	6,2	235
Haiti	44	1,191	27,0	2,782	900	420	46,6	9,545	3,1	0,7	80
Honduras	233	6,095	26,1	11,520	3,000	380	12,6	1,630	17,4	4,5	96
Mexico	17,035	408,840	24,0	196,934	28,921	7,394	25,6	434	1,109,0	15,0	3,327
Nicaragua.....	255	7,774	30,5	14,800	8,000	500	5,2	1,960	19,5	4,0	330
Panama	268	6,433	24,0	7,395	2,000	122	6,1	455	17,7	14,5	31
Paraguay	55	1,530	27,8	45,287	11,321	334	3,0	6,072	5,2	1,5	61
Peru	2,343	64,432	27,5	124,905	15,000	1,516	10,1	453	152,0	12,0	303
Uruguay	2,890	72,250	25,0	18,693	13,400	1,480	11,0	512	444,0	30,0	740
Venezuela	4,403	101,575	23,0	91,098	—	730	—	180	240,0	32,8	125
Totals	64,174	1,584,134	(2) 24,7	2,004,060	—	62,099	—	(2) 967	8,294.9	(2) 13,4	25,037

(1) Excluding the Antartic region.
(2) Averages.

APPENDIX B

Latin-American imports of fertilizer materials for agriculture and industry, 1937-1948

Fertilizers Imported by the Latin American Countries During the Period 1937-48

In metric tons

COUNTRIES	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948 (d)	Total of each country 1937-47
Argentina	4,325	5,685	5,148	4,108	5,673	8,212	10,718	14,072	29,979	14,926	34,448 d)	27,730	137,294
For agric. purposes (a).	2,600	3,960	2,449	2,907	3,783	5,244	5,413	9,149	25,063	8,559	24,004	22,544	92,730
Bolivia	121	67	127	106	172	325	188	236	127	173	191 d)	197	1,833
For agric. purposes (a).	121	67	127	106	172	325	155	167	54	79	134	61	1,502
Brazil	62,615	48,101	60,200	41,628	37,736	36,950	20,864	54,939	82,830	83,788	147,431	39,838	677,082
For agric. purposes (a).	53,174	40,415	45,095	20,380	30,057	25,778	6,626	41,370	72,693	72,202	132,168	27,834	545,952
Chile	6,966	10,474	7,204	178	363	724	153	188	305	986	699	—	28,240
Colombia	1,777	1,693	3,436	4,615	3,590	2,318	1,862	1,377	8,095	8,109	9,489	5,019	46,361
Costa Rica	4,500 b)	3,324	4,220	5,812	7,584	4,030	2,872	5,111	3,518	5,067	9,267	7,322	55,305
Cuba	48,000 b)	32,000 b)	30,377	23,681	48,529	38,699	35,202	64,237	66,845	75,968	92,922	31,168	556,478
Dominican Rep.	109	274	585	187	158	139	182	456	2,414	2,390	3,391	158	26,778
Ecuador	s/d	46	42	72	62	242	78	339	61	532	243	793	1,782
El Salvador	1,634	791	1,524	42	2,769	761	3,720	1,884	4,500	2,572	6,581	1,789	10,285
Guatemala	1,653	2,811	2,601	2,675	3,586	1,257	721	5,130	4,645	4,095	9,411	3,928	38,615
Haiti	7	13	8	16	43	218	272	14	27	12	33	—	663
Honduras	s/d	8,464	s/d	s/d	8,548	552	515	14,938	4,206	10,057	10,952	4,670	58,232
Mexico	15,338	12,315	15,638	12,144	19,254	8,419	21,175	14,892	21,251	15,360	24,453	19,252	180,239
For agric. purposes (a).	13,628	10,902	12,451	8,946	12,917	163	11,079	8,718	16,202	9,803	17,511	10,721	122,321
Nicaragua	19 c)	4 c)	21 c)	2 c)	—	—	—	—	75	29	29	—	179
Panama	333	482	486	2,294	1,459	1,535	232	2,772	2,431	3,064	3,904	1,340	18,994
Paraguay	14 d)	—	—	1 d)	—	—	7 d)	8 d)	22 d)	8 d)	—	2	60
Peru	28,874	12,906	17,297	7,361	6,702	31,225	40,328	26,100	32,362	44,517	44,046	25,506	291,718
For agric. purposes (a).	28,874	12,906	17,297	7,361	6,702	31,225	40,328	26,100	32,362	44,104	41,896	24,156	287,158
Uruguay	193	1,278	258	304 d)	1,755	3,035	4,120	169	445 d)	1,424 d)	5,964 d)	320	18,945
For agric. purposes (a).	193	1,278	258	304	1,755	2,899	3,988	79	184	804	3,268	170	15,010
Venezuela	1,116 c)	1,461 c)	2,710 c)	3,011 c)	1,414 d)	1,677 d)	3 d)	1,196 d)	1,210	1,278 d)	2,312 d)	1,314	17,388
TOTAL	177,595	142,189	151,882	108,237	149,367	140,318	143,216	210,939	265,348	277,060	406,797	170,346	2,166,323
TOTAL USED FOR AGRIC. PURPOSES	170,717	131,366	130,891	82,590	133,055	117,776	113,408	186,108	244,831	249,734	368,244	142,989	1,926,005

(a) excluding the nitrate used for industrial purposes during the corresponding years.
(b) estimates
(c) Nitrogennus fertilizers only.
(d) Chilean nitrate only.

APPENDIX C

Irrigation and irrigation projects in Latin America, 1948

Countries	Present irrigated area		Current programmes (1949–1952)									Other proposed projects				
			Projects under construction					Projects not yet commenced								
			No.	New area	Improved area	Cost		No.	New area	Improved area	Cost		No.	New area	Improved area	Cost	
	Thousand hectares	Per cent cultiv. area		Thousand hectares	Thousand hectares	Millions of nat. cy.	Millions $US		Thousand hectares	Thousand hectares	Millions of nat. cy.	Millions $US		Thousand hectares	Thousand hectares	Millions of nat. cy.	Millions $US
Mexico	2,000.0	27.0	48	721.0	66.0	1,000.0	144.0	3	60.0	–	116.0	16.7	–	–	–	–	–
Guatemala	10.0	1.0	–	–	–	–	–	–	–	–	–	–	1	16.0	–	5.0	5.0
El Salvador	3.0	0.4	–	–	–	–	–	–	–	–	–	–	[b]	3.0	–	[b]	[b]
Honduras	20.0	5.3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Nicaragua	2.0	0.4	–	–	–	–	–	–	–	–	–	–	[b]	2.0	–	[b]	[b]
Costa Rica	13.0	3.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Panama	8.0	4.6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cuba	60.0	3.7	–	–	–	–	–	–	–	–	–	–	13	32.0	–	[b]	[b]
Haiti	40.0	9.5	4	6.0	–	[a] 4.5	[a] 0.9	1	27.0	–	20.2	4.0	10	30.0	–	22.5	[a] 4.5
Dominican Rep.	85.0	19.8	[b]	21.0	–	[b]	[b]	[b]	54.0	–	[b]	[b]	[b]	[b]	[b]	25.0	25.0
Venezuela	100.0	12.5	4	24.0	–	39.0	11.6	–	–	–	–	–	5	580.0	–	[a] 940.0	[a] 280.0
Colombia	[c] 7.0	0.3	4	12.0	–	[a] 4.8	[a] 2.7	3	30.0	–	10.0	5.7	7	130.0	–	[a] 52.0	[a] 29.7
Ecuador	[c] 5.0	0.6	3	41.0	–	62.0	4.6	–	–	–	–	–	2	64.0	–	[a] 98.0	[a] 7.3
Bolivia	12.0	3.5	2	9.0	–	149.0	3.5	–	–	–	–	–	14	125.0	–	[a]1,250.0	[a] 29.5
Peru	1,200.0	80.0	2	25.0	53.0	65.0	10.0	–	–	–	–	–	15	475.0	227.0	1,140.0	175.0
Chile	1,250.0	45.4	8	67.0	146.0	[e] 540.0	[e] 17.4	2	32.0	–	200.0	6.4	59	488.0	62.0	3,425.0	110.0
Brazil	126.0	[b]	1	[d] 7.0	–	[b]	[b]	3	61.0	–	[b]	[b]	[b]	[b]	[b]	[b]	[b]
Paraguay	12.0	3.6	–	–	–	–	–	[b]	63.0	–	[b]	[b]	–	–	–	–	–
Uruguay	70.0	4.7	[b]	27.0	–	6.5	3.4	–	–	–	–	–	6	100.0	–	25.0	13.0
Argentina	1,000.0	4.3	Programme for irrigation of 1,675,000 hectares at a cost of $542,000,000 ($145,000,000) was commenced 1947. Nine small projects to be finished by 1951.														
Total	6,023.0	9.7	80	950.0	265.0		198.1	12	327.0	–		32.8	132	2,045.0	289.0		679.0

Note. Totals do not include Argentina, except for the present irrigated area.

– Indicates no project, or believed to be no project.

[a] Specific costs for these projects are not available. This figure is based on what is known regarding average costs per hectare in the country.

[b] Indicates data lacking.

[c] Refers only to the areas irrigated by national works.

[d] Refers only to Rio Grande do Sul.

[e] Includes estimate for that part of the cost of one large project which is not being borne by the Departmento de Riego.

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