

**FINAL REPORT OF THE
UNITED NATIONS ECONOMIC SURVEY MISSION
FOR THE MIDDLE EAST**

An Approach to Economic Development in the Middle East

PART II. THE TECHNICAL SUPPLEMENT



**UNITED NATIONS
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Note. For convenience in handling and consultation, the Report of the Economic Survey Mission for the Middle East is published in two parts:

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Part II. The Technical Supplement.

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FOREWORD AND ACKNOWLEDGMENT

The Economic Survey Mission has drawn its conclusions and tested many of its ideas from direct observation and exchange of views with the Middle East Governments. There was also available a vast body of literature developed by previous government missions, private firms, and investigations and reports by English, French, American and the Middle East Governments. In addition, many studies and reports of the Mission's experts in agriculture, engineering, finance and economics provided the factual foundation of the work of the Mission.

The staff of experts attached to the Mission was not large, nor were all of these available for the complete period of the three months devoted to field study in the Middle East countries. As each part of the scheduled investigations was reached, the Mission brought appropriate experts into the field for the duration of the special assignment for which they were retained. The observations and contributions of each were then integrated into the knowledge and thinking of the Mission in one way or another and thus added their valuable quota to the basis upon which the Mission's judgments, ideas, impressions and proposals rest.

The work of the Mission divided itself into two periods. Because the funds for the relief of Arab refugees were soon to be exhausted, the Economic Survey Mission was asked to make an interim report on this crucial problem in time for it to be considered by the United Nations General Assembly. The interim report was transmitted on 8 November 1949, and on 8 December 1949 the General Assembly approved a resolution implementing the essential elements of the Mission's interim proposals.

In the course of the investigations necessary for the interim report, and subsequently, the Mission and its staff also developed information relating to the need and feasibility of long range economic development in the Middle East, which the Mission has felt will prove to be its most important assignment. This second phase of the Mission's work is introduced in the interim report, but only as a prelude to this, the final report.

The experts attached to the Mission were organized around four general subjects: analysis of

the social and economic problem of the refugees, agricultural development, engineering development, and finance and economic analysis.

In each field the Mission relied principally upon a general consultant, with whom were associated several special consultants.

Sir Herbert Stewart, Agricultural Adviser to the British Middle East Office, Cairo, headed the staff for agricultural development. Associated with him for varying periods were Dr. Robert E. Buchanan, Director of Iowa State Agricultural Experiment Station and Dean of Iowa State College of Agriculture and Mechanic Arts (retired); Dr. Lawrence E. Kirk, Chief, Plant Industry Branch, Agricultural Division, Food and Agriculture Organization, Washington, D.C.; and Dr. Afif Tannous, Agricultural Economist (Regional Specialist for the Middle East), Office of Foreign Agricultural Relations, Department of Agriculture, Washington, D.C. The report on agriculture presented in the Technical Supplement is the product of this group, as are the appendix materials on agricultural projects for work relief.

Mr. William L. Voorduin, Chief Hydraulic Engineer, Gibbs & Hill, Inc., New York City, and formerly with the Tennessee Valley Authority, headed the engineering development staff. Associated with him were Mr. Frank F. Haigh, formerly President of the Irrigation Development Commission, Iraq; Mr. Van Court Hare, Office of the Chief Engineer of Tennessee Valley Authority, Tennessee, U.S.A.; and Mr. William H. Nalder, Chief Designing Engineer, U.S. Bureau of Reclamation, Denver, Colorado, U.S.A. The report on engineering development presented in this technical supplement is the product of this group, as are the appendix materials on engineering projects for work relief.

Mr. Royall Tyler, representative in Europe of the Treasurer of the International Bank for Reconstruction and Development, headed the staff for finance and economic analysis. Associated with him were Mr. Sidney Sherwood, Secretary of the Export and Import Bank, Washington, D.C.; Mr. Charles A. Coombs, Senior Economist with the Federal Reserve Bank of New York; and Dr. John Murray, Statistical Adviser, British Middle East

Office, Cairo. The appendix materials on economic and financial problems are the product of this group.

Mr. Dillon S. Myer, President, Institute of Inter-American Affairs, United States Government, served as General Consultant on refugee problems. Associated with him were Mr. H. Rex Lee, Assistant Director, Division of Territories and Island Possessions, United States Department of the Interior, and several other assistants. The work of this group was completed with the Mission's interim report.

The members of the Mission express their appreciation to the Secretary-General of the United Nations, through whom both these experts and a competent staff from the permanent Secretariat were placed at their disposal.

The heads of the Mission, the Chairman and the Deputy Chairmen, and particularly the Chairman, bear and assume full responsibility for the state-

ments, conclusions and recommendations of the Mission contained in the main texts of the interim and final reports. The Mission acknowledges, with gratification, the competent work of the expert staff and all who assisted the Mission in its work.

The contents of this technical supplement are commended to the study of those who have in their hearts and minds the present and future welfare of the Middle East. In addition to these reports, a substantial body of valuable working papers has been developed from first hand investigations and observations; these materials are to be in the hands of the United Nations.

To the Governments of the Middle Eastern countries, the Secretariat of the United Nations, the many chiefs and staff of Missions of other Governments represented in the Middle East, and to many others unnamed, the Economic Survey Mission expresses appreciation for helpful co-operation.

SECTION A

AGRICULTURE IN RELATION TO THE ECONOMIC DEVELOPMENT OF THE MIDDLE EAST

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Introduction

This report deals with the long-term agricultural development of the Middle East. It endeavours to convey, as briefly as possible, a general idea of the agriculture of the region, the conditions under which this age-old vocation is being practised today, the handicaps which have restricted its development so far and those which will continue to limit its progress in the future, the main directions along which improvement is thought to lie and the steps towards development which have been planned or are in execution by the several countries within this area. It also indicates the

nature and (where possible) the degree of outside assistance which some authorities believe to be essential if appreciable advancement of these territories is to be achieved within a reasonable period of time.

For the purpose of the report, the Middle East may be considered, territorially, to include the Kingdoms of Iraq and Jordan, with which, for convenience, may be included Arab Palestine, the Republics of Syria and the Lebanon, and the newly created State of Israel.

Each of these countries, except Iraq, has been visited in turn—most of them more than once—by the agricultural consultants of the Economic

Survey Mission: agricultural conditions have been observed during tours covering some hundreds of miles in each of them: reports have been studied: operations in the field have been seen: consultations have been held with members of the Governments, heads and senior officers of the departments concerned: plans have been examined where they exist: projects which have not yet reached the blue print stage have been discussed.

A full statement of the data which have been collected and the details which have been obtained would necessitate a report of dimensions far exceeding the limits suitable to the present occasion. In consequence, this report is intended to present a general picture rather than a detailed analysis of the position of agriculture in the region. The basic data—in some cases in considerable, though often rough, detail—will be retained for later use and assistance whether in planning or in execution, as and when occasion should arise.

Whilst each of the countries in the region has its own special peculiarities and problems, to many of which it alone can find the solution, conditions and circumstances, climatic, agricultural and otherwise, throughout the area as a whole, show remarkable similarities. Many of the forces with which the farmer has to contend are common everywhere: there is a universal lack of knowledge of how best to overcome them or turn them to the common good: with a few notable exceptions, skilled technical personnel is either non-existent or all too inadequate for the acquisition of the information without which the cultivator cannot be guided to better cultural practices and systems than those followed by his forefathers: the financial expenditure, almost throughout, on agricultural improvement is infinitesimal in relation to that on other activities of Governments and out of proportion to the importance of the agricultural industry not only to the advancement of these countries but even for their survival.

It will be convenient, therefore, to state in brief and general terms, at the outset, some of the major common factors which apply to the whole region, irrespective of national boundaries, and which are

responsible for the present backward condition of its agriculture. Thereafter, when considering each country individually, note will be taken of the main departures from the general position, the special problems which exist and the steps either actually being taken or in contemplation to deal with them.

The agricultural consultants of the Economic Survey Mission for the Middle East desire to place on record their great appreciation of the intense collaboration which they received in each of the countries visited by them. The time and services of members of the Governments, heads of departments and all departmental staff likely to be of assistance were always at their disposal. No effort was spared to enable the consultants to study conditions in the field in any important, even if remote, part of the several territories. No expenditure of time and no trouble were considered too great to provide available information or to prepare data not immediately to hand. Without that whole-hearted co-operation the presentation of this report in its present form would not have been possible.

CONVERSION RATES

All the countries to which this report relates use the same unit of land measurement—the dunum. Each, however, has its own currency. Where it has been desirable to convert them to a common value the dollar has been used. The conversion rates which have been applied are:

- 1 Palestinian pound (£P) = 2.80 dollars;
- 1 Israeli pound (£I) = 2.80 dollars;
- 2.185 Syrian pounds (£S) = 1 dollar;
- 2.185 Lebanese pounds (£L) = 1 dollar;
- 1 Iraqi dinar (ID) = 2.80 dollars.
- 1 dunum of land = .25 acre = .1 hectare.

Whilst the Syrian and Lebanese currencies have been converted at their official rates, it has to be noted that free market rates more favourable to the dollar exist. They are 3.15 and 3.35 Lebanese and Syrian pounds respectively to the dollar.

I. Present Status of Agriculture in the Middle East

IMPORTANCE

Agriculture is the basic industry of all the Middle East countries with which this report is concerned. It is, in fact, the only industry of importance in these countries, if such a notable ex-

ception as oil in Iraq is omitted. Two-thirds of their population is rural and depends directly on agriculture for a living, whilst most of the remainder are engaged in business dependent on or closely related to agriculture.

2. In view of the almost exclusive position

which agriculture thus occupies in the economy of this region, it is obvious that the increased prosperity of the people and the ability to raise the standard of living must be achieved largely through the promotion of agriculture: it can only attain the highest pitch by the full development and maximum exploitation of that great industry and of the several factors on which it depends.

POSSIBILITIES

3. The surveys which have been made show clearly that the potentials for improvement exist in each country. Only the will to develop, the careful planning of the most suitable lines to adopt, the availability of technical knowledge and skill to investigate, to plan and to execute, and the provision of the necessary finance, are needed.

4. If these requisites are provided and wisely used, there is no doubt that agricultural production can be vastly increased: such small industries as exist can be enlarged: new industries can be created and foreign trade can be expanded. The increased prosperity which will result will ensure to the people higher standards of food, health, education and better social conditions and amenities. For these reasons the full development of its agriculture demands priority in investigation, planning, finance and execution in each country in the region.

RAINFALL

5. Rainfall is of paramount importance to the agriculture of the Middle East for few of its countries yet have largely developed irrigation systems and in some of them the possibilities for irrigation, even if and when fully developed, will always be relatively small. Nature, however, showers this greatest of all blessings to agriculture, in this region, with rather a stinted hand. Except in the high mountains, few areas obtain an average annual rainfall of 750 mms. (30 inches). Over most of the territories it is very much less and eventually tails off together into the eastern and southern deserts. Cultivators pursue their cropping to the absolute limit possible, for it is not unusual to find an area sown to crops which normally can expect to receive no more than 200 mms. (8 inches). Beyond the limit of cultivation, grazing, particularly by sheep and goats, is practised till even that fails as the rainfall diminishes and only sheer desert remains. Seasonally too the rainfall is badly distributed for it is all received during the winter months whilst the remainder of the year from April to October is hot and rainless.

6. These semi-arid conditions make crop production precarious over large areas, and greatly restrict the crops which are grown. In the case of field crops and in the absence of irrigation, the adoption of a two years' rotation is customary. Within this period one winter and one summer crop are obtained. Further, in the low rainfall areas, or following an exceptionally dry season, even this intensity is not possible and, in order to conserve enough soil moisture for crop production, only two crops in three years are possible. In such circumstances the conservation of rainfall moisture in the soil is of supreme importance to successful farming. Far too little attention is paid to it and, though occasionally in sloping and hilly tracts excellent examples of soil and moisture conservation measures by terracing and afforestation are to be found in most of the countries, the practice needs adoption on a very much wider scale in all of them.

SOIL

7. Most types of soil from light sands to heavy clays, according to location and formation, are to be found in the region. In general the soil is not infertile and, under irrigation or adequate rainfall and good cultivation, it generally produces fair crop yields. Indeed, the capacity of most soils, which now are barren because of the dry conditions which maintain, to produce a crop when sufficient moisture can be provided is remarkable. In some areas the soil is characterised by salinity, sometimes marked, due to the presence of certain salts, mostly sodium chloride and sulphate.

8. Soil erosion is a common feature of the landscape and comparatively little has been done to check its ravages. In extreme cases whole hillsides have been eroded down to the bare rock. In this destruction of the region's most valuable asset, the soil, nature has been assisted liberally by man and beast throughout the ages; the former by his inefficient and harmful cultivation practices and by his destruction of trees for fuel, the latter by consuming forest growth and vegetation through uncontrolled grazing.

9. This gloomy picture is relieved, however, by the fact that the countries are becoming more soil-minded and are realising something of the value of the heritage which is being allowed to waste. Most countries have afforestation programmes in operation, not only in the hills but in fuel areas in the village; all have forest reserve areas; some have introduced laws and regulations controlling the keeping and movements of the goat. Again, in most of the countries excellent examples are seen

of land terracing: some Governments encourage its extension by the award of prizes. Nevertheless, what has been done and is being done now is no more than a beginning. The scope and need for soil conservation measures by both afforestation and terracing is almost unlimited and cannot be overtaken for decades if operations merely continue at the present pace.

CULTIVATION

10. In general, farming is still practised by primitive methods and with primitive equipment. The wooden plough with iron-shod point of biblical times is still the principal, and often the only, implement of cultivation. The grain is separated from the straw and the latter crushed and broken by treading out with cattle assisted by the *norag*, which they drag behind them. To this general statement there are exceptions of some magnitude. Difficulties of procuring food supplies from outside sources during the last war necessitated a drive for increased internal production. This was secured through the cultivation of large areas by tractors and power-drawn implements and machines, including harvesting by combines. Thus, the countries have become mechanically minded. During the years which have intervened since the war, the urge for more and more tractors and machines has gained in intensity so that the degree of mechanized agriculture which has been achieved up-to-date has been conditioned more by non-availability of adequate equipment and the difficulties of procuring sufficient dollars, rather than by the will and intention to mechanize. Yet, in spite of these handicaps, some thousands of tractors are in operation today throughout the region and each year witnesses an increase in their numbers by additional hundreds.

FERTILIZATION

11. The application of manures of any kind to the soil is extremely limited in scope and is confined to special areas and crops. Farmyard manure is largely consumed as fuel not only because of age-old custom but also of the general lack of any other suitable fuel ready-to-hand. In general, the use of chemical fertilizers is very restricted, though the demand for certain classes of fertilizer is steadily growing. There is, however, over most of the region, an almost entire lack of knowledge of the economics of manuring under the conditions which prevail locally, and extensive field experiments, scientifically conducted, are essential before any sound programme of fertilizer utilization can be drawn up.

IRRIGATION

12. Considered as a whole, the area of land under irrigated farming in the region is small at present and the opportunities for developing irrigation from surface supplies are variable. Irrigated land is largely devoted to fruit and vegetables and is very productive. Apart from the great rivers of Iraq, the Tigris and the Euphrates, which already cater for some millions of acres of irrigated farming, but which are capable, if fully developed, of serving several million acres more, the rivers in the region are relatively small. If harnessed for irrigation, however, their combined effect on the prosperity of the area could be considerable. In the series of mountain ranges in the other countries the rainfall which is received, at the highest altitudes, provides water in streams, wadis and perennial springs and is available for cultivation. Many of these sources have been partially, and in some cases largely, utilized in crop production. Many of the larger possibilities have not yet been fully exploited and many catchment areas are capable of development by the construction of dams and by other means. Sub-surface water supplies also exist in various localities but so far, except in Israel, they have not been extensively explored, nor are those which are known to exist being fully utilized.

13. There is, however, in the region a consciousness, which is gaining momentum, of the potentialities which the various sources of water possess, not only for soil irrigation but for hydro-electric power, and of the economic benefits which would result from their full utilization. Several small projects are under construction already. Plans for other major irrigation works which are completed or under preparation or technical examination will exercise a marked effect on the economy of some of these countries if their execution proves economically feasible and can be financed.

CROPS

14. The main field crops under rain-fed conditions are wheat, barley, and legumes in the rainy, winter season and durra (sorghum), sesame and melons in the dry summer months. The latter are produced entirely on the residual soil moisture from the winter rains. These crops constitute about 90 per cent of the field crops in the region. Amongst unirrigated fruits, olives, grapes and figs are grown extensively, especially on terraced land, in several of these countries: other fruits also find a place but to a much lesser degree.

LIVESTOCK

15. Sheep and goats are by far the most important domestic animals in the Middle East as a whole. They are reared for wool, meat and skins. In addition, they constitute the main source of supply of the milk and dairy products of the people. Cattle are relatively few in number. Their principal use is for work; in the neighbourhood of towns they are of importance as suppliers of milk and its products. The donkey is the common beast of burden though the camel also is important in some areas of the region.

16. Livestock rearing has two main aspects, that of the settled cultivator and that pertaining to the nomadic and semi-nomadic tribesmen. In the former case emphasis lies on cattle breeding for work, with relatively few sheep and goats. On the other hand, the nomads concentrate on the rearing of sheep which constitute probably 80 per cent of the animals held by Bedouins: the remainder consists of goats and camels in roughly equal proportions. Bedouin flocks do not necessarily belong exclusively to these nomads themselves. Often there is an owner-partnership or hiring arrangement between them and city merchants.

17. The preponderance of sheep and goats in the region is a natural result of local conditions, particularly in regard to fodder and drinking water supplies. Cultivated fodders are rare except in those limited areas where they are produced in pursuance of a mixed farming policy. Otherwise, fodder supplies are seasonal and irregular, since they are dependent on rainfall. This irregularity is responsible for the migratory customs which are a feature of livestock production in the region. Natural pasturage is available in winter and spring in very large tracts of country which lie between those areas where rainfall is sufficient for crop production and the vast barren deserts where it tails off altogether. Flocks follow this pasturage and when it becomes dried up and exhausted by the heat of summer, they withdraw to the cultivated areas where they subsist on the stubble of harvested crops and such other vegetation as may exist on fallow lands. Similarly, extensive migration takes place between the high mountain pastures of certain regions and the coastal and central plains in others.

18. The problems of animal husbandry are three-fold and relate to health, nutrition and improvement by breeding. Such limited work as the small veterinary organizations in most of the territories permit is centered mainly on the prevention and treatment of disease. Stock owners have become conscious of the value of inoculation

which has reduced the incidence of certain diseases which formerly caused serious losses. Some countries have already set up their own laboratories for the preparation of vaccines and sera, whilst others propose to do so as soon as necessary funds are available.

19. Nutrition is one of the major limiting factors in livestock development in the whole region and the possibility of improving the natural grazing areas is a matter requiring very early investigation. Conditions are far from ideal for, apart from the difficulty of exercising control and introducing rotational grazing in the vast areas involved, the seasonal and sparse nature of the rainfall make the survival of many of the best known grasses, if introduced, problematical.

20. Drinking water in the grazing areas provides another problem as its absence restricts the range of country over which grazing can be done and its inadequacy shortens the length of the grazing season. There is a limit to the distance from a drinking site which flocks can travel. Some countries have proposals for the excavation of earthen tanks suitably sited in the grazing areas to catch and store some of the run-off rainfall. It is thought that by this means the range of the grazing area can be increased and the grazing season lengthened.

21. Livestock improvement by selection and breeding is a long-term activity which no country has yet tackled seriously and for which few, if any, have the necessary technical staff and facilities.

SHORTAGES AND SURPLUSES

22. Whilst the Middle East is mainly a cereal producing region, the distribution of the cereals within it is uneven. Thus, under normal conditions, Iraq has a considerable annual surplus of barley and dates but in unfavourable years has to import wheat. Syria, its neighbour, on the other hand, has a large exportable surplus of wheat every year. Lebanon is short of wheat, barley and rice but has surplus potatoes, vegetables and fruits. Transjordan imports rice but produces small surpluses of wheat and other food grains. Israel's imports of wheat and other food grains and feeding stuffs involve the expenditure of many millions of pounds annually but it has had in the past, and hopes to develop again in the future, a large export trade in citrus fruit. In the region as a whole there is an over-all deficit in food grains but a surplus of pulses. Sugar is not produced anywhere on a scale of importance and, consequently, all countries have to import their requirements. Most countries have both an export and an import trade in livestock.

On balance, Transjordan and Lebanon are importers, Iraq an exporter of most classes of domestic animal other than sheep which it imports, whilst Syria exports sheep and camels but imports other classes.

TECHNICAL KNOWLEDGE, FACILITIES AND NEEDS

23. Research is the keystone and education the superstructure on which must be built up improvement in the conditions described in this general account of the agriculture of the Middle East. Both are indispensable requisites to progress; both are fundamental to development. For a proper appraisal of their capacity to contribute to the early development of this region, it is necessary to give some indication of the present state of technical knowledge in regard to agricultural improvement, and of the organization and facilities available for acquiring new knowledge, and for disseminating it, so as to ensure its full application in everyday agricultural practice. The conclusion is unavoidable that the state of essential technical knowledge is, as yet, immeasurably backward and that the organization and facilities are still underdeveloped to an extreme degree. Almost all Arab countries are equally unfavourably situated in this respect, though the extent to which steps are now being taken in them to remedy such a serious handicap to progress varies.

24. None of these countries has provided adequate facilities in either the field or the laboratory for essential research in the more important aspects of science applied to agriculture; none has a properly balanced educational system agriculturally; none has an effective extension service; no country incurs an annual expenditure, on the promotion of agriculture, bearing a reasonable relation to the importance of the agricultural industry in the national economy or to the expenditure on other activities of the State. All countries are, in fact, only in the earliest stages of scientific development agriculturally.

25. Nevertheless, all countries have substantial projects for the improvement of agriculture and, though many of the plans may not yet be in the blue-print stage, a measure of progress is being made in some directions. There is a growing recognition of the fact that the application of science is a fundamental requirement of any broad programme of agricultural development, and that there is a great lack of basic information without which the standard of living of the rural population cannot be materially improved. It is also recognized, though perhaps less clearly, that these deficiencies cannot be made good without research

facilities, educational opportunities and effective means for translating available information into farm practice. It is precisely in respect of these deficiencies that the plans of Middle East Governments for economic development will encounter the greatest difficulties.

AGRICULTURAL RESEARCH

26. Agricultural improvement cannot proceed very far without fundamental and applied research. The significance of this fact, in relation to economic development in the Middle East countries, becomes apparent when one considers the paramount importance and present state of agriculture in this area. Accurate information is the essential basis of all sound development and this applies with particular force to a very wide range of factors affecting agricultural prosperity. They include such subjects as maintenance of soil fertility, introduction and testing of new crops and varieties, improvement of field and horticultural crops by selection and breeding, cultural practices, crop rotations, plant protection, adaptation and efficient operation of tractors and farm implements, conservation and utilization of water resources, soil conservation, agricultural statistics, feeding and management of livestock, control of animal diseases, and marketing of agricultural products. In fact, the level of agricultural efficiency may be expected to correspond rather closely with the status of sound knowledge which has been acquired through painstaking investigation of agricultural problems.

27. All Middle East countries have several agricultural stations or centres that are owned and operated by Governments. Some farms are located where water is available for irrigation. Theoretically, the functions of these farms include experimentation and demonstration. Actually, with few exceptions, they operate almost exclusively as nurseries for the propagation and distribution of fruit trees, often forest trees and sometimes selected seeds.

28. A central research station on which to conduct investigations in all phases of agricultural production and marketing is a basic necessity for every country. Such an institution must be adequately supplied with land, laboratories, buildings and physical equipment. The choice of the most suitable location is a matter of the greatest importance. Associated with the central station, experimental sub-stations should be established in the major soil-climatic zones of the country.

29. Having recognized the need for research and provided the necessary facilities, the most im-

portant step remains to be taken, that of securing an experienced director for the research centre, and a well-qualified staff of investigators to head each of the major departments. The primary consideration is the quality of the research and this depends essentially on the competence of the staff. Qualified men to occupy the key positions are seldom available at present in the Middle East countries where research institutions are most urgently needed: initially they must be obtained from abroad. Moreover, such institutions are expensive to establish and maintain. It will probably be necessary, therefore, for Governments to make a modest beginning, giving priority to the most urgent aspects and problems and then expanding the scope of the investigations as finances, and the availability of technical personnel, permit. But the importance of giving very high priority to the provision of essential research facilities should be recognized by, and should receive the earliest possible consideration of, the Governments of this region.

AGRICULTURAL EDUCATION

30. Opportunity for agricultural education is another major factor which helps to determine the standard of living of the rural population. Just as research lays the basis for an efficient and prosperous agriculture, so educational facilities provide the means through which knowledge becomes a potent force for agricultural improvement and more satisfactory living conditions.

31. Little provision has been made in Arab countries until recently for theoretical and practical training in agricultural or domestic science for young people. This applies at all levels from elementary schools to institutions of college standing. There is the desire on the part of all Governments to remedy this situation and some progress is being made. In general, however, the present facilities for agricultural education tend to be too stereotyped and not sufficiently diversified. There is too great concentration on one type of education to the exclusion of other obvious needs.

32. The agricultural education system in an essentially agricultural country should cater for needs of different kinds and for training of different standards. It must cover all stages from the elementary school to the specialized university. This does not necessarily mean that every small country should provide, within its own frontiers, specialized training of the highest class. It may be, and often actually is, more economical and more efficient either to unite with, or to utilize the facilities already available in, an adjoining terri-

tory for education of university or even somewhat lower standard. For the less advanced types of instruction, however, each country should be self-contained. Agricultural education has, therefore, to be considered from different angles.

(a) Rural elementary schools

33. It is usually considered now, in Eastern countries, that the teaching of nature study and elementary agriculture should form an essential part of the curriculum of the higher classes of rural elementary schools, and that agricultural development can be accelerated by imparting, to the young, an elementary knowledge of the functions and processes of the plant and animal life by which their home life is surrounded, and of ways and means by which modern methods and improvements can be introduced into their own farms. This is done by visual and practical demonstrations on a small school farm or garden, rather than by intensive theoretical reading.

34. Some Middle East countries have already introduced this type of education: others have not yet done so. Some schools have the necessary small farms or gardens; others have none. The staffs of some schools include teachers suitably trained in this specialized aspect of education; in other schools such teachers are lacking. The importance to an agricultural country of starting the future farmer on right lines and principles is so great that this very important aspect of education should no longer be neglected. Countries which already have made a beginning should intensify effort till it is a part of the curriculum of every elementary school and the necessary facilities in land, equipment and qualified teachers are provided. The earliest action should be taken to introduce such education in those countries which have not yet given it a place. Opinion is now divided as to the advisability of continuing such instruction in high or secondary schools since the majority of the students of those schools do not return to the land, but seek their future in business or the professions.

35. In this connexion, the training of teachers of nature study is of great importance and the existing arrangements in these countries are not always adequate. When this subject does not form an integral part of the initial training of elementary school teachers it can probably be best provided by a subsequent special course of one year's duration at an agricultural college or other suitably advanced vocational school.

(b) Vocational schools

36. The position regarding agricultural schools in the different Arab countries varies in that the courses given are of three years' duration in some and cover two years in others. One country has opened its first agricultural school in the current month. Every country in the region now provides an education of this standard to a greater or lesser extent. In all cases the course of instruction is intended for boys who, on its conclusion, will return to the land. It does not, in general, qualify for government service.

37. There is need for avoiding what appears to be a tendency to have too many agricultural schools of the same mediocre class, giving one standard of education, rather than to provide one first class institution or a few good schools giving a variety of courses. Every student does not necessarily require a two or a three years' course in general agriculture. There is room and need for instruction, through short courses of one to six months duration, in specialized aspects of agriculture such as farm machinery, blacksmithy, dairying, poultry keeping, fruit drying and preservation for home consumption, bee-keeping, farm management, etc., etc. The educational system should also be such as to provide for the education and training of the various grades of subordinate staff of agricultural and allied departments.

(c) Higher agricultural education

38. Whilst some countries have taken steps in recent times to improve the standard of education given in some of their agricultural schools, no institution, outside Israel, has yet attained the status of an agricultural college where instruction of senior diploma or degree standard is provided. The need for such a college clearly exists, particularly for the training for the higher ranks of departmental subordinate staff, and if the financial resources of a given country are inadequate for the provision of such a facility, joint action by two or more countries to establish a common college is most desirable. On the university level not every country needs separate provision nor can afford it, and obviously the aim should be for one such institution within the region to cater for the common need. If the proposal now under consideration in Syria to constitute a faculty of agriculture in the local university should materialize, some of the other adjoining countries may be able to make suitable arrangements for the admission of their nationals to it.

39. For higher specialized education of the post-graduate type, foreign study will be necessary

for some years to come. Several countries already provide scholarships and send students abroad for both post-graduate specialization and technical education of degree standard.

EXTENSION OR ADVISORY SERVICES

40. Extension is essentially an educational activity which carries to the farm the findings of scientific investigation and presents the information in a form which the farmer can grasp and assimilate. Experience has shown that the most effective medium through which the results of research find practical application is a well organized department or division of advisory services.

41. In most Middle East countries there is no special department or bureau of extension in the Ministry of Agriculture. In fact, the role of extension as an independent technical activity has been officially recognized only recently by one or two countries. There are no agricultural specialists working as extension experts, although all countries have agricultural officers whose chief function is to administer government regulations and to undertake special assignments which often involve compulsion in applying government controls, thus greatly weakening their position as servants of the farmer.

42. Some extension work is being done, however, although by rather haphazard methods. On occasion, officials of the Ministry of Agriculture, along with their field representatives, extend help and advice to farmers in connexion with various agricultural problems. This aid is directed mainly to the control of insect pests and animal diseases and to the distribution of seedlings of fruit and forest trees from government nurseries. There is little, if any, demonstrational work, although farmers sometimes visit the nurseries to observe and learn what they can. A limited amount of good seed is distributed, including seed of improved varieties. Occasionally a leaflet or pamphlet is published, and distributed in limited quantities to farmers.

43. Even if the present technical staff wished to engage in serious extension activities, they would find it practically impossible to do so. They are few in number relative to the needs of the country and most of them are not specially trained in the principles and techniques of extension. On the other hand, the educational functions of the existing small field staff are often hampered by special tasks such as the protection of forests, the examination of agricultural disputes, the submission of reports on crop conditions and the organization of farmers to combat insect pests and diseases.

44. In Lebanon and Syria a few private agencies have been doing some excellent extension work in rural areas for a number of years. The scale of these operations is too small and funds for extending the work are not available. The results, however, provide a valuable object lesson in what can be achieved if and when Governments should decide to discharge, on a country-wide basis, their obvious responsibility in this direction.

45. Extension work requires the services of men who are specially trained in the techniques not only of such work but in that of production, marketing and the social sciences. The ultimate standard by which extension measures its achievement is not whether this or that practice has been adopted by the villager, important as this may be, but whether, because of its adoption, he has become more prosperous, healthier, happier, and a better citizen. It is necessary, therefore, to point out not only the urgent need for extension services in Middle East countries, but also the qualifications which should characterize members of the field staff who engage in this specialized work. Here, as in research and education, Governments will need to take advantage of the very considerable experience which has been gained in foreign countries in the organization of extension services and in the methods which have been found most effective in extension work.

TECHNICAL STAFF

46. Too great emphasis cannot be laid on the absolute necessity of the employment of fully trained and experienced specialist staff in any programme of development which may be contemplated, either in agriculture itself, or in the sciences applied to it, and in whatever aspect, whether investigational, educational, or demonstrative. This requirement is not only essential but urgent. It is also a fundamental need which, at the present time, in some cases, cannot be met at all by the nationals of the Middle East countries themselves, and in others can be satisfied only to a degree infinitesimal in relation to the extent and urgency of the need.

47. If, therefore, agricultural improvement and development is to be undertaken in the near future in the whole-hearted manner which is essential to progress, the countries of the region have no alternative but to endeavour to obtain the temporary services of fully trained and experienced foreign specialists to plan, inaugurate and organize development, in its various aspects, on a sound basis. Meantime selected nationals of the countries should be sent abroad for specialized training.

When they have acquired the requisite experience, after their return, they will be in a position to replace the foreign technicians.

48. Whilst the pressing need at the present time is for highly trained personnel from abroad to provide leadership and guidance and to initiate developments, it is precisely in the satisfaction of this need that the Governments of the Middle East are likely to be confronted with their greatest problems, those of finding experts who are available for service in the Middle East and of meeting the cost of such experts. Everywhere there is a scarcity of highly qualified scientists and technicians. Salaries and allowances are much higher than Middle East Governments are accustomed to pay to their own nationals. Experts who are most in demand usually hold important positions in their home countries, and often either their temporary release is difficult to arrange, or they themselves are precluded from going abroad because of family obligations or other responsibilities. Those who are minded to accept services with foreign Governments invariably expect assurances that conditions of work will be congenial and living conditions reasonably satisfactory. The practical effect of all these considerations may be to limit the number of experts from foreign countries who are eventually employed, unless special steps are taken. Any such obstacles would seriously retard those developments which are most essential to the economic advancement of the Middle East.

49. In these circumstances it is considered that it will be necessary to assist Governments in securing the highly qualified personnel whom they need. Financial assistance to meet, at least in part, the cost of the necessary additional specialists may also be required. When considering the various countries individually, an effort will be made to estimate the minimum foreign technical staff whose employment is basic to development.

INDUSTRIAL DEVELOPMENT

50. Whilst agriculture is, and is likely to remain, the basic industry of the Middle East, its efficient development requires the support of other industries subsidiary to and deriving their raw products from it. Such industries too give a more balanced economy and provide employment for the ever increasing population, particularly in areas where already the density is high in relation to the arable land.

51. Already a number of industries, which depend for their raw materials on the products of agriculture, exist in these Middle East countries.

They include olive oil pressing, soap making, fruit and vegetable preservation, wine-making, sugar manufacture, tobacco manufacture, textile manufacture (cotton, wool, silk) and leather tanning. Many of these industries have been developed on a very small scale as yet. Some follow very crude methods; others turn out products of variable and sometimes low quality.

52. If agriculture is developed to the degree of which it is believed to be capable; if the quality of its raw produce is improved to the extent which clearly is possible; if, as is considered feasible, new crops suitable for industrial use are introduced; if, as appears to be most desirable, the agriculture of certain regions is re-orientated along lines more intensive and more profitable than those which it now follows, the Middle East should become a fertile field for the development of industries. Present industries can be modernized and expanded and new ones created. It is by the sound and effective integration of agriculture and industry that this region will reach the greatest prosperity. It is superfluous to add that products must be high class and able to stand competition, both in quality and price, with those from outside countries on the open market.

II. Jordan

In its main features the agriculture of Jordan conforms to the general description given in the preceding chapter for the Arab countries of the Middle East as a whole. It will be sufficient, therefore, to refer here to some of the most important points of detail.

2. Such statistics as are available indicate that, of the total area of 10-12 million hectares in the Kingdom, less than 600,000 hectares, or 5 per cent of the whole, are cultivated. Even this meagre proportion is reached only by the inclusion of areas in which the annual rainfall does not exceed eight inches, a limit which would be considered in many other countries as below the safe minimum for arable farming in the absence of irrigation.

3. Agriculture is almost entirely of the rain-fed type. There are no major irrigation works and no sources of surface water supply of great magnitude for irrigation. The largest rivers in the country are the Jordan and the Yarmouk, and adjoining countries possess interests in the waters of both. Neither river has yet been developed for agricultural purposes, and probably cannot be thus fully utilized until agreement, on an international basis, is reached as to the distribution of its waters between the respective claimants. Such irrigated farming as is practised derives its supplies from

the several wadis which flow through the country westwards, mostly into the Jordan Valley, and from some natural springs in a few inland localities. Estimates place the total area irrigated annually from all such sources at 26,000 hectares, which represents about 5 per cent of the total cultivated area or only .25 per cent of the area of the country.

4. Jordan is essentially a producer of cereals. Its approximate 415,000 acres of wheat and 140,000 acres of barley represent about 85 per cent of the total area under field crops annually. Small areas of sorghum and maize swell the total under cereals slightly more. The area under the various legumes does not reach 100,000 acres. Sesame, the only oil-seed crop in cultivation, does not amount to 4,000 acres. Vegetables attain an area of about 13,000 acres.

5. Fruits occupy an area of about 35,000 acres. Grape-vines and olives constitute about 80 per cent of the whole. The area under the former has decreased alarmingly in the last five years, due to the ravages of phylloxera and, though disease-resistant American root stock is being produced and issued to counter this disease, the rate of production at present cannot even keep pace with the progressive deterioration which is occurring annually. Conditions of soil and climate in many parts of the country are ideal for fruit growing, particularly olives, grapes and figs, and much land which is now being cropped to cereals would give a vastly better return if planted to fruit.

6. Agricultural industries are few and poorly developed. They are represented only by two small factories for tobacco production and three for the manufacture of wines and spirits.

7. Livestock consists mainly of sheep and goats. There appear to be about 250,000 of the former and 300,000 of the latter. Cattle of all ages number about 60,000; donkeys 25,000 and camels 2,500. In an unfavourable rainfall year, when grazing fails, heavy losses in livestock occur. Thus, it has been estimated that in the drought year 1946-47 casualties amounted to 40 per cent in sheep and goats, 45 per cent in cattle, and 50 per cent in camels.

8. In normal years Jordan exports wheat and barley. The amount appears to have varied from 1,000 to 35,000 tons a year during the last five years, depending on the season. Fresh vegetables constitute the next most important export, but do not amount to 5,000 tons in a good year. Sugar is the main annual import. Rice and dates are also obtained from outside sources in considerable quantities. Whilst there is an annual export of

sheep and goats, statistics show that there tends to be a large import of livestock of different kinds. It is not clear whether there is need for these animals internally or whether they are merely passing through in transit.

9. The Agricultural Department is small and inadequately staffed and equipped to handle the many research problems which confront it, or the education and extension in which it must give advice and guidance if agriculture is to be developed on sound lines. Nature study and agriculture find a place in the curriculum of some rural elementary schools, but there is room for a large extension of this important aspect of the education of the rural youth of today who will be the farmer of tomorrow. The first vocational agricultural school is in process of being started. The type of education which it will give is intended to assist those who propose to return to the land. There is no agricultural research institute or even laboratory under the Agricultural Department, nor technical specialist officers to deal with the many problems of plant improvement, field experimentation, soil chemistry, insect and pest control. Nor is there a real experimental station in the country, though the Department possesses several farms which have been used hitherto mainly for the trial of various kinds of fruit trees and for fruit and forest nursery purposes, but some of which are now being developed also as seed farms. Livestock improvement and development is in much the same position as crop husbandry—inadequate technical staff, inadequate knowledge, inadequate facilities to acquire scientific data. Departmental activities are largely confined to matters affecting the health of farm stock.

Arab Palestine

10. The territory known as Arab Palestine, now associated with Jordan, is probably amongst the poorest land in former Palestine. From north to south it consists of a succession of hills. Some have become so eroded that they now are merely bare rock. On others, the soil is so shallow and so patchy that it is a matter for wonder that it is capable of producing cereals even of the standards which grow on it.

11. Agriculture depends largely on rainfall. Except on some wadis in the Jordan Valley and on a few internal springs of relatively small capacity, there is no irrigation. Occasionally in the north there are fertile valleys, which produce excellent cereal crops. Some hillsides, thickly planted with olives, grapes and other fruits, afford practical proof of what the poor soil of this country

can produce when it is properly utilized.

12. The territory north of Jerusalem is much better, agriculturally, than that to the south. A few villages in it are models of land use, with their terraced hill slopes, large areas of olives, apples, pears, plums, peaches, apricots, figs and extensive cereal crops. They give a picture of prosperity in striking contrast to the conditions found in other parts and indicate beyond all doubt the lines along which the future development of that part of the country should be directed. In the south cereal production is the main feature, though the hills around Bethlehem produce olives, figs and apricots, and towards Hebron a large vine-growing country is located.

13. It is against this background that the proposals of the Agricultural Department for development should be viewed.

DEVELOPMENT PLANS

14. The Government of Jordan has recently constituted a Development Board, consisting of: the Minister of Public Works; the Director of Agriculture; the Director of Lands and Surveys; the Inspector of Finance.

The functions of this Board have not yet been defined in detail, nor has it yet met, but it is presumed that all proposals for the economic development of the country will come within its purview.

15. Long-term plans for agricultural development in Jordan and Arab Palestine have not yet been drawn up, but considerable thought has been given to the subject by the Director of Agriculture, who has prepared tentative plans along several lines. His proposals have been discussed in some detail during several meetings in Amman. They cover a wide range of projects, several of which could not be undertaken without outside technical and, probably also, financial help. They include agricultural research, education and extension; production and distribution of improved seed of certain crops, and of fruit nursery stock; expansion of olive cultivation; farm mechanization; animal husbandry; afforestation; agricultural industries and land reclamation. While the Minister of Agriculture participated in some of the discussions and is familiar with some of the proposals, they have not yet been submitted to, or been considered by, the Government. At this stage, therefore, they must be taken to represent the views of the Director of Agriculture alone.

Agricultural education

16. The plan envisages a seven-year programme, and includes the following:

(1) Four residential elementary agricultural schools in different parts of the country for boys who expect to operate their own farms are proposed. The course of two years' duration would aim at training the students in theoretical and practical agriculture. Each school would admit annually fifteen-twenty students who must be at least thirteen years old and have attained an educational standard of sixth primary.

(2) One residential intermediate school giving a two years' vocational course in agriculture to students who have completed the course in one of the four elementary schools is contemplated. This intermediate school would accommodate fifteen-twenty students.

(3) An advanced three years' course following on that of the intermediate school, and eventually an agricultural college are visualized for the future, but they will not be required for at least four years after the other types of agricultural schools have been set up.

(4) Seven Jordan students have been sent abroad this year (1949) to begin degree courses in agriculture. Five have gone to France, and two to Egypt. It is hoped to add to the number next year, and to secure the admission of some students to British and American universities by making timely arrangements.

Technical staff required

The need for a principal for the agricultural college from some outside country is envisaged, but he will not be required for the next four years at least. Teachers of lower grade are expected to be available from ex-Palestinian staff.

Cost

The total capital cost for the execution of these plans is estimated at £P178,000, spread over seven years. The probable annual recurring cost when all schools are fully working is thought to be about £P35,000, against which a revenue of £P17,000 is expected from farms associated with the schools.

Agriculture in elementary and secondary schools

17. Agriculture forms a subject in the syllabus of the last five classes (3rd to 7th) in rural primary schools and of the first two of the four classes in secondary schools. Out of the present eighty rural primary schools, thirty-four have school gardens. It is the policy of the Ministry of Education under which these schools function, to provide more rural schools with school gardens for the

teaching of elementary agriculture by practice and visual demonstration as soon as funds permit, but no target appears to have been fixed so far.

Agricultural research

18. The proposals contemplate the opening of a series of experimental stations and sub-stations in different regions of the country. These stations would deal with research on the various aspects of crop-husbandry, both field and orchard. There would be two main stations under irrigation farming in the Jordan Valley, representing soils of different salt content; one station in the Azrak (a relatively small area in the eastern desert), which it may be possible to develop by irrigation from natural springs; a station in the Wadi Deleil, east of the Amman-Mafraq road, for experiments on fruit-growing under dry farming conditions and four rain-fed stations in the highland (southern) country of the Sheraa to determine the possibilities of utilizing this large uncultivated tract for the settlement of homeless people by developing diversified farming—cereals, fruits and livestock. Justification for so many stations (one principal station of 250 acres and three sub-stations of 25 acres each) in the Sheraa is said to lie in the different conditions maintaining in the area, which also is the only rain-fed area in Jordan which offers possibilities for fresh settlement and colonization. Finally, there would be a station in the eastern plains of Mafraq to determine the possibilities of converting an area which at present is waste land into productive cultivation by deep ploughing.

Technical staff proposed

- 1 Director General of Research
- 1 Agronomist
- 1 Horticulturist
- 1 Soil chemist
- 1 Plant protection officer

All these specialists and probably most of their eight technical assistants would have to be obtained from outside countries.

Cost

A rough estimate places the capital expenditure at about £P65,000, and the annual running cost at £P56,000. It was said to be unlikely that Jordan could meet all this expenditure without external help.

Extension, or advisory services

19. The extension staff, organized only one year ago, consists of three district agricultural officers,

located at Irbid, Kerak and Amman, and twelve junior agricultural officers, serving nine separate districts, under the direction of the district officers. No plans have been made to increase the extension staff until more experience has been gained under the present arrangement.

Farm mechanisation

20. It is proposed to purchase and operate on hire fourteen tractors of the Caterpillar D8 type, with ploughs and other tillage implements. These tractors are said to be required for the heavy work of sub-soil ploughing. Nine of them are for use in the Jordan Valley. A mobile repair outfit, or travelling workshop, is said to be necessary also in order to keep all the tractors in running order. Outside assistance to finance the scheme was estimated at £P120,000 but it was agreed that this figure is probably excessive.

Production and distribution of improved seed

21. A plan is proposed for the multiplication, storage and distribution of improved seeds. The seed would be selected at the headquarters' agricultural station, increased first on seed farms operated by the Department of Agriculture and then further multiplied on the farms of selected growers. From these private growers the Department would buy back the seed and make it available to farmers in general by a system of repayment in kind. The plan provides for enough improved seed to sow five million dunums (1¼ million acres) at the end of the fifth year. A beginning has been made on multiplication on three departmental stations.

22. The scheme calls for two additional seed farms and for the erection of fourteen seed stores, equipped with cleaning and grading machinery, in different parts of the country. The proposal contemplates distribution of the seed to cultivators by departmental staff.

Cost

23. The estimated costs are as follows:

	<i>Capital £P</i>	<i>Annual recurring £P</i>
Seed farms	64,000	8,000
Seed stores and cleaning machinery	48,000	2,000
TOTAL	112,000	10,000

Horticultural development

24. Probably no activity of the Agricultural

Department has received in the past, or is receiving today, so much attention as the development of fruit-growing. Many parts of the country are specially suited to specialization in this direction. The Department possesses more resources for the determination of the fruits and varieties of fruits best suited to local conditions and for the production of fruit nursery plants than for any other aspect of agricultural development. Departmental proposals for work relate to the increased provision of nursery plants and to an extension of the area of certain fruits.

Fruit nurseries

25. Apart from increasing the production of fruit nursery plants at the Ruseifa, Baqura and other existing centres, it is proposed to start an additional nursery at Wadi Shaaeb, near the Allenby Bridge. In addition, nursery work will be one of the activities of the proposed agricultural station at Udruh in the Sheraa. The annual production of these nurseries is estimated at 150,000 seedlings, of which one-third would be grape-vines and the remainder other fruits sufficient to plant new areas of less than 500 acres annually.

The capital expenditure is estimated at £P12,000, which would probably not be available from internal revenues.

Extension of the area under olives

(The Burma scheme)

26. There are considered to be about 53,000 dunums (13,000 acres) under olives in Jordan. In addition, wild olives grow spontaneously in large numbers in the Ajlun district, particularly in the Burma reserves near Jerash.

It is proposed to plant up to 20,000 dunums (5,000 acres) by transplanting within this area 200,000 wild olives from the locality and subsequently budding them to better varieties. The special advantage claimed for the project is that it would assist in the development of industries, such as refined olive oil and soap-making, and so make the import of other oils and oil-seeds unnecessary.

Cost

The project covers a period of ten years and is estimated to cost £P1 million, of which a large proportion represents the cost of terracing land and constructing Gradonis. It is considered that a long-term loan would be required over a twenty-five years' period, by the end of which the entire cost of the project would be recouped.

Afforestation

27. There is no co-ordinated long-term programme of afforestation on paper, but plans covering certain aspects have been prepared and put into execution in the form of pilot projects. They embrace the provision of village fuel supplies, the stabilization of the east bank of the River Jordan by planting for the provision of poles and fuel, the re-afforestation of denuded areas, coupled with Gradoni and other methods for stabilizing the soil and preventing run-off on steep slopes, regeneration of natural grasses by fencing off selected areas, and exploitation of existing forests for fuel, poles and commercial timber.

28. The Director of Lands and Surveys estimates that the expansion of these projects into a ten-year programme of afforestation would involve expenditure as follows:

	£P
(a) Continuation and extension of pilot schemes	40,000
(b) Gradoni work in catchment areas of perennial streams on privately owned land; area estimated at 600,000 dunums (150,000 acres)	300,000
(c) Enclosure of government land in catchment areas of perennial streams and re-afforestation of same; area 492,000 dunums (123,000 acres)	394,000
(d) Establishment of village fuel areas in 300 villages	120,000
(e) Re-afforestation of Government land not included in (c) above; area 800,000 dunums (200,000 acres)	640,000
(f) Training of forest personnel in Cyprus; five officers for three years, and fifty guards for one year	30,000
TOTAL	1,524,000

Technical help would be welcomed in preparing a long-term co-ordinated plan of land utilization. If arrangements could be made and financial assistance given for the training of personnel in all branches of forestry, there would then be in existence a staff capable of executing the long-term land utilization plan, in so far as it affects afforestation, by the time such a plan has been fully worked out.

Drainage and reclamation

29. The Azraq is the main area concerned, but it requires to be fully investigated before detailed plans can be made. A soil survey is in progress. An aerial survey is needed and is being arranged.

Animal husbandry

30. Plans for the improvement of livestock include (1) investigations on different milk-breeds

of cattle, sheep and goats and the maintenance of stud animals on the two agricultural stations proposed in the Jordan Valley; (2) sheep and goat improvement, horse breeding and cattle encouragement at the proposed Udruh Station in the Sheraa, and (3) cattle, horse, sheep and goat breeding at the Azraq which, it is claimed, should be the main centre of stock breeding in the country.

Cost

The capital cost of these proposals is estimated to be £P80,000, and the annual recurring cost £P40,000.

31. On the disease-control side there exist at present four centres each staffed with a fully-qualified veterinary officer. Livestock can be treated at these centres, but the country has no veterinary hospital. There is said to be difficulty in obtaining the country's requirement of vaccines for both human and livestock purposes.

It is proposed to open three frontier quarantine stations, at a capital cost of £P15,000 each, and a recurring cost of £P5,000. Thirty-four sheep dipping centres are also proposed. The capital outlay would be £P8,500, and the annual cost £P10,500.

Poultry improvement

32. Poultry improvement is to be effected by the establishment of six incubation centres at departmental farms, from which month-old chicks will be supplied to the public. An output of 85,000 chicks each season is contemplated.

Cost

Capital cost of the scheme is estimated at £P13,000 and annual recurring cost at £P8,000.

Technical staff needed

It is said that the employment from outside of two specialists in poultry diseases will be necessary, but no indication is given of the technical help required for the proposed animal breeding programme. Obviously, it could not be carried through without outside help, both technical and financial.

Agricultural industries

33. The proposals put forward for industrial development in Jordan and Arab Palestine include the establishment of a modern soap factory, a sugar factory, and a cement factory. Details with regard to those proposals were not well developed,

but with respect to the industries depending on agriculture for their raw materials, the following points emerged during the discussion:

Olives

34. There is need for at least one factory to serve the two territories and to utilize the crude oil from the olive presses, the most obvious products being refined olive oil and fine quality toilet soaps. Refined olive oil is not produced at present; only the raw product is exported. Soap is made to some extent at Nablus in Arab Palestine, but a much more attractive product is possible and highly desirable. The area devoted to olives is estimated at 450,000 dunums (112,500 acres), and the annual production 7,000 to 10,000 tons a year. This is considered to be adequate to support a factory in years of good crops. In poor crop years, however, it would be necessary to obtain additional supplies of crude olive oil from surrounding countries.

Grapes

35. A certain amount of wine-making is already done, but there is considerable scope for improving this industry. The same applies to dried raisins, dried figs, and grape juice. The annual production of grapes is estimated to be 48,000 tons. If phylloxera can be controlled and the area under vines is increased to the considerable extent which soil and climate appear to warrant, a wine and dried raisin industry of fair dimensions should result.

Sugar

36. Because of the high cost of sugar in Jordan, due mainly to overland transportation, it was thought that a sugar factory in the Jordan Valley should be considered. The position, however, appears to be that much investigation is still needed, first to determine whether sugar beet or sugar cane can be successfully grown; secondly, whether the economics of the proposal can be justified in view of the limited water resources of the Jordan Valley, the high cost of a sugar factory and the present world sugar supply situation.

Horticultural development in Arab Palestine

37. The principal proposals are:

(a) To extend the area of the present Jericho horticultural station.

(b) To establish a horticultural station in the Jiftliq Ghor.

(c) To establish olive nurseries.

(d) To extend the present olive area by 300,000 dunums (75,000 acres).

(a) Jericho station

38. Expansion of the Jericho station is necessary to provide nursery plants for the development of fruit growing in the Jordan Valley. It is proposed to include citrus and dates, and provide two million vegetable seedlings for the vicinity. This station would also provide olive seedlings for various parts of Arab Palestine, such as Hebron, Bethlehem and Ramallah sub-districts.

Cost

The annual cost is estimated at £P7,000. It is said that the station would be self-supporting after three years.

(b) Jiftliq station

The Jiftliq station is proposed in order to provide a number of sub-districts in Arab Palestine, not otherwise served, with nursery plants of various fruits, vines and olives. This is part of a programme for extending fruit cultivation and replacing cereals by fruit. It is proposed also that a number of stud animals, bulls, sheep and Damascus goats, would be kept at this station for the improvement of the local livestock.

Cost

The estimated capital cost is £P25,000, and the annual recurring cost £P11,000.

(c) Olive nurseries

Olive nurseries would be located at the Khadouri Agricultural School and at Qabatiya. At the former it is proposed to expand the present nursery so as to rear and distribute 50,000 budded olive trees and 20,000 fig trees annually. The latter station is in the Jenin sub-district where olives are already very extensively grown. It would supply nursery stock and conduct experimental work with olives, vines, and figs.

Cost

Capital expenditure on these nurseries is estimated to be about £P21,000 and recurring cost £P7,000 annually.

(d) Extension of area under olives

The proposal to increase the area under olives in Arab Palestine is an ambitious one. It consists of a ten-year plan to plant 30,000 dunums (7,500 acres) annually, and it extends throughout most

of the length of the country. The olive trees would be interplanted with grape-vines. The scheme provides for the purchase of the budded olive trees and the vines from foreign nurseries, and includes a large programme of land clearance, levelling and terracing.

Cost

The estimated capital cost of the whole project over ten years exceeds £P7½ millions, exclusive of the cost of the land. Of this total, land clearance and terracing account for about £P5½ millions. The estimated annual recurring expenditure is of the order of £P150,000.

39. The nature and variety of the projects which have been put forward show that the Director of Agriculture is keenly alive both to the problems with which the agriculture of the Kingdom of Jordan is confronted, and to the general lines along which development should take place. Some of his projects are of greater urgency than others; some are more readily realizable than others. All, however, have a place in the orderly development of the country. His Department is small and his highly trained technical help possessing local experience few. To attempt to embark suddenly on a wide range of projects, some of them complex, would, even if funds were available, be to risk efficiency and to endanger success.

40. In these circumstances it is suggested that priorities should be established and attention should concentrate in the initial years on matters fundamental to successful development, leaving other aspects, however desirable, to a later date when the essentials have been firmly established.

III. Israel

Topographically and from the agricultural point of view, the territory which constitutes Israel may be divided into three main regions: the hilly tract of Galilee which occupies the north, the central coastal plain and the southern area of the Negev. As is to be expected from the differences in climate, soil and water supply, the contribution which each region has made in the past to agricultural production and which it is capable of making in the future, even when all aids to development are employed, varies greatly.

2. In the hills of the north cereals and olives are the main products, though certain areas are suited to special purposes, such as tobacco growing. In the valleys, particularly when irrigation supplies are available, as along the shores of Lake Tiberias, the range of crops is more varied and the intensity of cropping high. Citrus growing,

intensive vegetable production under irrigation, mixed farming and poultry keeping are notable features of the central coastal plain. The south or Negev is arid, largely undeveloped.

3. As in the adjoining countries of the Middle East rainfall is seasonal and is received entirely between November and April. In quantity it varies greatly. It is heavier in the north than in the south and on the coast than in the interior. While Safad in the northeast has an annual average of 900 mms. (36 inches), Haifa 650 mms. (26 inches) and Nazareth 625 mms. (25 inches), Tiberias receives only 452 mms. (18 inches) and Beisan, near the Jordan, 305 mms. (12 inches). Tel Aviv gets 509 mms. (20 inches) and Beer-sheba 270 mms. (9 inches). Though over much of the north of the country the rainfall would be adequate for more diversified farming, its uneven distribution is responsible for the one-season system of cropping which characterizes agriculture in areas which depend for their soil moisture entirely on rainfall. Thus, as in other countries in the region, irrigation is a limiting factor in agricultural development. It is of greater importance in Israel today than ever before because of the very extensive immigration now taking place and the need for settling as many of the immigrants as possible on the land. The proportion of the population employed on agriculture has declined considerably and at present represents only 22 per cent of the total. An increase of the total population of the country from one million today to two millions in ten years time is contemplated.

4. In general the prevailing type of agriculture in Israel is mixed farming. It includes most branches such as dairy farming, poultry farming, fodder growing, vegetable production, fruit orchards and cereal cultivation. Within the farm itself the importance of the various branches depends on the district, its soil, climate and the extent of irrigation. Arab farming is mostly of a more extensive type but fruit and vegetable growing is an important source of income.

5. A notable characteristic of present-day agriculture in Israel is the effort which is being made to bring about a change over from extensive farming with its emphasis on cereal production, to intensive farming concentrating on the production of fruit, vegetables, poultry and dairy products. Such a development makes it possible to greatly reduce the amount of land required per family and correspondingly to increase the number of people who can be settled on the land. In such a transformation the provision of a water supply for irrigation is indispensable.

6. From the agricultural aspect Israel differs widely from other Middle East countries in a variety of directions. Some are so striking as to merit brief mention.

(a) An outstanding feature which immediately distinguishes this country from all others adjoining it is its communal and co-operative system of land settlement. This system has its origin in Turkish times, for the first communal settlement was established to the south of Lake Tiberias in 1908. Since then the system has been developed and expanded so that today 7 per cent of the agricultural community of the country, or one-third of the population engaged in agriculture, carry on their farming activities on one or other of the types of co-operative which are now so prominent a feature of Israeli agriculture.

It is of interest to note that the future settler is at liberty to decide which of the types of settlement he will join. Thus he may become a member of a "Kibbutz" (or of its less flexible and smaller twin, the "Kvutza"), a communal settlement in which he owns nothing individually, works for the common good on one large farm, is provided with clothing, food and living quarters for himself and his wife, and dines in a common mess. Alternatively he may join a "Moshav", in which he owns his home and the small plot adjoining it, lives his own family life and farms a particular piece of the land belonging to the settlement. He can also join a settlement of individual owners provided he has the necessary capital. It is said that the tendency today is to favour the "Kibbutz".

Certain features are common to all types of co-operatives. Each is organized nationally. The land of each was purchased and is still owned by the Jewish National Fund, a subsidiary of the Jewish Agency. It is never sold by the Fund but is only leased out inalienably for a long term of years. All produce must be sold through an official co-operative agricultural marketing organization of which "Tnuva" is the most important. Mechanized cultivation is also common to all.

(b) The intensity of citrus cultivation in the central coastal plain, once seen, will always be remembered as something exceptional in the Middle East. Prior to the 1939-45 World War, the total area of citrus fruit—mainly oranges—was around 290,000 dunums (72,500 acres). For the disposal of its fruit the country depends on foreign markets. Difficulties of shipment made export impossible during the war; exports dropped from 15 million cases a year to nothing; cultivators could not pay for the necessary labour to maintain the orchards since they could not sell their fruit; labour also was scarce owing to the attraction of

war-time industries. Subsequently, during the fighting with the Arabs, the position deteriorated further: labour was not available; pumping machinery for some of the tube wells which irrigate these orchards was broken or removed. These adversities have taken a heavy toll of the citrus industry in Israel and today the orchards present a depressing spectacle. Many have disappeared altogether; large numbers are either dead or beyond recovery; many of those which survive are in very poor condition. Statistically it is estimated that of the original 290,000 dunums ten years ago the total area remaining today is only 120,000 to 130,000 dunums of which only about 90,000 dunums are in bearing and not all bearing to full capacity. From the pre-war peak export of 15 million cases, exports fell to 3,865,000 cases last year.

(c) The system of land irrigation in Israel is an object lesson in the economical use of water supplies and in securing the utmost benefit from the limited supplies at present available. Whilst irrigation of the citrus orchards is by direct surface flow from watering points on pipelines installed below ground level, the system of irrigation from most other supplies is the overhead sprinkler of which the revolving arm and the oscillating perforated pipe are the two main types. Such a system is said to be extremely economical of water and not unduly expensive to instal. Large areas of vegetable and forage crops are irrigated by this means.

(d) Fish culture in artificial ponds is practised extensively by some settlements where conditions are suitable. It is done in rotation with an ordinary crop. A field is flooded and maintained under the necessary head of water for a year during which a crop of fish is taken. The field is then dried off and put under a rice or other crop. Of the total catch of 2 million kilos of fish from all sources, fresh and salt water, during the nine months ending June, 1949, about 1.4 million kilos were obtained from artificial ponds.

(e) The Agricultural Department in Israel, unlike those in other Middle East countries, is well organized, staffed and equipped for various aspects of research, education and extension services.

The agricultural education system provides training of several intensities and at several levels. Mikveh Israel, the oldest agricultural school, was founded in 1870. It still continues today and has 550 students. The Agricultural College at Rehovot, in association with the Hebrew University, gives an education of degree standard; six special agricultural schools, with sixty-two teachers and fifty-two whole- or part-time instructors, have

1,410 students; eight training farms have 815 students; training centres in existing settlements provide instruction for a further 5,250 students; short courses for adult farm workers, each of three weeks, have been organized at the Ruppın Institute, an agricultural-theological seminary where the regular students must spend half the day on the land. These short courses cover a variety of branches of agriculture such as field, fruit and vegetable crops, nurseries, poultry and animal husbandry, elementary veterinary knowledge, farm machinery and soil conservation. Courses are given about twice a year in each subject and eighty people attend each course.

These data are sufficient to indicate both the wide range of education which is provided and the very large extent to which advantage is taken of it. At a lower level elementary agriculture has been for long a subject in the curriculum of rural elementary schools under the Ministry of Education.

7. Facilities for agricultural research take the form of: (1) a Central Agricultural Research Institute and Station at Rehovot, with facilities for investigations in agronomy, horticulture, plant-breeding, agricultural chemistry, entomology, plant pathology, rural economics, forestry, animal husbandry and nutrition, agricultural products and extension; (2) six regional stations in different parts of the country, subsidiary to the central station; (3) a number of sub-stations connected with the regional stations.

8. For all these lines of research well qualified technical staffs have been provided.

9. Each department of the Ministry of Agriculture has a staff of field instructors for extension work. They have specialized in field, forage and vegetable crops, different branches of fruit farming, cattle, sheep and poultry breeding, fish breeding and apiculture. Each instructor has his own district, lays out demonstration plots, gives lectures, holds regional meetings and arranges field demonstrations to show new developments in farming including the use of farm machinery.

ISRAEL'S PROBLEMS AND PLANS

10. Over a period of years there has been evolved in the territory now forming Israel, a type of agriculture designed to suit the particular conditions and possibilities of the country and the character and standard of living of its people. Such degree of self-sufficiency (or surplus in some connexions) as was attained has now been materially altered, partly by a fall in the proportion of agriculturists as a result of the recent war, but

more especially by the unprecedented scale of present immigration. On the one hand there is a shortage of farmers and on the other a surplus of people. There are areas of cultivable land which are not cultivated at present and a shortage of land under cultivation for the production of essential needs. This somewhat paradoxical situation has now to be overcome and, as a first step towards development, Israel proposes to take such measures as are likely to establish the degree of self-sufficiency previously attained.

11. In the view of the Israeli Government, there are available at present three factors that can be made achieve the desired end, if properly integrated. They are land (uncultivated), people (at the moment idle) and markets (at present unsatisfied). Only planning, training, technical organization, and finance are needed. To this end physical and economical plans are well advanced. Outside technical help is not required. The main problem is finance. With outside financial assistance the programme can be accelerated but, even if it is not forthcoming, the Israelis believe that the plan can be executed, though it will take a longer time.

12. Present plans fall under two heads—a short-term plan for one year only and a longer plan covering a four-year period.

GOVERNMENT'S SHORT-TERM PLAN FOR 1950

13. In its main aspect the plan provides for the settlement of 17,000 families on the land, established as follows:

(a) Forty settlements with 4,000 farm units each of 25-30 dunums ($6\frac{1}{4}$ - $7\frac{1}{2}$ acres).

Initial capital required, £1 250 per unit, exclusive of housing and water supply.

Over five years £1 2,000 will have to be invested in each unit to provide a living for the family.

(b) Thirty settlements based on plantations, mainly olive, and consisting of 3,000 farm units of 20 dunums (5 acres) each.

Initial capital required per unit, £1 400.

(c) Thirty-five workers' settlements with auxiliary farms.

Initial capital, £1 125 per farm. Housing and water supply for drinking, £1 500.

(d) Fifty settlements with 2,000 farm units, for discharged soldiers and pioneer youths.

Requires an initial capital investment of £1 1 million.

(e) There are 3,000 new immigrant families to be absorbed in existing settlements.

Capital required, £1 300 per family, exclusive of housing.

(f) One thousand auxiliary farms in existing new immigrant settlements.

Capital required, £1200,000.

The total cost of this plan, inclusive of housing, is estimated to be £114 million in the first year and £128 million finally.

GOVERNMENT'S 4-YEAR PLAN (1950-1953)

14. The four-year plan is intended to settle part of the new immigrants on the land and to meet the needs of the increased population for protective and energy-producing food-stuffs. Its aims include the development of Arab farming on more modern lines and its complete integration into Israeli agriculture. The plan is still in the draft stage but its main outlines can be stated. Its primary aim is self-sufficiency to the largest extent possible. Its high lights are:

(a) The total cultivated area to be doubled; the irrigated area also to be doubled.

(b) Total agricultural production to be more than doubled so that by 1952-53 there is complete self-sufficiency in vegetables, potatoes, fruit, eggs, milk and fish and an export (at pre-war prices) of £112,600,000.

(c) In regard to existing lines of production: the wheat area to be increased substantially; the fodder area to be more than trebled; the vegetable area to be trebled; the area under citrus fruits not to be extended but production to be increased through improved cultivation of existing orchards; the area of other fruits to be increased by 50 per cent.

(d) Oilseed crops such as sunflower, groundnut and safflower to be introduced on a large scale: sugar-beet to be grown in large quantities for the first time.

(e) The number of pure-bred dairy cows, milch sheep and goats to be more than doubled; (the production of meat will be merely incidental to milk); poultry farming and fish breeding in ponds to double their production; deep sea and inshore fishing to be quadrupled.

15. It is estimated that the investment necessary for the execution of this plan will be £150 million, exclusive of any major irrigation projects or rural housing. Brief particulars of the development proposals as they affect individual items, some of which bear on the realization of the plans, may be of interest.

Irrigation

16. The most important, and an absolutely indispensable feature of the plan is the exploitation of the water resources so as to irrigate a larger

proportion of the arable land which now produces rain-fed crops or no crops at all. Irrigation plans have two aspects: those relating to waters the use of which requires agreements with neighbouring countries and those which can be developed internally. The former take time to negotiate; in the latter direct action is possible.

17. The present irrigated area in Israel is approximately 300,000 dunums (75,000 acres). It is devoted chiefly to fruit, vegetable and fodder crops. Most of the orange groves and much of the vegetables derive their water by pumping from the 3,000 existing deep wells. Most of the forage crops are irrigated by surface waters from sources such as the River Yarkon and large springs in the Esdraelon and Beisan Valleys.

18. Countrywide plans for irrigation are being made and some twenty schemes stretching from the Hula in the north to the Negev in the south are contemplated. First priority is given to the utilization of the waters of the River Yarkon. It is planned to carry these waters, by eastern and western pipelines, from the river north of Tel Aviv to the Negev, the water being pushed through the pipes by pumping. The area which both pipelines could irrigate is estimated to be 250,000-300,000 dunums (62,500-75,000 acres), the cost £19 million (approximately) and the time required for construction 2-2½ years. It will be observed that on the estimates as they stand this project would almost double the present irrigated area.

19. Second in priority is the Beisan scheme, which is under examination at present. This scheme is based on the exploitation of numerous natural springs in the region. At present much of their water runs to waste. Their organization would provide irrigation supplies for 100,000 dunums (25,000 acres). The cost of the scheme, together with drainage works associated with it, is estimated at £13.6 million: eighteen months would be required for construction.

20. Other irrigation projects based on internal water sources are also visualized. A preliminary estimate of the cost of constructing nine such projects, inclusive of the Yarkon and the Beisan schemes, is £118.8 million.

Fruit Growing

21. The area of fruit orchards other than citrus is about 270,000 dunums (67,500 acres). It includes a wide variety of cold-region and sub-tropical fruits. As already indicated, the area of citrus fruits now remaining is about 130,000 dunums as against 290,000 dunums ten years ago.

22. Citrus fruits and their products constitute Israel's most valued export. In 1948-49 fresh fruit exports were 3,864,684 cases valued at £15,682,172. Concentrated and unconcentrated juices added a further £1820,000. Thus the total value of citrus exports was £16.5 million.

23. The 4-year plan proposes to increase the area of fruits other than citrus by 50 per cent, i.e., to raise it to 400,000 dunums (100,000 acres).

24. The development of the citrus growing industry is contemplated in two stages.

(a) The rehabilitation of the existing orchards from the state of neglect into which they fell during the war years, and the improvement of cultivation practices in order to bring them up to full production. This will require fertilizers, water pumping equipment for more efficient irrigation and tractors for mechanized cultivation. Partial mechanization is envisaged on 30,000 dunums: it is estimated that it will reduce production costs by 28 per cent. The full mechanization which will be undertaken on 50,000 dunums will reduce production costs by 48 per cent. The estimated cost of these mechanization proposals is £12½ million. It is calculated that the full cost of rehabilitation can be recovered in two years, with prices at their present level.

(b) In the second stage, an extension of the present area will be undertaken in order to bring it back to the 1938 figure. This stage is not likely to be undertaken in the four years of the present plan.

Soil conservation

25. The Ministry of Agriculture has a special section on soil conservation. It is surveying the country's needs for counter erosion measures and is assisting cultivators in introducing production methods such as contour ploughing and planting and terracing. This programme will continue.

Drainage

26. In some areas a drainage system must be installed in conjunction with irrigation development. No large-scale drainage project, such as the Hula basin, is proposed in the immediate future.

Fertilizers

27. Present annual requirements are estimated at 15,000 tons of nitrates, 6,000 tons of double superphosphate, and 4,500 tons of potash fertilizers. These requirements are mostly imported. Small quantities of single superphosphate—about 3,000 tons a year—are now being produced in

Israel. A new factory has been established in Haifa Bay. It will be able in the future to provide Israel's full needs of superphosphate, and possibly of nitrates also, but about three years will be required for developing the factory. Potassium fertilizers can be produced from the Dead Sea. Manufacture has not yet been resumed since it was interrupted during the recent internal fighting. There is an acute shortage of organic fertilizers, and the growing of green manure crops is practised wherever possible. Israeli soils in general need nitrogen and phosphate. Only a negligible area requires potash.

Agricultural machinery

28. Mechanization is a feature of the communal and co-operative system of cultivation. As already indicated, the 4-year plan also includes full or partial mechanization in connexion with the rehabilitation of the citrus orchards. The extensive land settlement programme surveyed for next year will also call for tractors and machines in considerable numbers.

29. There are, in the country at present, 2,200 tractors, 700 combine harvesters, 450 baling machines and complementary power implements. Also 1,700 tractors were imported last year. There are on order, at present, 540 tractors, 100 combine harvesters, 100 balers and hundreds of tractor-drawn implements. The Export-Import Bank loan last year was partially utilized in the purchase of this machinery.

30. The Government owns no machinery: it is owned by the settlements. The Government merely controls the import within the limits of foreign currency available.

Agricultural marketing

31. Agricultural marketing through co-operatives is well organized in Israel. "Tnuva", the co-operative marketing organization of all the collective settlements and workers smallholders' settlements affiliated to the Agricultural Workers Audit Union, markets 60-65 per cent of the produce of Jewish farming. "Tenne", another marketing co-operative, deals with other smallholders' settlements. The marketing of the produce of Arab farms is being organized. These marketing co-operatives are controlled by the settlers themselves and not by the Government. Future plans relate only to an expansion of the existing organizations.

Agricultural industries

32. The development of industries which derive

their raw products from agriculture appears to be shared by private enterprise and communal settlements (Kebbutzim). Whilst development plans are not known, it is of interest to indicate the scope of some of the main industries.

33. It will be observed that the variety of industries is considerable and, as agricultural production increases and the range of raw products grows, there should be large opportunities for industrial development of this nature.

(a) *Vegetable oils*

There are several oil crushing factories. Raw materials are imported in some cases; in others they are locally produced. Olives constitute the principal local raw product. Future plans provide for increased supplies of locally-produced sesame, sunflower, groundnut and safflower. Olive production is also to be stepped up. The present area of olives is about 165,000 dunums (41,250 acres), of which 1,500 dunums are pickling varieties under irrigation. There are 30,000 dunums in very bad condition and 100,000 dunums need to be improved by replanting and grafting. The present yield is about 100 kilos per dunum and the aim is to increase it to more than double in the next few years by improvements in cultural methods. It is also planned to put 40,000 dunums under irrigation.

(b) *Citrus products*

There are six factories for the manufacture of citrus products and six additional canning factories have special citrus fruit departments. The principal products are citrus juice in three forms—ordinary, pasteurised and concentrated; essential oil; pulp peels.

There were 74,500 tons of fruit used in 1948-49 in the manufacture of citrus fruit products. The total production of citrus juice in different forms was 6,390 tons of which 5,050 tons were exported. Concentrated juice accounted for about 60 per cent of the production and 80 per cent of the export.

(c) *Canned fruit and vegetables*

There are twenty-six factories. Their annual producing capacity is estimated at 12,000-14,000 tons. Local vegetables and fruit constitute the main raw products. The annual rate of production is 10,000 tons of which canned vegetables represent about 60 per cent, canned fruits and pickles about 20 per cent each and tomato products the remainder.

(d) *Jam*

Thirty factories produce jam. The annual output is about 2,350 tons.

(e) *Sugar*

The erection of a sugar factory is contemplated. Its raw materials would be both sugar-beet and sugar-cane, but mainly the former of which it is said that two crops can be grown in the year. The possibilities of growing sugarbeet have been under investigation since 1940, and are said to be satisfactory from both sugar content and tonnage per dunum. The Hula basin and Jordan Valley would be the main centres of production. It is understood that a proposal for funds has been submitted to the Export-Import Bank. If funds from an external source are not forthcoming the project is unlikely to progress in the near future.

(f) *Tobacco manufacture*

Turkish tobacco is grown in some parts of the country and five or six factories exist for the manufacture of cigarettes. Efforts are being made to introduce Virginia tobacco growing.

(g) *Wines, spirits and beer*

The Wine Growers Co-operative, Rishon, and the Palestine Breweries, Rishon, manufacture wines and beer respectively. Particulars of production are not immediately available.

Fisheries

34. The production of fish by all means—lake fishing, inshore fishing, deep sea fishing and artificial ponds—was 2,500 tons in 1947/48 and 2,000 tons in the first nine months of 1948/49. Artificial ponds contributed 90 per cent of the former, 70 per cent of the latter. Their importance in relation to the fish supplies of the country is obvious.

35. Future plans are directed to an expansion of fish farming. According to a preliminary draft, the present area of 18,000 dunums under fish culture will be raised to 40,000 dunums in 1952/53. At the same time deep sea fishing and inshore fishing will be expanded four times; lake fishing will be doubled and river fishing, which is negligible at present, will be increased by fifty fishing boats. As a result of these plans there will be 525 fishing boats in 1952/53. It is estimated that these measures will result in a production of the value of £16.4 millions in that year as against £12.3 millions in 1949/50.

Forestry

36. The forest area in Israel is about 285,000 dunums (71,250 acres). There are plans to expand it to about 1.3 million dunums by afforestation in various sections of the country from Beer-sheba to Upper Galilee during a twenty years' period. If this programme materializes a little more than 15 per cent of the country will be afforested.

*Departmental developments**(a) Agricultural education*

37. It is proposed to increase the facilities at existing agricultural schools and so to raise the number of students whom they can accommodate, rather than to add to the present number of schools.

There is a plan to establish a short 3-year course for farm youths whose education has ceased at the elementary school. This course will be held at the Ruppin Institute and will consist of two terms of 17 weeks each, during a time when there is little work to be done on the farm.

(b) Agricultural research

It is planned to establish six or seven more regional sub-stations for field investigations in areas for which existing stations do not cater adequately.

(c) Extension service

Plans are being made for the expansion of the service and for improving the organization. Details are not available.

38. From this general outline it will be seen that there are few aspects of crop and animal husbandry for which development plans have not been prepared or visualised and that, if these plans are put into execution, the effect on the agricultural economy of Israel must be very considerable. The high degree—amounting almost to completeness—of the self-sufficiency of Israel in technical specialist staff, to plan and execute these many aspects of agricultural development, should be particularly noted. It appears that availability of adequate finance, rather than of technical staff, is likely to be the determining factor in Israel's ability to implement the plan fully within the period contemplated.

IV. Syria

Territorially Syria is one of the largest countries in the Middle East and, in common with all of them, its economy is essentially agricultural.

More than two-thirds of its entire population derive their source of livelihood directly by the cultivation of the land, whilst its raw products are the source from which the means of subsistence of a large proportion of the remainder is derived.

2. Though the total area of the republic amounts to some 18 million hectares, the cultivated area is estimated to be no more than 2.3 millions or about 12 per cent of the whole territory. Pastures account for 4 million hectares or 22 per cent, and forests to .4 million hectares. Cultivable waste is estimated at 3.4 million hectares or about $1\frac{1}{2}$ times the area at present under irrigation. Uncultivable land, mountains, swamps and desert, make up the remainder which represents almost half the total area of the country.

3. About 90 per cent of the cropping is done under rain-fed conditions. The distribution and quantity of the rain-fall govern largely both the type and the scope of the agriculture. It is only in the limited north-west coastal region that the annual rainfall averages thirty inches or over. From that locality it tails off till in the south-west it amounts to eight inches and less, in the south-east to six inches and on the northern frontier in the Jezireh to twenty inches with a rapid decrease southwards. As a consequence, it is only in the west and north of the country that rain-fed farming is practicable. The centre is desert.

4. So far only very limited action has been taken to develop the water resources of Syria for irrigation purposes. The irrigated area is estimated to amount at present to about 280,000 hectares or one-eighth of the land under cultivation. Most of the water is derived from river supplies: wells, springs and "qanats" make only a small contribution. Recently two flow-irrigation projects have been executed in western districts and one has been partially constructed in the east. When used to full capacity the waters of the former will be capable, it is believed, of catering for about 26,000 hectares of which about half will be irrigated annually. The latter project will probably bring under irrigation about 8,000 hectares.

5. These developments are small in relation to the possibilities. Though the latter can never equal those in the adjoining Kingdom of Iraq, with its two great rivers, the Tigris and Euphrates, in the latter of which Syria itself has an interest, a study of these possibilities has led one competent authority to the conclusion that the water resources of Syria are sufficient, if developed, to increase the area under irrigation to 600,000 hectares, i.e., to double the present irrigated area.

6. The agriculture of Syria has been the subject of special study by consultants and a mission in the recent past. Their reports give accounts of the existing state of agriculture from a variety of angles and make sound recommendations on the many lines of action which are essential to the full development of this basic industry. In these circumstances to attempt to outline here either the conditions under which agriculture is now practised or its needs, if it is to be developed fully and efficiently, would be largely to repeat what is known already. During the time which has elapsed since the various reports were prepared conditions have not changed materially, progress has been slow and only limited action has been taken so far to give effect to the major recommendations which have been made.

7. For the full development of Syrian agriculture action is needed on a variety of lines common to most of the countries in the region. Amongst those of major importance are the maximum utilization of all water resources for irrigation purposes, improved standards of cultivation on land already under the plough and increased production through the use of modern machinery where practicable, better varieties of existing crops, the application of fertilizers, the control of pests and diseases, the introduction of new crops, adequate soil and water conservation measures, an extension of cultivation to all cultivable waste wherever rainfall is adequate or irrigation can be provided or where drainage can reclaim it, the organization of agricultural marketing, the development of industries complementary to agriculture, the improvement of livestock and its protection against disease.

8. Surmounting all these essentials and limiting the extent to which action can be taken on many of them, is the need for an efficient agricultural department, adequately staffed with technical officers of high standard and with full facilities to enable it to discharge its three essential functions of research, education and extension. In this respect, Syria is very ill-served. Its highly trained technical staff is inadequate: it has not the facilities and equipment needed for undertaking investigations which are fundamental to improvement and development, and its scope is too restricted. These shortcomings are well known to senior departmental officers who realize the limitations to their own sphere of usefulness to the country on this account. Various considerations, however, have stood in the way of provision of these needs hitherto, though some additional facilities have been provided and progress has been made in some directions.

LONG-TERM DEVELOPMENT PLANS

9. No large scale long-term plans for the development of agriculture have yet been drawn up or considered by the Government. Many plans have been visualized: a few of them have been brought to maturity, but no detailed programme exists for the orderly improvement and development of agriculture in its various phases and branches.

10. Discussions with the Director of Agriculture and other heads of departments in Syria have indicated certain lines along which future development is contemplated. These views do not necessarily represent the attitude or intentions of the Government of Syria and must be regarded as personal to the officers themselves. In general these plans have not yet received adequate detailed consideration nor has an estimate been formed of their cost. Plans have been directed so far mainly to an improvement of the departmental extension service.

Agricultural education

11. Prior to the last year, vocational agricultural training was restricted to three schools of the intermediate type. During the past year two other classes of school have come into being. Two elementary schools, differing from the intermediate largely by providing a two years' course instead of three, and by concentration on practice, rather than the theory, of agriculture, have been opened. Both are located in the eastern part of the country. A higher agricultural school has been established at Hosh Kharabo, a new agricultural station some miles from Damascus. This station will probably become in due course the central experimental station of the Agricultural Department. This school sets a higher initial standard of education for admission, provides a four years' course of instruction and all-round is of higher standard than the intermediate schools. One of its aims is to give a better foundation than was provided hitherto, of agricultural knowledge to students desirous of proceeding abroad for advanced agricultural study.

12. An increase in the number of elementary schools is not contemplated at present, but the opening, in the near future, of two more schools of the intermediate type is visualised. No more higher agricultural schools are proposed.

13. For the training of its higher staff Syria relies, so far, on foreign universities and institutions and provides a number of studentships annually. In addition to some students already at Egyptian and Belgian institutions, four members

of the Department's staff have been sent to America this year for specialization in entomology, field crops, pastures and horticulture. Twelve students, selected by competitive examination, are also being sent to Europe and the U.S.A. for courses of degree standard in agriculture, veterinary science and forestry. Next year's programme contemplates the sending of about the same number.

14. Meantime the desirability of establishing, in Syria, a college of agriculture in connexion with the University of Syria has been the subject of study and report by a special committee. The recommendation has not yet received the consideration of the Government and the proposal is unlikely to mature in the near future.

15. A recent feature of agricultural education is its introduction into rural elementary schools. To take charge of this new activity Syria has obtained the services of an Inspector of Rural Schools, who held a similar position in former Palestine. Progress has been considerable already. The recruitment of fifty teachers of the former Palestine staff has enabled an immediate start to be made in a corresponding number of rural elementary schools. Short summer courses for two successive summers have given training in this specialized line to thirty local teachers, thus further hastening its introduction into these schools. A new Rural Teachers' Training Centre has been started outside Damascus. Agriculture forms one of the subjects of study throughout the three years of the course. Thus, every teacher who passes through this Centre will be competent to teach agriculture in rural elementary schools. Each school will have a school garden which is an essential facility. An interesting feature is that these gardens are provided by local residents free of cost to the school.

16. There are about 1,000 rural elementary schools in Syria at present. The Inspector of Rural Schools aims to introduce the subject of agriculture into all of them within ten years.

Technical staff required

17. The Director of Agriculture felt that a specialist in agricultural education to overhaul and improve the present system would be useful.

Agricultural research

18. So far no real agricultural research has been carried out in the country for a period sufficiently long to produce final results. About three years ago the services of three experienced scientific officers were obtained from America to initiate research and improvement in agriculture,

horticulture and livestock. Only one officer completed the full contract of three years (it was only one year in the case of the livestock officer). One had to resign owing to ill health. All have now left Syria and no substitutes have been appointed. Syria possesses no other suitably qualified research staff.

19. Nor has the Agricultural Department any research laboratories for any aspect of crop or animal husbandry other than a small chemical laboratory which is devoted to analytical work only and is not staffed or equipped for research.

20. Though the Agricultural Department possesses more than a dozen farms throughout the country none is of the status of an experimental station. A central experimental station, supported by some of these outside farms as regional centres of investigation, is essential. Hosh Kharabo may fill this need if it is suitably extended.

21. Research is the basis on which all agricultural improvement rests and until a programme of properly organized and co-ordinated research is undertaken by fully-qualified specialists Syria will not have the knowledge essential to full development. The initiation of such programme and the provision of the necessary technical staff, laboratories, equipment, and facilities, in Syria's most urgent need and should be the starting point for its development programme.

Technical staff required

22. It is in the field of agricultural research that Syria's greatest need for outside technical assistance lies. It will require a team of experienced specialists who will inaugurate research in the various aspects of plant and animal improvement.

Extension services

23. Whilst in point of numbers the departmental staff operating in the districts is of fair proportions it is not adequate to needs. Its greatest defect, however, lies in the low standard of its technical qualifications and especially in the lack of proper training in extension methods and work.

24. The Director of Agriculture has worked out an extension organization whereby there would be at the centre a Director to plan, guide and co-ordinate all extension activities. Each territorial division and sub-division of the country would be provided with staff of appropriate technical standing. Each would be provided with the equipment and facilities necessary for the efficient conduct of his work. This scheme has not yet received the official approval of the Government, nor are funds or personnel yet available to give effect to it.

Technical staff required

25. The Director of the Extension Service should, in the opinion of the Director of Agriculture, be recruited from outside. He must have special training and adequate experience in the organization and conduct of extension work in its various aspects.

Soil conservation and afforestation

26. The short-term works projects which the Mission has prepared for Syria in these connexions, will be as much as can be undertaken in the near future, if effect is given to them.

Irrigation and drainage

27. These activities fall under the Ministry of Public Works. They have been considered in the report of the engineering consultants on the Mission. The main sources of irrigation must probably be sought in the Euphrates and Khabour rivers. Partial development has been undertaken of the waters of the Khabour, but plans for its full utilization, which could contribute to land colonization and settlement do not appear to be complete.

28. Drainage is of principal importance in the Ghab, Madikh and Roudj areas. For the reclamation and development of the Ghab a pilot project is being proposed by the Mission and the drainage and irrigation of the Madikh is in progress. It is understood that plans for the Roudj have already been prepared by the Ministry of Public Works.

Technical staff required

29. A qualified agronomist will be required from an outside country for agricultural experimentation in the Ghab Valley if and when the pilot project is undertaken.

Agricultural machinery

30. Mechanization in Syria became important during the war years owing to the need for increasing internal food production in the Middle East, and because Syria had large areas of land suitable for mechanized farming under rain-fed conditions. It steadily gained in popularity and in the intervening years the demand for tractors and power machinery has exceeded the available supply. It is understood, however, that, owing to the fall in the price of wheat this year, this position is reversed and that at the moment more new tractors have been imported than can find purchasers. The total number of tractors in Syria is believed to be 600 to 700 and of combine harvesters 350.

Of the former about 400 and almost all the latter machines are located in the Jezireh.

Technical staff required

31. The import of tractors and power machinery by commercial interests, has been supplemented by imports in considerable numbers through a Government agency. The latter, however, makes no arrangements for maintenance and repairs, and machinery owners have to depend on private enterprise to supply spare parts and to undertake their repairs. This arrangement is not always satisfactory or adequate. The Director of Agriculture is of opinion that Government should set up centres for repair and for the training of the public in the care and maintenance of tractors and their machines. He would provide a fully-qualified tractor engineer to take charge of these activities.

Agricultural marketing

32. There exists at present in the country no marketing organization for agricultural products except wheat. Nor are there any plans other than a proposal to introduce legislation for the establishment of co-operative societies. If this legislation should materialize, agricultural marketing would probably be one of the societies' functions.

Agricultural industries

33. Existing industries are olive oil crushing, but no refining; soap making, fruit and vegetable preservation and sugar manufacture. With the exception of oil crushing, these industries are on a small scale. The first sugar factory began production only last season. So far as is known, there are no plans for the immediate future.

Forests

34. No plans for forest extension or improvement have yet been drawn up, nor has soil conservation been considered by the Department of Forests. Proposals for a Government policy were suggested by an outside forestry expert some time ago, but no action appears to have been taken on them nor on his proposal that a pilot project in land-use planning in a sample valley be undertaken as a model to be adopted elsewhere.

Technical staff required

35. There appears to be little hope of progress in the field of forestry until technical help is available. A specialist in forestry to prepare a

forest and soil conservation policy and to supervise and control its execution is required. He should have two qualified forest officers from outside for the actual work in the field.

Animal husbandry

36. Livestock problems have three aspects—health, nutrition and improvement of the animal. Development calls for action in all three directions.

37. The Director of Veterinary Services has stated that a plan was prepared last year for the prevention and control of disease. It included improvements in departmental veterinary services, the erection of a laboratory and the manufacture of vaccines and sera, the initiation of a campaign against disease by preventive measures, and of a two years' course of instruction for veterinary assistants. The plan involved an expenditure of £S10 millions over 5 years. So far the proposal does not appear to have got beyond the preliminary planning stage.

38. Major nutrition problems are the scarcity of food for nomadic flocks, particularly in years of poor rainfall, and of drinking water supplies in the grazing areas. There is a conflict of views as to the availability of surplus grass and the possibility of haymaking in some parts of the country, such as the north-east Jezireh. If hay could be made it would serve as a reserve of fodder in the non-grazing season. The question can only be decided by a full study of the circumstances, but no plans to do so appear to have been made yet. Where the sinking of wells is impossible the practicability of collecting and storing surface run-off water during the rainy season in tanks dug or constructed in the grazing areas should be explored. Action on these lines is thought to be a practical solution of a similar problem in an adjoining country. It is a measure which has been adopted with success elsewhere than in the Middle East. Consideration has not, however, been given yet in Syria to practical measures to overcome the problem.

39. No programme has been drawn up so far of livestock improvement by either selection of breeding, but the Director of Veterinary Services visualizes that to cover different climates and conditions three livestock breeding stations will be required, one near Mount Hermon for cattle and sheep, a second at Palmyra for sheep only and a third in the Jezireh.

Technical staff needed

40. In the view of the Director of Veterinary

Services the following technical specialists would have to be obtained from outside countries:

(a) For health services

A parasitologist to study local pests;
A bacteriologist to survey diseases and to prepare vaccines and sera.

(b) For livestock improvement

A geneticist with adequate experience of breeding.

THE JEZIREH

41. In the Jezireh, Syria possesses one great asset which no other Middle East country enjoys in equal measure. Here there is a large tract of incompletely developed land over a large part of which rainfall is adequate for the practice of arable farming and through which flows a river whose waters, if controlled and canalized, would make possible the cultivation of a very considerable area further south where rainfall is inadequate for rain-fed cultivation.

42. According to the published statistics of the Government of Syria in 1946, the cultivated area in the Jezireh was 783,000 acres, but the cultivable waste is 1.75 million acres. These figures are estimates but, even if not exact, they indicate that the scope for development is likely to be great. Existing knowledge of exact possibilities must continue to be vague unless and until action is taken on the following lines in particular:

(1) To investigate the extent of actual private ownership of land, the validity of other probable claims to ownership within the area and the present area of State-owned land still available for settlement. Development has been haphazard and uncontrolled. So far squatters seem to have settled without let or hindrance. Through prolonged occupation and cultivation they may have acquired title to ownership of land at present thought to be State-owned.

(2) To determine the validity of grazing or other rights claimed by nomad tribes.

(3) To ascertain the area of land available for development within the rainfall zone adequate for rain-fed farming and the proportion of that area which is State domain.

(4) To make a complete study of the capacity of the River Khabour, if fully developed for irrigated farming, the extent of the area for which it can cater, the location where the water can be utilized most efficiently, and the area of land available for settlement under irrigated holdings.

43. It is widely believed that the Jezireh offers

great scope for the settlement of population surpluses elsewhere. Estimates of its absorptive capacity amount to as much as 200,000 persons engaged in actual farming under systems of mechanization in the rain-fed area and small-holding intensive cultivation on the irrigated land. A survey on the lines indicated can alone give data on which the capacity of the tract for settlement and its probable contribution to the agricultural and industrial production of the country can be assessed with reasonable accuracy. Such a survey is long overdue and should not be delayed further. On its completion a plan for the full development of the area from the agriculture, irrigation, communication and other related aspects, should be prepared and put into immediate execution.

44. It will be clear from this general analysis that while on the one hand the capacity for the agricultural improvement and development of Syria is potentially large and the need is great, no serious consideration has been given, on the other hand, to the preparation of development plans on a countrywide basis. Any practical measures taken so far towards actual development have been only of local application and very limited scope. As has been said already, surveys of agricultural conditions have been made by more than one authority and needs are generally known.

V. Lebanon

The territory of Lebanon is a long narrow strip of country characterized by two parallel ranges of mountains, the Lebanons and the Anti-Lebanons, which are separated from the sea by a relatively narrow coastal strip throughout the length of the country and from each other by fertile plain situated at an altitude of about 3,000 feet.

2. The latest available statistics sub-divide the total area of the country according to the following estimates:

	Hectares	Percentage of total
Cultivated	210,000	20.6
Cultivable	298,000	29.4
Forests	125,000	12.2
Capable of afforestation.....	170,000	16.7
Uncultivable	215,000	21.1
	<u>1,018,000</u>	<u>100.0</u>

3. The population which is estimated at 1,239,000 is considered to be increasing by 25,000 annually. The rural element represents about two-thirds of the population as a whole though, in four of the five districts, the proportion is much

higher. The fifth district, Beirut, which accounts for 28 per cent of the whole population, is 100 per cent urban. For the country as a whole the average density of population is about 120 persons per square kilometre. Pressure on area is thus considerable and indicates the need for early measures to develop as much as possible of the area shown as cultivable. Apart from the commercial centres of Beirut and Tripoli, agriculture is the country's principal industry.

4. Of the total area under cultivation two years ago, 110,000 acres were estimated to be irrigated. There are considerable possibilities of increasing this area if the available water resources are fully developed. Action has already been taken by the Lebanese Government in some localities but much can still be done. One authority has estimated that the further possibilities for irrigation amount to 100,000 acres, thus virtually doubling the 1946 area.

5. Nature provides for the country as a whole more liberal rainfall than that received in adjoining territories. Along the coastal region the average annual rainfall is about 33 inches; it may be reduced or increased by 50 per cent according to the nature of the season. Across the Lebanon mountains the centre of the Beqaa valley receives about an equal amount.

6. One of the main features of the agriculture of the Lebanon is its diversity. Conditions on most of the coastal plain are admirably suited to fruit and vegetable growing and large areas are under intensive cropping of this nature. In recent years the area under fruits, particularly bananas and citrus, has greatly increased. To make this extension possible, there has been a corresponding extension of irrigation by the development of the mountain streams which flow towards the sea. Higher up on the hillsides grape-growing is a prominent feature, though apples and other cold region fruits are grown to an increasing degree. The rain-fed lands of the Beqaa and Akkar plains are devoted mainly to cereal growing.

7. Wheat is by far the most important crop, with barley as a poor second. These two crops combine to represent about 80 per cent of the total area under field crops. Potatoes are next in importance.

8. Amongst fruits, grape-vines occupy the premier position in point of area. They are followed closely by olives. Citrus occupies a third place and loquats, figs and apples follow. Onions, beans and melons constitute the principal vegetables.

9. Citrus fruits, onions and potatoes form the principal agricultural exports. Among foodstuffs

wheat is the commodity in greatest shortage; rice also is imported, though in much smaller quantities.

10. Estimates of livestock are variable. The goat is by far the most numerous of all animals (it also is the most destructive). The goat population is given as about 500,000. Along with sheep (15,000), it provides the main milk supply of the country. Cattle number about 20,000 and of those 90 per cent are draft animals.

11. The Beqaa valley and the Akkar plain, much of whose area is now given to extensive rain-fed farming, are the tracts which offer most scope in the country for intensive development if and when irrigation supplies are provided.

12. From this brief statement of the agriculture of the country, it will be seen that Lebanon's problems of development are not identical with those of neighbouring Arab countries. They are more restricted in nature and, though wheat is now and may long remain the most extensively grown crop, they relate more to specialized intensive agriculture under fruit and vegetables than to the wide-scale growing of ordinary field crops or to livestock production. With the development of the country's water resources attention will concentrate on intensive farming. Increased production of the wheat, which the country needs, is more likely to result in future from an improvement through research in the yield from the existing area rather than from any extensive increase in the area itself.

13. As in the case of Syria, the agriculture of Lebanon has been the subject of study by more than one Mission or authority. In their several reports will be found more detailed information regarding the present state of this industry and views as to the directions in which development is needed and the lines it should follow. The Lebanese authorities do not lack internal information and knowledge, as well as outside advice, on these matters. It is, therefore, of interest to note their proposals for dealing with their problems.

THE 6-YEAR DEVELOPMENT PLAN

14. In respect of planning for the development of agriculture, Lebanon is in advance of its sister Arab countries in the Middle East in that it has drawn up a 6-year Plan which has been adopted by the Council of Ministers. It has now to be considered by Parliament. If approval is given and the necessary special funds are voted, it is aimed at putting the plan into effect on 1st January 1950. The special appropriations for which sanction is sought total 4.5 million Lebanese pounds (ap-

proximately £562,500 or \$2,060,000 at the official exchange rates). The principal heads of expenditure are:

Lebanese pounds

1. Forestry	1,350,000
2. Agricultural machinery	900,000
3. Agricultural education	1,200,000
4. Experiments and extension work...	600,000
5. Livestock breeding	150,000
6. Quarantine and control stations.....	200,000
Total	4,500,000

Forestry

15. The Ministry of Agriculture has a scheme to plant up 625,000 acres of forests in about 15 years. The total cost is estimated at £L30 millions, of which the major part is to be spent in directly buying up all the goats in the surrounding villages (in the interests of the survival of the forest areas) and in replacing them by sheep or cattle. This aspect is to cover 10 years.

16. The present 6-year Plan in this connexion proposes:

(a) To establish forest nurseries to supply the needs of seedling trees for an extension of the area under forests in various parts of the country. Afforestation is to be done by two methods—seedling plants and sown seed. Pines will be planted in the higher altitudes and oaks lower in areas. Three years after starting this scheme it is expected to have 500,000 seedlings available for planting and thereafter one million seedlings annually.

(b) To establish two stations for the exploitation of lumber and fuel.

(c) To spend two-thirds of the special appropriation under forestry on purchasing goats in villages near forests and substituting sheep and cattle.

(d) To construct tanks and reservoirs in the forest areas for the provision of a water supply for the irrigation of young forest trees. The purchase and utilization of tractors with suitable machinery for excavating tanks is contemplated.

Technical staff required

17. One forest officer for two years till Lebanese nationals return from abroad after the necessary training.

One officer for the exploitation of forest products.

One specialist in grasses for the improvement of grazing.

Agricultural machinery

18. The Ministry of Agriculture at present owns several tractors which are rented out to cultivators at low rates in order both to assist them and to popularize mechanized farming.

19. It is now proposed to increase the number of such tractors by fifteen, together with their complementary machines and to hand them to co-operative societies which will put them at the disposal of their members. The terms on which the machines will be supplied to the societies have not been decided yet.

20. It is proposed to set up three tractor repair stations at different centres, in order to provide facilities for maintaining the machines owned by both the Government and private individuals.

Technical staff required

21. One tractor engineer to take charge of machinery and repairs.

Three mechanics for the repair station.

Agricultural education

22. The Lebanese Government has adopted a policy of sending selected nationals abroad for specialized education in different aspects of agriculture. Twenty such students are studying at present, in institutions almost entirely in France, general agriculture, horticulture, veterinary science and forestry. For each student an annual provision of £L4,000 to £L5,000 is made. This policy is financed partially in the ordinary departmental budget and partly in the special development budget. Thirty-seven students are to be sent abroad in 1950.

23. The Higher School of Agriculture is located at present in Beirut. It is to be moved to a rural area outside the town. Financial provision is made for the necessary buildings. No improvements in the course of instruction are contemplated.

24. Two agricultural schools already exist in the Beqaa and near Tripoli. Another is about to be opened in the hills. One more still remains to be provided. Each school will concentrate on separate aspects of farming, e.g., (1) cereals, live-stock, industrial crops; (2) deciduous fruits; (3) olives and grapes; (4) vegetables and citrus fruits.

25. The teaching of elementary agriculture has not yet been introduced in rural elementary schools, nor are there any teachers for the subject. The ordinary budget of the Agricultural Department contains a provision of £L30,000 for the encouragement of the teaching of the subject in both private and Government schools. There is said to

be no demand for this type of agricultural education and no action is being taken to introduce it. This policy is in striking contrast to the vigorous action at present being taken in the neighbouring country of Syria.

Technical staff needed

26. Language presents a difficulty for outsiders as all teaching is in the Arabic language. One specialist in agricultural education might be needed to organize and direct the teaching of the subject at different levels.

Research and extension

27. Lebanon has no facilities for agricultural research at present. The Government's present proposals constitute a beginning in the provision of the facilities without which research cannot be conducted. They include the building of laboratories for soil and fertilizer analysis, entomology, plant diseases, meteorology and veterinary medicine. The laboratories of the Higher School of Agriculture will be available for research purposes.

28. The five existing fruit nurseries and stations in the country are to be improved and expanded, in order mainly to permit of the production and free issue of a larger number of nursery plants and also to provide for field experiments.

29. Syria imports seed potatoes and seeds of cereals and vegetables without facilities for ascertaining their suitability to climate and soil. It is proposed to provide £L100,000 in connexion with a seed farm for testing and multiplying approved seeds. It is not yet exactly determined how the money is to be spent.

30. Provision is included for setting up a section of statistics and agricultural economics.

31. £L200,000 are included for the construction of grain silos to protect agricultural produce from damage by weather, insects, pests and fungal diseases.

Technical staff required:

32. 1 botanist, 1 soil chemist, 1 agronomist, 1 entomologist, 1 plant pathologist, 1 agricultural meteorologist, 1 statistician, 1 nurseryman for each of 4 departmental nurseries (1 each for olives, grapes, deciduous fruits and vegetables).

Extension services

33. Though the proposals state that "it is incumbent on departments to spread their knowledge and experiences amongst the farms by means

of cinemas, lectures and publications" no funds are actually provided to establish an extension service and no such service in the true sense yet exists.

Technical staff proposed:

One specialist in agricultural co-operation, three experienced extension officers.

34. The Near East Foundation has been conducting a programme of agricultural extension and social welfare in the Beqaa valley in Lebanon and in Syria. Its programme, based on the principles of education and co-operation, has been conducted by means of classes in a number of rural elementary schools followed by practical demonstrations on the lands of the parents and by group discussions and classes for adults. Thus it has performed in a small way services of the highest usefulness to the rural community in the limited area in which it is functioning. In most aspects the work is of a pioneer nature: it is showing what can be done and how it can be done. It is to be hoped that the departments of government concerned will follow up the work and expand and broaden its scope.

Livestock

35. At present the Department locates two good stud bulls at some of their nurseries for the improvement of cattle in the locality. It is intended to purchase and similarly locate seven more bulls in the immediate future. No measures for the improvement of sheep are contemplated, and goats are to be eliminated. Poultry diseases are of major importance and a programme of protective treatment by vaccines and sera is proposed. The department desires to manufacture its own requirements of these materials.

Technical staff and assistance required:

- (a) One specialist in the preparation of vaccines and sera.
- (b) Three scholarships for foreign training.

Quarantine and control stations

36. The provision is intended for the purchase of twenty pre-fabricated houses for forest guards, and for the quarantine, veterinary and export services at the frontiers.

37. In submitting the foregoing proposals for a 6-year Plan of Development to his Government the Director-General of Agriculture has recognized that they fall short of Lebanon's ultimate

needs and that additional provision in a variety of directions will be required later. He has concluded, however, that this programme is as much as can be undertaken administratively or financially within the period for which it has been prepared. The items included in it are in his opinion those which demand priority of action.

38. The estimates which have been approved by the Council of Ministers for submission to Parliament do not include the cost of the superior technical staff whose employment the Director-General of Agriculture considers necessary to progress in development.

39. The Government of Lebanon has set up no Development Board or other special organization for handling a programme of general economic development.

VI. Iraq

The account of the agriculture of Iraq which follows derives its information from published literature, departmental and other reports and the personal knowledge which one of the agricultural consultants possesses of the territory, its conditions as they affect agriculture and the present state of agriculture in it. The consultants had not the advantage during their attachment to the Mission of visiting this kingdom. Consequently, the information at their disposal is neither so detailed nor as up-to-date in all respects as the corresponding data which they have given for the other countries of the Middle East visited by them. This may be particularly so regarding the future plans and proposals for Iraq's agricultural development.

2. Whilst the climate of Iraq in some respects, such as in the seasonal nature of its rainfall, follows the usual pattern of adjoining countries, it differs in others in degree, e.g., in the intense summer heat in the plains of the country. The outstanding feature which distinguishes Iraq from those other countries with reference to climate, however, is that whilst their agriculture depends very largely both in its extent and for its success on rainfall, the rain-fed agriculture of Iraq is of small dimensions in comparison with irrigated farming.

3. An official publication of the Government in Iraq in 1944 gives the area within the political boundaries of the kingdom as 112 million acres (45 million hectares). The productive part is very much smaller. It may be divided into two broad regions—the northern or rain-fed zone and the southern or irrigated zone.

4. Agriculture in the rainfall zone is largely a one-season-a-year cereal-growing economy, with

a considerable area under fruit and forest trees which include the almond, walnut, oak and pine. It is fed by winter rain, supplemented by perennial mountain streams.

5. Agricultural statistics in Iraq make no claim to accuracy. They are, in fact, only estimates and any figures quoted should be regarded in that light. Published figures indicate that in the northern zone out of approximately 10 million acres of cultivable land, only 1.5 million acres (approximately) are actually cultivated, thus leaving about 8.5 million acres available for future development. This very large area is said to include lands potentially cultivable by rain or by lift or flow irrigation from various rivers but to exclude vast grazing areas. How far these estimates represent actualities, to what extent undeveloped land is available and suitable for cultivation, to what degree it is State or privately owned or what obstacles, if any, exist to its development are not known. In the absence of fuller information it would probably be unwise to conclude that potentialities are so great as the figures suggest.

6. In the southern zone the annual rainfall is totally inadequate for the practice of arable farming. Thus, at Bagdad it is of the order of 4 to 5 inches only. In the dependence of agriculture on irrigation for its existence in this area, Iraq is most favourably situated for its two great rivers, the Euphrates and Tigris, not only provide the life-blood for the present cultivated area, but carry surplus supplies sufficient for the irrigation of some additional millions of acres when they are fully controlled, stored and canalized. According to the recent conclusions of the Irrigation Development Commission, Iraq, the present position and possibilities of irrigation from these rivers is:

	<i>Acres provided with water at present</i>	<i>Additional acres possible through storage</i>	<i>Final total acreage</i>
Euphrates	1,200,000	1,000,000	2,200,000
Tigris	2,000,000	2,200,000	4,200,000
Total	<u>3,200,000</u>	<u>3,200,000</u>	<u>6,400,000</u>

Since, in addition to possessing large surplus water resources Iraq also has vast reserves of undeveloped land to which to apply them, this country stands out in marked contrast to its neighbours in the immense scope which exists for development when these two great assets are fully utilized in conjunction with each other.

7. In addition to the large possibilities of extending irrigated farming to new lands, another very important aspect of agricultural development

lies in the reclamation of extensive areas of land which either have gone out of cultivation altogether through the rise of saline subsoil water—at no place very far from ground level—and the accumulation of harmful salts in the soil or in which production has fallen for the same reason to varying extents below the normal level. Irrigation experts consider that appreciable deterioration has already occurred in an area which may be, on an average, 60 per cent of the lands served by flow irrigation. Since flow irrigation accounts for 1,710,000 acres, the area of salt-deteriorated land apparently exceeds one million acres. The magnitude of the reclamation problem and the effect on agricultural production which reclamation would produce can be judged from these data. Drainage is the principal treatment necessary for this reclamation. The main salts in the soil are highly soluble and if they are leached out into a suitable drainage system which will dispose of the saline water, reclamation is comparatively easy and rapid. Nothing has been done so far in the development of soil drainage in the country.

8. Experience has shown that the majority of irrigated areas in Iraq deteriorate rapidly owing to waterlogging and salination of the soil and that drainage is essential if productivity of the land is to be maintained. Thus, a major point for determination when a new area is to be brought under irrigation is whether or not to instal a drainage system simultaneously with the construction of the irrigation system.

9. Though the potentialities for the development of agriculture are great, the population of the country is relatively small. It has not yet reached the 5 million mark. Consequently, any large scale extension of the area under cultivation by the present population following the present method of cultivation would be impossible. It can be achieved only through immigration or by development on a mechanized basis. It is in the latter direction that Iraq appears to visualize the future.

10. Cultivation under irrigation is usually done by the "Neren" system in which half the cultivable area is cropped in the winter season in alternate years thus giving a winter cropping intensity of 50 per cent. Summer irrigation provides for a further 15 per cent under crops. Thus the total intensity of cropping annually is 65 per cent. This figure compares unfavourably with the 100 per cent and more in special areas and the 80 to 90 per cent over large areas under irrigation in India and Egypt. Where rice is grown over considerable areas in the summer season a 50 per cent intensity of cropping is usual.

11. Wheat and barley constitute the principal winter crops. The former is less important than the latter. In comparison with either of them other crops are of little significance in point of area. They include linseed, tobacco, beans and vetch. Again, rice is the chief summer crop; millet is a very poor second; other crops are sesame, maize and cotton. It will thus be seen that the agricultural economy of Iraq is based largely on cereal production.

12. Various varieties of fruit are grown but the date is by far the most important. Barley and dates constitute the major agricultural exports.

13. It will be apparent from what has preceded that agricultural practice is defective from several angles. It does not produce from valuable irrigated land—an asset which is all too scarce in Middle East countries—results and returns comparable with those which are obtained in other eastern countries, such as India, where conditions are similar in many important respects. Amongst major deficiencies are the very low intensity of cropping under irrigation, the inefficient and wasteful use of irrigation water, the faulty crop rotation which is normally practised, the restricted range of field crops which are grown and the almost unknown use of chemical or other forms of fertilizer.

14. The remedy for all these shortcomings must be sought in research, for it is only by field investigations, well-planned and scientifically conducted by competent specialists, that maximum economic and efficient use of soil and water can be determined. Iraq is still inadequately prepared for such investigations. Though it has recently made considerable progress in the provision of research facilities in some directions, it is still insufficiently provided in other essentials.

DEVELOPMENT PROGRESS AND PLANS

The Irrigation Development Commission

15. In recent years much attention has been given by Iraq to investigations and plans associated with the waters of the rivers Euphrates and Tigris. Whilst the primary object of these investigations was to determine how best to control the great floods which pour down these rivers at certain seasons of the year and threaten destruction to the country and its inhabitants, the secondary object was concerned with the development of the water resources of the country for irrigation purposes. These investigations received the whole-time attention of an Irrigation Development Commission from 1946 to 1949.

16. Whilst the Commission has concluded that a further area exceeding three million acres could be brought under irrigated farming if the river waters were fully utilized by storage, it does not visualize development to that extent for many years. It has proposed a 10-years' development programme of flood control, irrigation extension and drainage of waterlogged areas. The chief features of this programme from the agricultural point of view are that 550,000 acres of land now waste would be brought under cultivation by irrigation and that half the area of land requiring drainage would be reclaimed. One item in the programme is under actual construction—the provision of an inlet channel from the Euphrates to the Habbaniyah Lake into which a part of the flood waters of the river will be diverted and stored.

17. The cost of the programme is estimated at about ID 20 million (\$56 million). It is understood that the practical feasibility of this programme under present conditions in Iraq depends largely on the ability to obtain financial assistance from international sources.

The Agricultural Advisory Council

18. At its first session early this year this Council put forward a 27-point programme of agricultural development, after taking into consideration the views and recommendations of five committees which it had set up to examine the various aspects of development. Its recommendations are comprehensive: they include expansion of mechanized cultivation and provision of maintenance and repair facilities; supply and distribution of improved seeds and orchard and other nursery plants; control of pests and diseases in the field and store; establishment of experimental farms throughout the country; construction of storage dams for flood control and the utilization of the stored waters for extending summer cultivation; control of rice cultivation in areas where it competes with fruit growing; the drainage of land under irrigated farming; investigations into the possibilities of irrigation from subsoil supplies in the north and south of the country; placing the two Departments of Agriculture and Irrigation under one Ministry, in order to ensure the degree of collaboration and co-operation essential to farming under irrigation; research on the improvement of pasturage by qualified specialists; the improvement of livestock and of their products, wool, hides, skins, meat and milk and the provision of the necessary facilities including specialist staff, laboratories and equipment; control of pests and

diseases of livestock; establishment of a soil survey section; expansion of forests; establishment of meteorological stations; survey of chemical and organic fertilizers and of the possibilities of setting up a factory for manufacture of fertilizers.

19. It is of interest to note that the Council considered it necessary to set up an Higher Economic Planning Board to co-ordinate research by various departments of Government, to prepare a sound constructive plan for development and to put it into force within a limited period.

20. The action taken or proposed on these proposals is not known. If they can be implemented efficiently they will have a far reaching effect on many phases of agricultural development.

Mechanisation

21. In recent years there has been a considerable movement in favour of mechanized cultivation. The number of tractors operating in the country at present may be of the order of 500. The Iraq Government itself is gradually building up a fleet of tractors and power machinery, including combine-harvesters and threshing machines, which it maintains directly and operates on a hire-contract service. Tractor ploughing is very popular and the demand for it cannot be met fully at present. The policy is to help the small farmer rather than the large landowner by extending these facilities.

22. The Department of Agriculture has a 5-year programme for increasing the number of tractors in the country by 1,700 and the combine harvesters by 450 as from 1948. By 1952 there would thus be about 2,000 tractors and 500 combines in the country. The plan visualizes that the Government will own and itself operate 900 of this total on a hire-contract basis for the public benefit.

23. The Government also proposes setting up its own large workshops in different parts of the country for the maintenance and repair of power machinery. At least one such workshop has been erected already.

24. A 10-year mechanization project has also been prepared by the Directorate-General of Agriculture. Its aim is to apply modern mechanized methods of farming to an area of 500,000 acres of land already under cultivation and thereby to increase production (a) through better cultivation than is given by the primitive implements and methods now in use, (b) through remedying the position created by the shortage of farm labour or human frailties which prevent important agricultural operations being conducted at the opti-

imum time, (c) by avoiding the losses of grain which occur through pilfering and other causes during harvesting operations. It is estimated that for all these reasons the increased production will amount to 100,000 tons of grain per annum.

25. The project necessitates the purchase of 2,500 tractors with their complementary power machines, 550 combine harvesters and 150 threshing machines. Half the machinery is to be sold to landowners by the Government and the remainder is to be retained and operated by the Government on hire-contract terms.

26. The cost is estimated at ID4 million (\$11.2 million) which could only be met by an external loan.

27. During the last year legislation has been introduced by which the Government of Iraq has reserved to itself the sole right to import and distribute agricultural machinery of all kinds ranging from tractors to dairy appliances. The Act will be operated by an Administrative Council of five persons who will import the machinery, determine its selling prices, and distribute it. No private authority can do business in this line.

Agricultural research

28. There exists a greater appreciation in Iraq than in most Arab countries of the place of research in agricultural development. At any rate Iraq has taken more practical action than the others to prepare the way for such research.

29. More than two years ago the Government decided on a policy of engaging from abroad the services of a large number of specialist officers for research in the sciences applied to agriculture. In the end, for various reasons, the result was disappointing. Only two or three specialists were finally appointed and all of them have now left Iraq. Consequently, in the matter of personnel, Iraq is in much the same position as neighbouring countries. It has not the necessary specialists to undertake the research which is fundamental to success in the many fields of agricultural development. Without such staff it is in no position to collect the data and knowledge which are essential to the removal of the serious defects in agricultural practice and crop husbandry to which attention has been drawn already.

30. Simultaneously with the decision to recruit specialist officers, action was taken to provide suitable laboratory facilities at the main agricultural station some miles from Bagdad. Certain laboratories have been erected and equipped. They now await staff who can make the best use of them.

31. At the same main centre of departmental

activities there exists an Agricultural School where a three-years' course is given in agriculture and the sciences applied to it. The syllabus of instruction has been improved recently, and it is expected that in course of time the school will be developed and raised to the status of an agricultural college. For an agricultural education of degree standard the local authorities consider that it is cheaper and better to send scholars to foreign universities than to attempt to provide such an education locally.

32. From this general outline, it is clear that while Iraq is making important progress towards the development of its agriculture in certain directions, it still is far short of the necessary facilities in others. In it, as in adjoining countries, the basic need at the moment is for research and education. Until full facilities are forthcoming—in Iraq they now concern the appointment of specialist staff rather than the provision of buildings and land—and knowledge is acquired, the state of agriculture in the country must continue to be backward.

VII. Summary and Conclusions

The various proposals for agricultural development, as briefly outlined, provide a valuable commentary on what each country believes to be the directions in which its agricultural development should proceed. With respect to many details the views expressed are admittedly tentative and the estimates of cost rough, as the various proposals were prepared on extremely short notice in most cases. Nevertheless, in spite of limitations of time, the information supplied to the agricultural consultants has been of the greatest help, thanks to many Government officials who spared no effort to make it as complete as possible.

2. The projects which were submitted vary greatly in the value of the information they contain. Some are little more than an expression of personal opinion and, therefore, a doubtful basis for long-term planning. Other proposals have a richer content of factual material and are correspondingly more satisfactory. Nearly all, however, fall far short of providing reliable blueprints that could stand the scrutiny of specialists who are competent in the field of economic analysis and comprehensive planning.

3. Projects of the various countries may be classified under the following main heads:

1. Agricultural research and experimentation;
2. Agricultural education and extension;
3. Production and distribution of improved seed and nursery seedlings;

4. Farm mechanization;
5. Afforestation;
6. Improvement of livestock and veterinary services;
7. Agricultural industries.

4. In every country the need for agricultural research and experimentation was placed high on the priority list, especially the need for highly qualified technical assistance. Beyond this it was unusual to indicate priorities, but agricultural education and the production and distribution of improved seed and fruit nursery seedlings in large quantities were considered of great importance. Less emphasis was placed on farm mechanization and livestock improvement. Afforestation was recognized as a very necessary long-term item extending over many years, relatively expensive and requiring, initially, the training of a staff of forest officers and forest guards. The place of agricultural industries in relation to agricultural development was less clearly appreciated.

5. In spite of the prominence which was usually given by Government officials to the need for providing facilities for agricultural research, it was felt by the agricultural consultants that its fundamental importance to development was often inadequately appreciated, its cost greatly underestimated and the contemplated financial provision inadequate.

6. Agricultural research in all the countries visited, except Israel, is practically non-existent, yet hardly a single project was put forward that will not call for investigation at some stage. For example, in the matter of improved seed multiplication and distribution to which most countries attach considerable importance, it is surely a first essential that reliable tests, according to modern statistical methods, should be conducted to determine which varieties to popularize. Yet tests of cereal varieties, as of other field and horticultural crops, by methods which present-day scientific thought would consider adequate or reliable are nowhere to be found in these countries. The same general statement could be made with reference to practically every aspect of agricultural science. Israel is much better supplied with research facilities, but, even in that country, there is a recognized need for more comprehensive investigation.

7. It is generally agreed that the full development of their water resources is of primary importance to the economic welfare of Middle East countries and that projects designed to utilize these resources for the irrigation of the land should receive almost the highest priority in any

programme of agricultural development. Even in that connexion one should not underestimate the fundamental role that research should play. No new land should be brought under irrigation without first making a detailed soil survey of the land. Lack of such studies has sometimes been responsible in the past for turning an irrigation scheme into a liability rather than an asset. The intensification of agriculture which inevitably follows irrigation of the land brings in its train a whole series of problems requiring careful investigation.

8. There is no aspect of agricultural development in the Middle East so conspicuous as the almost total lack of research personnel and facilities. It is difficult to understand why this obvious necessity has been so long and so completely neglected. To remedy this deficiency should be the first step in any programme of agricultural development. There is no doubt that a well-equipped and properly staffed agricultural research institution would have a stimulating effect on every one of the proposals submitted and, directly or indirectly, would tend to promote their implementation. It is suggested, also, that nowhere would the beneficial effect be more pronounced than in the fields of agricultural education and extension.

9. Governments of several Middle East countries have recently established inter-departmental committees or organizations to deal with economic development. Jordan has constituted a development board; Syria has set up a special inter-departmental committee "to prepare plans for the improvement of agriculture and for the general uplift of the farmer"; the Government of Lebanon has prepared a six-year plan for over-all development, including agriculture, though no special organization has been constituted; in Iraq the formation of a development board is currently under consideration. The action taken by these Governments to ensure development on co-ordinated lines is an important move in the right direction and one which should greatly facilitate over-all planning and subsequent action.

10. Nevertheless, although some countries are more advanced in this respect than others, there is an urgent need in all of them for more intensive planning, especially with respect to the main industry of agriculture. Sound planning must begin with a critical analysis of agricultural resources; it should then proceed to the development of practical, co-ordinated and integrated plans suited to the particular needs and possibilities of each country; it must also establish priorities amongst those needs and give special emphasis to fundamental requirements.

11. For these reasons it is the considered opinion of the agricultural consultants that each Middle East Government, which has not done so, should immediately complete arrangements for a properly constituted development board.

12. Having in mind the obvious similarities which exist between countries in the region with respect to the present status of agricultural development and the types of projects suggested by the different Governments, a similar initial approach to development in all the countries involved would seem to be desirable. The agricultural consultants are in no doubt that this approach lies in the provision of highly trained specialist officers, equipped with all the necessary facilities for the acquisition of fundamental knowledge without which full development on sound lines can never be achieved.

13. The following suggestions are put forward, therefore, as a realistic approach to the objective of securing agricultural improvement on the soundest basis in the shortest possible time:

(1) That as the preparation of detailed plans for economic development is a task for specialists who are experienced in such matters, the Arab Governments in the region engage from abroad experienced and competent specialists to assist their development boards in preparing detailed long-term plans for agricultural development on lines suitable to the countries' needs and resources, both existing and potential;

(2) That Jordan, Syria and Lebanon take the earliest possible steps to establish central research stations provided with adequate equipment and facilities for both laboratory and field investigations and that Iraq complete without delay the erection and equipment of the research laboratories which it has already gone a long way to provide;

(3) That each of these Governments recruit from abroad on contracts of not less than five years initially, a number of highly trained specialist officers to initiate and conduct research on agriculture and the major sciences applied to it. The initial and basic needs for each such station are a director, an agronomist, a horticulturist, an economic botanist, a soil chemist, an entomologist, a plant pathologist, an agricultural engineer (machinery) and an officer for livestock improvement. Others could be proposed with advantage but they can be added later when the basic specialists have been firmly established;

(4) That each Government make adequate provision for sending abroad a substantial number of its own nationals for advanced study at univer-

sities and research institutions, in order to qualify them to undertake research under the supervision and guidance of the experienced specialist heads of the various sections of the station. In course of time, after acquiring the necessary experience, these nationals will replace such of those heads as may have been recruited from foreign countries. In selecting men for foreign study members of the

existing departmental staff of both graduate and undergraduate status with years of practical experience of local conditions should find a place.

14. The logical sequel to this first approach will be the establishment of an extension service fully trained in all the modern methods by which the results of scientific investigation are translated into farm practice.

SECTION B

ENGINEERING REPORT ON THE MIDDLE EAST

LONG-TERM DEVELOPMENT PROJECTS

In the Arab countries of the Middle East the welfare of the people depends largely upon the development and efficient use of two basic resources—land and water. The long-term development of this region depends upon the full exploitation of these resources. Upon such a long-term programme depends the progress of agriculture, improved water supply for the towns and villages, improved public health, including control of malaria and the production of hydro-electric power to provide opportunities for employment and a higher standard of living through expansion of agriculture and industry.

Members of the Economic Survey Mission have conferred with government officials in Jordan, Arab Palestine, Lebanon, Syria, Iraq, Egypt and Israel, and the technical staff has inspected sites for development in all of these countries, with the exception of Iraq and Egypt.

This report describes in general the future long-term development plans of the countries in the region visited by the technical staff. Rough estimates of the future costs have been provided, where such estimates are available. In addition, rough estimates are given for funds required for review of available plans or for further technical study to advance projects to a point where they would be ready for consideration of feasibility and allotment of funds. In some cases where there is a marked absence of data, a reconnaissance report would be required in advance of further technical study.

In view of the varying nature of the engineering projects each country is discussed separately.

Jordan—Arab Palestine

PROJECTS WITHIN FUTURE PLANS OF COUNTRY

In so far as could be ascertained from discussions with Government officials, and from an examination of existing reports, there is no over-all

development plan in existence for the country as a whole. However, various long-term development schemes are being studied.

WATER CONSERVATION AND IRRIGATION

Probably the most important plan which could be undertaken in the future is the extension of perennial irrigation works by means of storage of the waters of the rivers and wadis. The most important of the rivers are the Yarmuk River and the main stem of the Jordan River between Lake Tiberias and the Dead Sea. A plan for the storage of the waters of the Yarmuk River is now under study, and this scheme involves one or more storage dams on the Yarmuk River whence the water will flow by gravity into a main irrigation canal in Jordan, paralleling the Jordan River. A considerable area of the Jordan plain could thus be brought under perennial irrigation. The flow in the irrigation canal could be augmented by the flow obtained from storage of waters in the various wadis, but in so far as is known, storage of water in the wadis has not thus far been made a part of the scheme.

Land ownership in the Jordan plain is divided amongst some 400 or more owners. King Abdullah owns a large tract of land just north of the Allenby Bridge.

On the Arab Palestine side of the Jordan River a general scheme is in existence to conduct the water on the land by means of a low storage dam on the Jordan River, about 15 km. south of Beisan, and a main irrigation canal paralleling the Jordan River from this dam. The water could be pumped to a higher level canal to command additional area. The area under irrigation could be further extended by storage of the waters of the Wadis Fara, Auja and Qilt.¹

¹ Stage 7 of the report on "Proposals for Irrigation and Hydroelectric Development in Palestine" by James B. Hays, June 1948.

In addition, various possibilities of obtaining irrigation water by pumping from wells are under consideration. In the Ghor area, measures for control of existing irrigation systems are contemplated.

TRANSPORTATION AND COMMUNICATIONS

Roads: In Jordan the following road programme is considered to be desirable by the Jordan Government:

North-south roads:

	kms.
1. Along the valley from the south of the Dead Sea to a point opposite Beisan in the north..	250
2. Irbid-Hasn-Jerash-Suweleh	87
3. Madaba-Kerak	125
4. Kerak-Tafila-Shobak-Maan	171
5. Maan-Naqb-Ashtar	40
6. Lower end of the asphalt road near Aqaba to be reconstructed	30
	703

Transverse roads:

	kms.
1. Salt-Damiya	30
2. Madaba-Shuneh	30
3. Karak-Myzra	30
4. Petra-Kh Udruh	10
5. Jerash-Ajlun-Kureima	60
6. Amman-Mafraq road to Azraq (only if the Azraq is developed)	70
	230
Total	933

In Arab Palestine the future road programme includes the following:

	kms.
1. Ramallah-Beer Zeit—Abud to Rantis	39
2. Nablus-Azzoun-Qalqiliya	30
3. Jerusalem-Bethlehem	18
4. Qabatiya-Tubas-Badam	27
5. Nablus-Damiya-Jericho	72
6. Bira-Taiyiba-Mazraa-Sinjil	16
7. Sinjil-Beit Rima	11
Total	213

Railroads: Railway communications are being studied internationally with the adjoining countries—Syria and Saudi Arabia. The expenditure for the construction of the Ma'an to Medina narrow-gauge railway, 830 kms. in length, is estimated to cost £P 4,500,000. About one-third of this length (Ma'an to Mudawwara) lies in Jordan.

Airports: At present large aircraft land at Mafraq, while the airport at Amman is adequate for small aircraft only. It is contemplated that the Amman airport be improved to make it a Class "D" international airport.

Harbour: It is possible that in the future the

port of Aqaba may be improved. Studies and cost estimates are at present incomplete.

Telephone and telegraph: No studies are available for the improvement of the telephone and telegraph services.

Electric power: No comprehensive plan appears to be in existence for the development of the electric power systems. Present installation at Amman is about 2,000 kw. in several small diesel engine sets. An additional 2,000 kw. is under construction and a further 5,000 kw. is contemplated. No data have been obtained for the electric-power supply in other towns of Jordan and Arab Palestine. However, it would appear that there is a considerable power shortage in the area as a whole. The Yarmuk River may offer some possibilities for hydro-electric power development.

Housing: No studies are available for large-scale housing schemes. However, the Jordan Government considers that such schemes can be accomplished if a long-term loan is made available. It was suggested that at least £P2 million might be needed.

Industrial development: In Jordan there appears to be scope for development of light industries based on the products from the land, such as the manufacture of sugar, vegetable oils, soap, textiles, leather goods, as well as fruit, vegetable and fish canning, and dairying. A cement factory appears to be an immediate necessity. Cement is now being imported and present plans for a cement factory contemplate an annual capacity of some 80,000 tons. However, a Government official stated that the proposed annual output should be increased to at least 200,000 tons per year. The cost of cement in Jordan is now between £P20 and £P22 a ton. Plans are also being made for the manufacture of phosphates in Jordan, but particulars regarding these plans cannot be ascertained readily.

Domestic and industrial water supply: No adequate information has been obtained on the domestic and industrial water supply facilities in the area. These are generally the concern of the various municipalities. There appears to be need for development in this field.

Need and approximate cost for further technical investigation: All of the above-described development plans are of interest to and within the future plans of the Jordan Government. Many of the plans need considerable further investigation and technical assistance before they can be implemented.

The following table summarizes the status of the development plans, including rough estimates of funds required for technical study.

<i>Description</i>	<i>Estimated cost £P</i>	<i>Cost of further technical study £P</i>	<i>Cost of reconnais- sance report £P</i>
<i>Water Conservation and Irrigation:</i>			
<i>Jordan:</i>			
Dams on 9 wadis	Not known	Not known	20,000
Dams on Yarmuk River	" "	" "	20,000
Headworks on 9 wadis	410,000	—	—
Headworks on Yarmuk River	Not known	Not known	2,000
Irrigation canals	" "	" "	10,000
<i>Arab Palestine:</i>			
Dams on 3 wadis	5,500,000	50,000	—
Dams on Jordan River			
Headworks on 3 wadis			
Headworks and pumping plant on Jordan River			
Irrigation canals			
Land purchase			
<i>Transportation and Communications:</i>			
<i>Roads:</i>			
Jordan 933 km.	3,750,000	25,000	—
Arab Palestine 213 km.	450,000	3,000	—
<i>Railroads:</i>			
Ma'an to Medina	Not known	Not known	25,000
Aqaba to Ashtar	" "	" "	5,000
Harbour: Port of Aqaba	" "	" "	5,000
Telephone and telegraph	" "	" "	Not known
Housing	" "	" "	10,000
Industrial Development	" "	" "	25,000
Electric Power	" "	" "	20,000
Water Supply	" "	" "	10,000

Lebanon

Lebanon's future development programme is fairly well defined, and studies are in progress on various long-term development schemes. Unquestionably the major natural resource of Lebanon is the Litani River.

IRRIGATION AND DRAINAGE

Plans are being made for the reorganization of all irrigation systems commanding some 30,000 hectares, and new projects which will cover some 37,000 hectares are being implemented or planned. Included in the long-term schemes are the South Beqaa, Akkar Plain and Tyr-Saida schemes which are proposed to be initiated under the short-term projects.

DOMESTIC WATER SUPPLY

Studies are under way for the general improvement of the domestic water supply systems for numerous cities, towns and villages in Lebanon. Sources of supply will be rivers, springs, wells and cisterns. Plans and surveys are available for

some 800 km. of pipeline for village water supply systems.

TRANSPORTATION

Roads: The highway system of the country is advanced relatively further than other classes of public works, and with few exceptions it is considered adequate for the present needs. A moderate programme of continued maintenance, improvement and extension is under way and contemplated for the future.

Railroads: Railroad communications appear to be inadequate and a study for betterment should be undertaken. Plans for the construction of a standard gauge line from Beirut to Rayak, connecting with the Homs line, have been in existence for a long time. The economic justification for this line requires further study. The standard gauge coastal line from Tripoli to Naqoura requires considerable improvement of the road-bed and elimination of level crossings.

Ports: The principal ports are Beirut and Tripoli. Plans have been made for the improvement of the port of Beirut and some dredging may be required at Tripoli.

INDUSTRIAL DEVELOPMENT

Heavy industry does not appear feasible in Lebanon in view of the absence of the necessary basic materials. Industrial development must therefore be based on products of the land, and must await the development of an abundant source of low cost power. An early survey would be advisable.

ELECTRIC POWER

Of the total population of Lebanon somewhat more than one-half live in centres served by electricity. The most important of these are Beirut and Tripoli, with a total population in excess of 500,000 living in the area served, of which only about 10 per cent are consumers.

Electric power supply at present appears inadequate and unreliable. Electricity supply companies generate power under concessions from the Government. In addition, there are distribution companies which obtain their power from the supply companies. The generating plant consists of both hydro-electric and thermal stations. The thermal stations are generally diesel engine and the largest unit is 3,000 kw. The largest hydro-electric unit is about 4,000 kw. The highest transmission voltage is 25 kv. in Beirhut and 35 kv. in Tripoli.

Costs of generation are high. Cost of fuel alone varies between 4 and 9 piastres per kwh. (1.2 to 2.7 U.S. cents).

The average rate for domestic lighting is probably in the neighbourhood of 16 piastres per kwh. in Beirut (5 cents per kwh.) and 23 piastres (7 cents) in Tripoli. The average number of customers (domestic and power consumers) totalled about 60,000 in 1946, and average domestic consumption in 1946 was somewhat over 400 kwh. in Beirut and about 250 kwh. in Tripoli. In the same year industrial consumption averaged approximately 11,000 kwh. in Beirut and 15,000 kwh. in Tripoli per customer. The total installed capacity in 1946 in Beirut and Tripoli was about 26,000 kw. Consumption in general is restricted by the shortage of supply.

The most important source for the future supply of electricity is the Litani River. The total drainage area of the Litani River is 2,168 sq. km. (816 sq. miles) of which some 80 per cent lies above the 800 metre contour. The average rainfall in the basin is about 690 mm. (27 ins.). In its lower course after it leaves the Beqaa Plain, the Litani River drops from an elevation of 850 metres (2800 ft.) to sea level in a distance of 100 km. (62 miles). The steepest drop of about 650

metres (2100 ft.) is concentrated in a river distance of 40 km. (25 miles).

In the lower stretch of the Litani River below the Beqaa Plain there are numerous possibilities for construction of dams, although there are major geologic faults in the area. It seems entirely feasible that sufficient storage could be developed to regulate the flow of the river. The power available in the stretch of river between the Beqaa Plain and the coastal strip is estimated at 750 million kwh. per annum, delivered at load centres after allowance for water use for irrigation and all losses, including evaporation in the reservoirs, head losses and generation, transformation and transmission losses. The power available in the stretch of the river where the fall is most concentrated, that is, between the Plain of Beqaa and the bend where the river turns sharply west from a general southerly direction, is estimated at about 550 million kwh. per annum. At a capacity factor of about 50 per cent, the corresponding installed capacities would be in the neighbourhood of 200,000 kw. and 150,000 kw., respectively.

The water discharge from the hydro-electric power developments would be far in excess of possible water requirements for the comparatively small irrigable area along the coast from Tyr to Saïda. This area is approximately 5,000 hectares, and an estimated flow of 5 cubic metres per sec. of the available regulated flow released during the driest six months of the year would be sufficient for its intensive cultivation. This is equivalent to a continuous flow of 2.5 cubic metres per sec., which is less than one-eighth of the total available regulated flow.

Additional utilization of the important economic resource to be obtained from the development of the Litani River can be achieved by diverting that portion of the water not used for irrigation purposes in the Tyr-Saïda area; that is, approximately seven-eighths of the regulated flow, equivalent to a continuous flow of some 20 cubic metres per second, into the Jordan Valley where a total drop of some 550 metres is available between the bend of the river and the Dead Sea level, as compared with a drop of some 150 metres between the bend and the coastal plain of Lebanon. An additional development of this nature could be of material assistance in the retirement of the necessary capital investment in the hydro-electric development.

The hydro-electric projects are within easy transmission distance from the load centres. The straight line distance from the upper dam site to Beirut is only about 40 km. (25 miles). The

hydro-electric projects are high head developments, and the generating capacity may reasonably be expected to be installed at a comparatively low cost.

Full development of the Litani River may be considered to be of utmost importance to the economy of the country. Two hundred and fifty thousand customers, roughly four times the present number, consuming 2,000 kwh. per annum, approximately five times the present residential consumption, would utilize only two-thirds of the potentially available amount of power, and the remainder would be available for industrial development. The power which will be made available will thus be sufficient to serve all the needs of the population of Lebanon for a long time in the future, and thermal plants will not be needed during this period.

The development of the Litani River should therefore receive a high priority, and a thorough and complete study of this entire problem should be undertaken at the earliest possible moment. The study should deal with the river as a whole, in order that its full potential may be achieved. To deal with this major resource without such an over-all study would in all probability make achievement of its maximum development difficult, if not impossible.

In addition to the Litani River projects, there are several possibilities for hydro-electric development on smaller rivers, such as the Nahr el Ibrahim. Further development of these rivers should be postponed until the Litani River study has been completed.

Low cost and abundant electric power will facilitate development of village water supplies, increase pumped water supply for irrigation, and aid industrial expansion.

NEED AND APPROXIMATE COST OF FURTHER TECHNICAL INVESTIGATIONS

Many of the projects in the long-term programme require further investigations before they can be implemented. The following table summarizes the status of the development plans, including rough estimates of funds required for further technical study.

Description	Estimated cost £L	Cost of further technical study £L	Cost of reconnaissance report £L
Irrigation and drainage	50,000,000	50,000	—
Water supply	30,000,000	50,000	—
Transportation	Not known	Not known	100,000
Industrial development	Not known	Not known	75,000
Electric power	Not known	750,000	—

Syria

Plans for long-term development in Syria include the following:

WATER CONSERVATION AND IRRIGATION

The total area of Syria is about 18 million hectares of which half is uncultivable desert and mountains. Of the balance about 4 million hectares are forest or pasture. 2.2 million hectares are cultivated and the balance of 3.2 million hectares is unused arable land.

Of the cultivated land 90 per cent is dependent on rainfall and only 240,000 hectares are irrigated. Extensions of irrigation to 425,000 hectares are eventually contemplated.

Details of this area are as follows:

	Hectares
<i>Euphrates Valley</i>	
From privately owned pumping installations ...	150,000
From canals commanded by a weir in the Halabye gorge	150,000
<i>Khabour Valley</i>	
Canals from the Khabour at various sites	33,000
<i>Orontes River</i>	
From new canals upstream of Acharnee	40,000
In the Ghab depression after drainage	34,000
<i>The Maerib project on the Yarmuk-drainage</i>	3,000
<i>Baraj's River-drainage</i>	1,000
<i>Awass River-drainage</i>	1,000
<i>The Roudj Depression-drainage</i>	5,000
<i>The Qouiah Marshes-drainage</i>	8,000

TRANSPORT AND COMMUNICATIONS

Roads: Considering the general state of development of the country, Syria has a fairly adequate road system. The principal arterial roads are:

Aleppo—Homs—Damascus—Daraa—Jordan.

Aleppo—Raqqah—Deir ez Zor.

Aleppo—Latakia—Tartouss—Tripoli (Lebanon).

Homs—Tripoli (Lebanon).

Homs—Baalbeck (Lebanon).

Damascus—Beirut (Lebanon).

Damascus—Qneitra—Haifa (Palestine).

Chak Meskiné Souida.

These roads totalling in length over 1,300 km. are generally in good condition but require improvement in surfacing, in easing curves and in widening in certain reaches.

Syria also has 860 km. of all weather secondary roads connecting administrative centres. There are also some 1,400 km. of fair weather secondary roads which could be metalled. Some 1,100 km. of further secondary roads are contemplated.

Railways: The railway system includes two gauges and is not well aligned from the point of

view of international boundaries. The high Euphrates and Khabour valley areas are without any railway communications as is the port of Latakia. The standard gauge Istanbul-Bagdad railway passes along the northern border with stations at Aleppo, Djerablous and Qamichliye. The standard gauge also connects Aleppo with Homs and the latter city with the Lebanon railroad at Tripoli and Baalbeck. Metre gauge lines connect Damascus with Beirut, Haifa and Amman.

In addition to the new lines it may also be advisable to convert about 183 km. of metre gauge (actually 1.05 metres) to standard gauge.

Air Communications: Damascus is already an important calling point for international air traffic, lying as it does on the direct route from Europe to the East. The airport at Mezze is well situated but requires some modification to bring it up to international standards.

Syria is a country in which long distances justify the establishment of internal air services and airports, which may well be required eventually at Aleppo, Latakia, Homs, Deir ez Zor, Hassatche, and Qamichliye. At most of these towns, landing grounds already exist but much work of improvement and re-equipment will be required to make them suitable for regular service.

Ports: The only important port in Syria is Latakia, natural outlet for Aleppo and the rich agricultural areas of Northern Syria. At present it has an open harbour which can accommodate vessels of 6 metres draft but is not very safe from south-easterly winds. Larger ships lie in the roadstead off the port and are unloaded and loaded by lighter. Plans exist for the improvement of the port, including the provision of a main breakwater 1,500 metres long to enclose the roadstead. Also included is a subsidiary breakwater to the north, and the construction of quays capable of berthing vessels of 8 metres draft with provision of transit sheds, cranes and other harbour equipment.

Telephone and Radio Service: Syria has at present only 1.1 telephone connexions per 1,000 inhabitants, and the existing service is old and inefficient. Plans exist for the replacement of the system at an estimated cost of £S30 million. There is, at present, no broadcasting station, but the installation of a small station at a cost of about £S2 million has been suggested.

HYDRO-ELECTRIC POWER

The only hydro-electric power at present developed in the country is at two small stations on the Barada River with an installed capacity of 2,200 kw. This power is used in Damascus. There

is a possibility of increasing this power by about 3,000 kw. by new construction.

The greatest possibility of hydro-electric development is on the Euphrates where a scheme has been worked out for the construction of a dam at Youssef Pacha. This power would be used in Aleppo and other towns in Northern Syria and also for irrigation pumping in the Euphrates Valley.

Other possibilities are the development of the Yarmuk River and development on the Orontes River in the Ghab area. The Secretary-General of the Ministry of Public Works and Communications has prepared a report entitled *The Yarmuk Project for the Solution of the Power Crisis in Damascus*, relating to the hydro-electric development of the Yarmuk River. The area of the watershed is 7,000 sq. km. of which 5,700 sq. km. are in Syrian territory, the remaining area being in Transjordan. Near Tell-Shehab the Yarmuk starts cutting a deep canyon from an elevation of 380 metres above sea level and descends to 150 metres below sea level at Hamme (the frontier between Syria and Palestine) located some 50 km. from Tell-Shehab.

In the report referred to it is planned to utilize only the ground water flowing from a number of springs in the vicinity of Kaumel Kassab at an elevation of 408 metres above sea level. Diversion weirs and canals, together with penstocks, are planned to divert and conduct the water to a power plant which would be located at Makaren with an installed capacity of 15,400 kw. It is estimated that this installation will produce 93 million kwh. per year and it is planned to transmit this power by a 88,000 v. transmission line some 115 km. in length to Damascus. The total estimated cost of this project is £S15 million.

It is known that additional power can be secured later as a result of the development of storage and full utilization of the waters of this river. A study dealing with the river as a whole including the development of storage to achieve the full potential of this river should receive high priority in any plan for the development of hydro-electric power in Syria.

PUBLIC BUILDINGS

It is considered that an extensive programme of public buildings is justified in Syria. The following buildings are required: a President's palace, a Prime Minister's residence, Ministries of Foreign Affairs, Public Works and National Economy, a Parliament library, courts, serails, customs warehouses and officials' residences; post

offices, telephone exchanges and printing offices; hospitals and dispensaries; schools and colleges.

INDUSTRIAL DEVELOPMENT

The principal industries of Syria are cotton spinning, cotton and silk weaving, cement factories, tanneries, canneries, vegetable oil factories, match factories and cigarette factories. Most of these are growing and expansion of the cotton spinning and cement plants appears desirable. An industrial survey of Syria should be undertaken.

DOMESTIC WATER SUPPLY

Domestic water supplies throughout Syria are at present unsatisfactory. Rural areas and small towns are generally dependent on rivers, springs or wells, and many of these sources are subject to pollution. Except for Damascus, no large town has an adequate supply, and in most towns only about one-third of the population has house connexions, the balance being dependent on public fountains or wells.

Under these conditions there is considerable scope for improvement. In rural areas there are

many towns and villages requiring piped supplies from existing sources after suitable purification. When existing sources are not adequate, wells will be necessary in many cases.

The plan for the town of Aleppo for a new source of water supply is estimated to cost some £S28 million. This comprises double lift pumping of about 1 cubic metre per second from the Euphrates in the vicinity of Habboube, and the construction of a closed concrete aqueduct 73 km. long to Aleppo, as well as provision of a purification plant, an additional reservoir and distribution lines. Plans for improvement of water supply systems are also in preparation for the towns of Homs, Hama and Latakia.

NEED AND APPROXIMATE COST OF FURTHER TECHNICAL INVESTIGATIONS

While future development of Syria has been studied at great length in the past, and various plans have been worked out in detail, there is still a great deal of further investigation required.

The following table summarizes the status of the development plans and estimates roughly the cost of future technical investigations required.

Description	Estimated cost		
	Total construction £S	Further technical study £S	Reconnaissance report £S
<i>Water conservation and irrigation</i>			
Euphrates Valley	20,000,000	500,000	—
Khabour Valley	3,500,000	50,000	—
Orontes River:			
Upstream Acharnee	4,500,000	50,000	—
Ghab scheme	37,500,000	100,000	—
Mzerib project	340,000	10,000	—
Barada River	1,000,000	20,000	—
Awaz River	1,000,000	20,000	—
Roudj Depression	Not known	100,000	—
Qouaik Marshes	5,000,000	50,000	—
<i>Transport and communications</i>			
Roads	35,000,000	200,000	—
Railways	126,000,000	2,500,000	—
Air communications	Not known	Not known	50,000
Ports	28,000,000	—	—
Telephone			
<i>Hydro-electric power</i>	125,000,000	200,000	—
<i>Buildings</i>	70,000,000	300,000	—
<i>Industrial development</i>	Not known	Not known	200,000
<i>Domestic water supply</i>	Not known	Not known	100,000

Israel

PROJECTS WITHIN FUTURE PLANS OF THE COUNTRY

Full development of available water resources is the key to the future welfare of the countries of the Middle East. This is particularly true of the

arid territory of Palestine where full use of the land is limited by the available water supply.

The major plan for development of the water resources of Palestine is described in the report, *Proposals for Irrigation and Hydroelectric Development in Palestine*, by James B. Hays, June 1948. In this report the development of the water

resources in Palestine is planned for execution in eight stages. In the introduction to the report, Walter C. Lowdermilk states: "While construction of the entire project obviously depends on harmonious co-operation between Jewish and Arab States of Palestine, a number of the stages need not wait upon such co-operation."

Unfortunately, for early execution of the plan, an analysis of the various stages shows that within the present borders of Israel only a portion of stage 1 could be executed without co-operation from the contiguous Arab States.

Stage 1—Underground water supplies and springs

This stage involves the development of the underground water sources and springs along the coastal plain from the northern border with Lebanon south to the Egyptian border. Only the Gaza Strip would have to be eliminated if the work is to be confined within Israel territory. Also included under Stage 1 is the development of the Hasbani reservoir and power stations located in Lebanon.

The estimated cost of Stage 1 is as follows:

Development of water resources in	
the coastal area	\$22,582,000
Hasbani power projects	\$13,535,000

Stage 2—Upper Jordan summer waters and Hasbani reservoir

This stage proposes the use for irrigation purposes of the summer flow from the Banyas River, Tell el Quadi and other springs, and the entire flow of the Hasbani River. The area to be irrigated is, in general, located in the north-east corner of Israel, south of Huleh Lake and south-west of Lake Tiberias. The irrigation canal from the Banyas reservoir crosses the Syrian and Lebanese frontiers, and this stretch of the canal would have to be replaced by a costly inverted syphon in order to stay within Israeli territory. Moreover, diversion of a portion of the flow from the Jordan headwaters will affect the outflow from Lake Tiberias and the flow of the Jordan River downstream. It is doubtful whether this stage can be executed without compensating for this reduction of flow.

The total estimated cost of Stage 2, exclusive of the additional cost of the inverted syphon, is about \$37,829,000.

Stage 3—Yarmuk River diversion

In this stage additional diversions of waters

from Lake Tiberias are proposed which will disturb the existing balance between inflow and evaporation of Lake Tiberias. The Yarmuk River diversion is proposed to restore the balance. This diversion depends upon agreement with the neighbouring Arab States.

The cost of stage 3 is estimated to be \$10,146,000.

Stage 4—Mediterranean—Dead Sea power system

This stage will be needed to supply power and furnish sufficient water to replenish the deficiencies in the Dead Sea, created by the diversion of the upper Jordan waters. The main power canal is located in Arab Palestine for about half of its length, including the location of the power plants. In the introduction to the report, Mr. Lowdermilk states:

"Stage 4 includes the Mediterranean-Dead Sea hydro-electric power project, which requires co-operation between the two States for its construction. Yet within the Jewish State, a portion of this power project, with some modifications, may be installed. The tail race from the turbines of the first power station would be discharged into the Jordan River channel, leaving construction of the second powerhouse to some later time."

It should be obvious that salt water cannot be discharged into the Jordan River without an agreement with the Arab States and, secondly, the location of the first power plant is in Arab Palestine. Moving the location of this station farther upstream would result in a reduction of the available head.

Stage 4 is estimated to cost \$43,530,000.

Stage 5—Upper Jordan winter waters

This stage provides for the utilization for irrigation of the remaining waters of the upper Jordan. This can only be accomplished after the Yarmuk River diversion has been made, which, as noted above, depends upon agreement with the neighbouring States.

The cost of stage 5 is estimated at \$32,830,000.

Stage 6—Huleh Lake and marsh drainage

Reclamation of Huleh Lake and marshes is dependent upon the prior diversion of the summer and winter flow of the Upper Jordan and its tributaries. As noted previously, such diversion is contingent upon replenishment of Lake Tiberias by diversion of the Yarmuk River.

The cost of stage 6 is estimated at \$21,512,000.

Stage 7—Lower Jordan Valley

This stage is located entirely within Arab Palestine. Its cost is estimated at \$15,352,000.

Stage 8—Storage on coastal plain wadis

This stage contemplates the storage and recovery of winter flood waters from the principal wadis draining into the Mediterranean, as well as the use of the surplus waters of the Kabri and other springs along the coast. It may be noted that a considerable number of the dam sites on the wadis, as well as a portion of the upper section of the main canal, are located in Arab Palestine.

Only a comparatively small local development would remain of this stage if it is to be confined to Israeli territory.

The cost of stage 8 is estimated at \$53,882,000.

The total construction cost of all stages of the Hays plan is estimated at \$251,198,000.

As outlined apparently the only portion of the long-range water development programme which could be undertaken in Israel without prior agreement with the neighbouring States is the part represented by the development of the underground water resources along the coastal plain. The construction cost of this work is approximately 9 per cent of the total cost of the entire development. If some small local developments are added in anticipation of future agreement, the work which can be undertaken at present would probably not exceed 15 per cent of the entire programme.

INTERNAL WATER CONSERVATION PROJECTS

Due to the urgent need for additional land for agricultural expansion the Israeli Government is working on a number of conservation projects to provide water for irrigation based on internal sources of supply. The total cost of these projects is estimated at £ 1 19 million or \$US53,200,000, and it is estimated that most of the projects could be completed during a period of about two years. Data made available to the Mission's engineering consultants do not make it possible to express a judgment concerning the economic feasibility of these projects. These projects include:

(1) The proposed Yarkon reservoir

This project is planned in two main parts—a reservoir for flood water from the Yarkon proper and storage reservoirs on the tributary wadis to provide an additional source of water. For the complete utilization of the waters of this river

it will be necessary to have a storage reservoir capable of storing its flood waters. It is estimated that this scheme can be completed within two years at a cost of about £ 1 700,000 or \$US1,960,000.

(2) Project for utilisation of Yarkon water to the south

This project is comprised of two pipelines extending from the Yarkon reservoir to the south. The eastern line is planned to carry 50 million cubic metres per year and will irrigate the area between the Yarkon and the Gezer. It will then continue its course as far as the Beersheba highway. The western pipeline will be designed to carry some 150 cubic metres per year to the southern coastal area. The total area irrigated by both of these pipelines would amount to between 250,000 and 300,000 dunums. The cost of this project may total £ 1 9 million or \$US25,200,000.

(3) The Beisan project

A detailed plan is being prepared, based on the exploitation of the spring waters in the Beisan region. It is estimated that the construction necessary to concentrate and distribute the spring waters among the agricultural settlements will total £ 1 1 million. The project will provide irrigation for an area of 100,000 dunums. The total cost of this project, together with the necessary drainage works, will amount to about £ 1 3.6 million or \$US10.08 million.

(4) Western Galilee water supply project

The area of this project includes the plain along the length of the sea between Acre and Ras-el-Nakura and extends as far as the high mountains in central Galilee. It is planned to develop the underground water resources and supply water to all areas of the plain, as well as specified quantities of water to the mountainous areas. The approximate cost of this project is £ 1 1 million or \$US2,800,000.

(5) Qishon reservoir project

Central and western Emek Israel will receive a considerable part of its water from the Qishon reservoir. The utilization of the Qishon waters will require the construction of a storage dam. It is estimated that this project can be completed within two years at a cost of about £ 1 800,000 or \$US2,240,000.

(6) *Reclamation of the Na'aman River and utilization of the Halazon flood waters*

This project involves the reclamation of the Na'aman river area from the point of view of public health, including malaria control, as well as the utilization of the flood waters for irrigation purposes. The Israeli Government considers this project as urgent and estimates that it will be possible to complete it within two years at an estimated cost of about £I 1 million, or \$US-2,800,000.

(7) *Jordan Valley water supply project for settlements*

This project is an expansion of a recent scheme and will supply water to seven existing settlements and provide the supply for some four additional settlements. It is planned to supply water from the existing pumping station in the Jordan Valley and convey it in an aqueduct to various irrigation areas. The total cost of this project is about £I 300,000 or \$US840,000.

(8) *The Harod Valley water supply project*

The Harod Valley settlements require an increase in water and it is planned, by the construction of two reservoirs, to store the winter waters of the springs, together with the eastern and western flood waters. This, together with water secured from the Jausaq spring will provide some 6 million cubic metres per year. It is estimated that this project can be completed within two years at an estimated cost of £I 400,000 or \$US1,120,000.

(9) *Conservation of winter floods from wadis along the coastal plain*

This project will require further investigation to determine the possibilities of storing water in reservoirs and the absorption of water in the soil for the replenishment of the underground waters. It is planned, depending upon investigations, to utilize the developed storage and the waters of each of the following sources: Zerka River, Wadi Kabir, Rubin River, Wadi Zukrir and Wadi Hasi. It is estimated that the total cost of these projects may reach £I 2 million or \$US5,600,000.

The following table gives a summary of the estimated cost of these projects:

ESTIMATED COSTS OF NINE REGIONAL
IRRIGATION PROJECTS

	Estimated cost	
	£I	\$US
(1) The proposed Yarkon reservoir	700,000	1,960,000
(2) Project for utilization of Yarkon water to the south.....	9,000,000	25,200,000
(3) The Beisan project.....	3,600,000	10,080,000
(4) Western Galilee water supply project	1,000,000	2,800,000
(5) Qishon reservoir project.....	800,000	2,240,000
(6) Reclamation of the Na'aman River and utilization of the Halazon flood waters.....	1,000,000	2,800,000
(7) Jordan Valley water supply project for settlements.....	300,000	840,000
(8) The Harod Valley water supply project	400,000	1,120,000
(9) Conservation of winter floods from wadis along the coastal plain	2,000,000	5,600,000
Total	18,800,000	52,640,000

Gaza Strip

PROJECTS WITHIN THE FUTURE PLANS
OF THE AREA

The development of the Gaza Strip has never been considered as a problem separate from that of the contiguous territories. However, certain engineering plans have been made which apply specifically to this area.

WATER CONSERVATION AND IRRIGATION

Increase in agricultural productivity is possible by means of storage on the Wadi Gaza or by sinking of additional wells. Plans for the development of the Wadi Gaza cannot be considered at present because, apparently, the most suitable storage sites are located within the area presently occupied by Israel. Sinking of additional wells requires considerable further investigation and study. A major fault passes through the area from north to south, and if the fault is tapped by wells a good supply appears likely, although the ground water supplies in the area are somewhat uncertain. It is also possible that some water may be obtained from wells in the sand dune area. A programme of experimental boring, together with a geologic study, is necessary before extensive work could proceed.

HOUSING

Plans are in existence for various housing schemes at Gaza, at Khan Yunis and Narrafa. Further study and determination of requirements will be necessary before initiation of such a programme.

INDUSTRIAL DEVELOPMENT

There may be some possibility of small-scale development applied to industries based on products of the land.

DOMESTIC WATER SUPPLY

Domestic water supply systems appear insufficient and unsatisfactory in both rural and urban areas. Plans for the development of the Gaza water supply system are available, and additional water supply systems may be also required in other areas.

ELECTRIC POWER

The electric power supply system will probably prove to be inadequate for future needs, particularly if new light industries are to be established and the irrigation and pump installations are to be modernized and electrified.

PORT

There is a possibility of developing a local fishing industry which could make use of a small port, and an investigation of this would appear justified.

NEED AND APPROXIMATE COST OF FURTHER TECHNICAL INVESTIGATION

The following table summarizes the investigations which are required, and gives a rough estimate of possible cost:

<i>Description</i>	<i>Estimated cost £P</i>	<i>Further technical study £P</i>	<i>Cost of reconnaissance survey £P</i>
<i>Irrigation (Wadi Gaza dams not included):</i>			
Wells	—	—	2,000
Housing	1,350,000	5,000	1,000
Industrial development.	Not known	Not known	5,000
Water supply	"	5,000	—
Electric power	"	Not known	1,000
Port	"	"	1,000

SECTION C
DETAILS OF SOME POTENTIAL WORK RELIEF PROJECTS
(a) AGRICULTURE
Short-term Projects for Palestinian Arab Refugees

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Conclusions and explanations

For facility of reference it is felt desirable that the conclusions which have been reached in this report and the programme which has been proposed, should appear at the forefront. The bases on which these conclusions rest are described in the pages which follow and the data from which the final calculations have been computed will be found in the appendices relating to the various countries.

2. Rapid tours for the purpose of observing conditions, in each of the countries included in the report, supported by discussions with senior officials of their Governments, showed clearly that without exception no country visited had taken in the past, nor is taking at present, adequate measures for soil and rainfall moisture conservation. Consequently, the soil is being eroded; water which is the lifeblood of the agriculture of these territories is wasted: land is often not being used to the best advantage nor for the purpose to which it is best suited and the financial returns which are being obtained from it are not so great as they can be under a proper system of land usage.

3. The agricultural consultants, therefore, concluded that the greatest contribution on the purely agricultural side which Arab refugee labour can make on a short-term basis and which will be of lasting economic benefit to the countries lies in the execution of a programme of soil and water conservation in rain-fed areas, through the terracing and afforestation of the land. Their proposals have been confined to these two measures. In both of them labour accounts for at least 90 per cent of the cost.

4. The projects recommended are common to all the countries which the consultants have visited, with two exceptions. Conditions in the Gaza Strip do not necessitate land terracing, whilst the afforestation project concerns sand-dunes along the coast and not hilly areas, as in the other territories. Lebanon finds no place in the projects for the special reason stated in the section of the report which deals with that country.

5. The calculations which have been made of area, man-days of labour, number of men required and cost are the best possible that can be made in all the circumstances, but they lay no claim to perfection and, indeed, in some respects the margin of error may be considerable. It must be said, at the same time, however, that the maximum effort has been made to secure as reliable basic data as exist for use in their preparation.

6. The variations that will be observed in the man-power required and in the cost of the same

operation in adjoining countries may cause the student of economics to throw doubt on the value of the data in some of the tables below. Hurried conclusions of such a kind should be avoided, for the kind of terrace which is constructed or the method of afforestation which is adopted regulates the amount of labour required and the cost involved. Thus, terraces vary in nature from the relatively cheap type which requires no stones to the costly stone-wall, according to the slope of the land and the purpose for which it is used. Again, afforestation may be by sowing seed, or by planting seedlings either with or without Gradoni trenches. It is to factors such as these that the variations are due.

7. In calculating the number of labourers required for terracing and for Gradoni work, a working year of 300 days has been used throughout. On the basis of a 6-day working week this allows only 13 days a year for lost time due to sickness, bad weather or other cause. This margin is probably too low and it is unlikely that in practice a refugee will work 300 days a year, even if whole-time work is available. A 300 working-day year has been adopted, however, in the belief that if a refugee receives pay for that number of days, his earnings will enable him to subsist for the remaining days of the year. If, on the other hand, he is paid only, say, 250 days a year, he will require relief in some form for the remainder.

8. In fixing the daily rate of wage for refugee labour, the current rate for local labour in the country concerned has been taken. Thus, for Syria the calculations of cost are based on £S3 and in Jordan and Arab Palestine on 30 piastres per man per day. Doubt was cast by local authorities in these countries as to whether a refugee and his family can subsist on these rates without some additional relief. In Syria £S5 a day and in Jordan and Arab Palestine £P120 a year (40 piastres a day on a 300 day year basis) were felt locally to be necessary for the unaided maintenance of a family. It was pointed out that although the rates which have been adopted are those actually maintaining for labour, local workers have their homes and usually they and their families have other ways of supplementing the receipts of the wage-earner. Against these doubts it is considered that in an average family of five people there will usually be amongst the four other than the head, at least one and possibly more who, though they may not be full-grown, able-bodied individuals, will, nevertheless, be capable of some earnings which will go towards the upkeep of the family. It will be essential, of course, in most cases to

provide the refugee labourer and his family with some sort of shelter.

9. It is difficult to forecast with accuracy the rate at which the proposed projects can be brought into operation since a number of factors are involved. The organizing ability of the country itself will be an important consideration. The availability of tools and equipment may play an even greater determining role. Many of the tools will have to be imported and a three months' delay may easily be involved thereby. It may perhaps be estimated generally, however, that within three months of sanctioning the projects and providing funds, the programme may be under execution to the extent of 25 per cent, within 6 months, 50 per cent and within 12 months, 100 per cent.

10. Then there is the question of the organization which will undertake the execution of projects. A senior government official in one country was very emphatic that each project must be carried out by the department of government to which the nature of the work normally relates and that the creation of a separate organization for refugee works projects would cause confusion and be entirely unsatis-

factory. On the other hand, the head of one department who will be heavily involved if that course is adopted was equally emphatic that in no circumstance could his department undertake responsibility for a works programme of such magnitude unless it were considerably strengthened and freed from hampering regulations. It seems certain that if the work is done departmentally, the strengthening of staff will be obligatory. For terracing and afforestation which fall entirely in some countries under the Department of Agriculture and in others are divided between two departments, the best course will probably be to set up a new soil conservation division under one or the other department, to deal with such projects.

11. All calculations of cost refer to labour only. In order to present a complete picture of the total cost of the projects it is necessary to make provision for tools and accessories. Their cost is estimated at 2 per cent of the labour charges. This item has been included in table IV which gives a final summary of the data for all the agricultural projects.

Table I. Terracing

Summary of area, man power and cost of complete project

	First year			Total	Second year			Complete project		
	Arab Palestine	Jordan	Syria		Arab Palestine	Jordan	Syria	Total		
Area in dunums.....	160,000	52,500	425,000	637,000		105,000	850,000	1,275,000		
Man-days of work.....	4,800,000	1,575,000	3,765,000	10,140,000	Same as first year in all respects	3,150,000	7,530,000	20,280,000		
Men required daily.....	16,000	5,250	12,550	33,800		5,250	12,550	33,800		
Cost in local currency.....	2,500,000 £P	806,400 £P	12,355,000 £S	—		1,612,800	24,710,000	—		
Cost in dollars.....	7,000,000	2,258,000	3,581,000	12,839,000	14,000,000	4,516,000	7,162,000	25,678,000		

Norres. 10 dunums = 1 hectares; 4 dunums = 1 acre.
Conversion rates: 1 Palestine pound = 2.8 dollars.

3.45 Syrian pounds = 1 dollar.
The men required are for 300 working days each year.

NOTES. 10 dunums = 1 hectare; 4 dunums = 1 acre.

Conversion rates: 1 Palestine pound = 2.8 dollars.

3.45 Syrian pounds = 1 dollar.

The men required are for 300 working days each year.

Table II. Afforestation

Summary of area, man power and cost of complete project

	First year			Second year			Third year							
	Arab Palestine	Jordan	Syria	Gaza Strip	Total	Arab Palestine	Jordan	Syria	Gaza Strip	Total	Arab Palestine	Total	Gaza Strip	Total
Area in dunums.....	12,250	10,000	10,000	—	32,250	12,250	10,000	10,000	10,000	42,250	15,000	10,000	10,000	25,000
Man-days { Planting	90,772	90,000	12,000	—	192,772	90,772	90,000	12,000	70,000	262,772	135,000	70,000	70,000	205,000
of { Nursery	16,800	—	—	8,400	25,200	—	—	—	8,400	8,400	—	—	—	—
work { Planting	302	300	200*	—	802	300	300	200*	1,170*	1,972	2,245*	1,170*	1,170*	3,415*
Men { Nursery	56	—	—	28	84	—	—	—	28	28	—	—	—	—
required { Planting	28,298	32,200	41,000	—	—	28,297	32,200	41,000	17,500	—	48,000	17,500	17,500	—
daily { local currency	£P	£P	£S	—	—	£P	£P	£S	£P	—	£P	£P	£P	—
Cost in { Nursery	43,950	—	—	21,975	—	—	—	—	21,975	—	—	—	—	—
Cost in { Planting	79,200	90,160	11,900	—	181,260	79,200	90,160	11,900	49,000	230,260	134,400	49,000	49,000	183,400
in { Nursery	123,060	—	—	61,530	184,590	—	—	—	61,530	61,530	—	—	—	—
dollars { Nursery	—	—	—	—	—	—	—	—	—	—	—	—	—	—

NOTES. 10 dunums = 1 hectare; 4 dunums = 1 acre.

Conversion rates: 1 Palestine pound = 2.8 dollars; 3.45 Syrian pounds = 1 dollar.

* Men are required for 60 days; otherwise for 300 days a year.

Table III
Afforestation

Sum-total of complete project

Area in dunums	99,500	
Man days of work .	{ Planting 660,544 } { Nursery 33,600 }	694,144
Men required daily .	{ Planting 6,189 } { Nursery 112 }	6,301
Cost in dollars	{ Planting 594,920 } { Nursery 246,120 }	841,040

NOTES.

(1) Men employed on planting are required for 60 days only; remainder for 300 days in the year.

(2) 10 dunums = 1 hectare : 4 dunums = 1 acre.

Table IV

Final summary of all agricultural projects

	<i>Terracing</i>	<i>Afforestation</i>	<i>Total</i>
<i>Area in dunums.</i>	1,275,000	99,500	1,374,500
Man-days	20,280,000	694,000	20,974,000
Men required daily	33,800	6,300 ^a	40,100 ^a
<i>Cost in dollars</i>			
Labour	25,678,000	841,000	26,519,000
Tools and accessories ..	513,000	17,000	530,000
Total	26,191,000	858,000	27,049,000

NOTES.

^aOf whom 4,985 are required for 60 days a year for two years; the remainder are for 300 days a year.

The cost in dollars has been rounded off to the nearest thousand.

Scope

1. Since the nature of this report is restricted to proposals for finding temporary work for Palestinian Arab refugees, its scope does not cover all the Middle East but is limited to those countries or areas in which substantial numbers of these refugees at present find shelter pending a permanent settlement of their future. These territories are Jordan, Arab Palestine, the Gaza Strip, Lebanon and Syria.

Procedure

2. The procedure adopted in each case was that:

- (1) The agricultural officers of the Mission, in company with their colleagues on the engineering side, first visited the headquarters of the country or area, met senior govern-

ment officials, technical officers and, in some cases, prominent local individuals and discussed with them the technical aspects of the immediate task before the Mission. Information was obtained from the local officials regarding possible work projects in which the countries themselves were interested, either as complete and self-contained short-term schemes of economic benefit to the country or as first steps essential to the ultimate realization of larger, long-term schemes of economic development. To this list of projects the Mission's officers then contributed their own suggestions as to general types of schemes and, in some cases, actual projects which, they felt, could be included suitably in work to be executed by refugee labour for the benefit of the country.

- (2) Rapid tours were next made of most of the principal areas in which works projects were contemplated. These tours enabled the Mission's staff to appreciate the agricultural and other relevant conditions of each tract and to see how the various projects would fit the needs and economies of the areas concerned.
- (3) A final meeting was then held with the local administrative and technical officers of the country for a further exchange of views in the light of the greater local knowledge which had accrued as a result of the tours. At this meeting agreement was reached as to the projects to be included for the country, and data were collected to make possible the preparation of estimates as to extent of work to be undertaken, manpower required and rough cost of each project.

Brief survey of conditions

3. For a full understanding of the difficulties under which agriculture, the principal industry of each country in this region, is carried on and for the better assessment of the economic and other benefits which can be conferred through undertaking some of the projects later proposed in this report, it is desirable to refer briefly to some of the climatic and other major factors which affect and restrict the scope of present and future agricultural activities in these territories.

4. The soil is the principal natural resource of the countries in this region. It provides the direct means of subsistence of the vast majority of their inhabitants and through its products contributes extensively to the means by which many of the

remainder find a living. Unfortunately, through ages of neglect and the ravages of man and beast, this priceless asset has been allowed to deteriorate. Over whole areas erosion has been allowed full play and in widely separated parts of these territories the soil has completely disappeared down to bed rock. This process still continues over large areas in the region, though within it magnificent examples can be found of land use and soil conservation measures approaching the maximum possible. These examples show that at least some of the inhabitants are soil-conscious and fully realize the need for taking effective measures to conserve what, in fact, is their most valuable asset. Any programme of agricultural development and improvement must place well at the forefront adequate measures for soil conservation. In this regard refugee labour can make a valuable contribution.

5. In these countries, as also in territories extending for thousands of miles still further east, scarcity of water is the main obstacle to agricultural development. With certain exceptions, such as areas in which the soil is highly saline, evidence abounds everywhere that, given the necessary moisture, the soil in general is highly productive. The problem confronting man in these regions is the provision of water in quantity adequate to support plant life. The sources are twofold: (a) natural rainfall, (b) man-made irrigation projects which utilize for their supplies the surface waters of rivers, springs etc., or the reservoirs of water to be found in underground regions. The development of the latter source is usually a long-term project, but in the better utilization of the former source refugee labour can give extensive and valuable assistance.

6. The outstanding features of the rainfall of the Middle East region are its uneven distribution and its sparseness. Actual precipitation occurs in only 4 or 5 winter months. The remainder of the year is hot and rainless. With the exception of the mountain regions where relatively high rainfall and snow occur in winter, the maximum annual rainfall seldom exceeds 30 inches and that too in very limited areas only. Over a very large area under cultivation, it is considerably less than 20 inches, whilst extensive tracts where it does not exceed 10 inches and even less are brought under the plough annually. In some countries, notably Syria and Jordan, large desert areas exist because of inadequate rainfall and the absence of any form of artificial irrigation to support plant life.

7. In these circumstances, cereals constitute the principal annual crop of the region, though le-

gumes such as the pulses and lentils, also find a place in the winter cropping scheme. When conditions are favourable melons, grain sorghum, and some other summer crops are grown in areas in which the soil moisture carried over from the rainy season is sufficient for their production. In a limited area, as in North Syria, cotton also finds a place. In years of sufficient rainfall it is not uncommon merely to follow cereal by cereal in successive years. Over a large area, however, the rainfall is so limited and the need for conserving soil moisture is so great that the maximum intensity of cropping that can be practised is at best no more than 50 per cent. In the relatively small areas under irrigation in these countries much more intensive cropping can be and is practised. Conditions in many parts are admirably suited to fruit growing and very large areas of rain-fed olives, vines, figs and numerous other fruits are grown.

Types of projects recommended

8. From the foregoing brief description of conditions it will be evident that two directions in which very material aid can be given quickly on a short-term programme, such as is envisaged for refugee labour, and which will be of great economic benefit to each of the countries, lie in measures which have for their object better land use and, in particular, the conservation of the soil itself and of the natural rainfall moisture in it.

9. These measures by no means exhaust the short-term possibilities for the useful employment of refugee labour in agriculture whether directly or indirectly. They have the particular merit, however, for the purpose of the present scheme, that labour forms an extremely high percentage—possibly 90 per cent—of the total cost involved. Further, schemes of this type have the support of the Government concerned. They are such also as to be attractive to the owners of private lands which may be included in them, by virtue of the extensive assistance which private owners will receive in measures which ameliorate their land and enhance its value.

10. It is considered that four major ways in which temporary refugee labour can be employed for the promotion of the economic development of these countries, with special reference to agriculture are:

(a) The terracing of moderate to steeply sloping land for the better retention in the soil of the natural rainfall which it receives and for the protection of the soil from erosion, so that this land may be utilized to better and more profitable ad-

vantage either by growing annual field crops or in its being planted to fruit trees, particularly olives, vines, and figs, for which climatic and other conditions make much of the area admirably suited.

(b) The afforestation of lands not suited to other purposes. By this means, large stretches of country, now non-productive and often deteriorating, can be protected from soil erosion and will contribute in time valuable and much needed supplies of fuel and timber.

(c) The development of good roads to open up the country is of great importance to agriculture for the marketing of its products, particularly where perishable fruits and vegetables are concerned. Roads are closely related to improvement in agricultural practice and the need for them will increase with the development of irrigation schemes proposed for various areas. Road building is another type of development especially suitable for refugee work projects because of the relatively high proportion which expenditure on labour bears to the total cost of the project.

(d) Finally, certain aspects of irrigation projects offer scope for labour employment, sometimes on a considerable scale. This is particularly so in the digging and construction of the water distribution system associated with such schemes.

11. Of the foregoing four types of work projects specially suitable for refugee labour and directly associated with land use and development, the last two fall primarily within the field of engineering. The possibilities which they offer for the employment of labour will be assessed by the engineering consultants of the Mission and, consequently, such projects will not be discussed further in this report, which will be confined principally to land terracing and afforestation. Some general observations on these two aspects of refugee employment may be made before proceeding to deal with the needs of each country separately in these two connexions and the degree to which they appear capable of absorbing refugee labour.

TERRACING

12. As already indicated, the terracing of land is a method of water conservation and land use. It is by no means an innovation in these Middle East countries; on the contrary it has been practised to some extent for ages. It is adopted on land of certain degrees of slope to prevent the run-off of rain water and to preserve it for crop production, to check soil erosion by such run-off, and so to enhance the productive capacity of the land. The work to be done in the countries under

consideration is of two types. These are the reconstruction of existing terraces which have fallen into a state of disrepair through neglect and the construction of new terraces on areas which have not so far come under improvement by this means.

13. On gently sloping land where the soil can be more readily fixed, a relatively inexpensive type of terracing, not requiring the use of stones, is sufficient and effective. Land for afforestation can often be suitably treated in this way. The provision of a single row of stones is an equally effective means of dealing with other slopes and conditions. It often is adequate for the protection of areas to be planted to fruit trees, such as olives and vines and, whilst it is somewhat more expensive than the stoneless terrace, it is very much cheaper than the massive open stone walls, often rising to a height of a metre or more, which are a necessary feature of the countryside in some areas where slopes are steep. Local conditions of rainfall, nature of the soil, slope of the land, availability of stones and purpose for which the terraced land is to be used subsequently must determine the type of terrace to be constructed in each area.

14. Initially terracing, particularly of the stone-wall type, may be expensive but in Middle East countries where rainfall is scanty, precarious and badly distributed, where facilities for artificial irrigation are limited or absent altogether, where agriculture is the main source of livelihood of the people and the backbone of the national economy of the country, the expense is justified in the long run because of the greater productive capacity of the treated land, its ability to produce a variety of field and orchard crops of which it was incapable in its former state and the consequent enhanced value of the land itself.

15. For these reasons the employment of refugee labour on land terracing in these countries will be of very material benefit to their agricultural economy. The practical results of such a measure will not only begin to be experienced almost immediately but will continue to be felt, often to an increasing degree, for many years to come. Such a project, in fact, will be an item in the long-term economic development of the area, capable of immediate realization to such degree as labour under the present scheme may be available to undertake it.

AFFORESTATION

16. Though the importance of afforestation in Middle East countries is widely recognized, far too little practical action has been taken so far in any of them to extend the area under forest trees.

In all these countries there are very extensive areas unsuitable for normal cultivation and at present standing bare and unproductive either because the slope of the land is too steep for cultivation, the soil is too shallow or too stony or for some other reason. Apart from the important effect on soil and water conservation which the planting of these large areas would produce, they are capable of yielding large revenues if used for the production of fuel and timber trees. Within five years of planting returns would begin to accrue from fuel trees and the thinning of timber trees, though the main earnings of the latter class would not be realizable for many years. In such areas as Latakia, where the special method of tobacco curing calls for supplies of pine wood, fresh plantings of such trees would soon begin to give returns by providing much needed fuel.

17. The principal trees favoured in these areas are the different species of oak and pine for timber; for fuel, acacia, eucalyptus, juniper, wild pistachio, terebinth, etc., according to their suitability under local conditions.

18. Two methods of afforestation are practised. These are the direct sowing of seed on the lands to be developed and the planting of seedlings from the nursery. By the former method large areas can be treated in a short time, provided the necessary seed and labour are available. The latter method demands nursery seedling production on a large scale as a prerequisite. It is necessarily a slow and expensive process which produces no results in the form of seedlings ready for final transplantation for a minimum period of one year in the case of some rapidly growing trees, but of two years in that of the main timber trees. Nursery production is thus a principal limiting factor in the rate at which afforestation can be undertaken in a short-term project, when the system of using seedling plants has to be adopted.

19. In some areas and on the steeper slopes where a good covering of soil exists, the Gradoni system of tree planting is favoured by some forest experts. The system consists of cutting V-shaped trenches along the hillside contours in such a way as to catch the run-off water and avoid the necessity of watering seedlings. These strip trenches are at intervals of 4 to 6 metres on average slopes. Seeds are sown on the moist earth. This method of afforestation offers good scope for the employment of labour.

20. Whilst afforestation is a suitable, most important and useful direction in which refugee labour can be employed, the scope which the different countries in the region offer varies. It depends

on a number of factors which include conditions of soil and rainfall and the methods of afforestation favoured. Where seedling production has first to be undertaken, progress in actual afforestation within a two years' period must necessarily be slow. In addition, the planting of seedlings in these countries is usually restricted to about two months annually in the rainy season. On the other hand, Gradoni terracing and afforestation by sowing seed are limited only by the amount of labour and seed available. Whatever system be adopted, however, it is essential that no planting programme be initiated without the advice and guidance of a forestry specialist who will ensure that all the necessary preliminary preparations necessary to such a scheme are made.

21. In any programme of afforestation, however small, one factor which cannot be overlooked is the absolute necessity of the local authorities exercising the strictest control over the areas under afforestation. They must be rigidly closed to grazing, be declared protected areas, and man and beast excluded from them. Without adequate assurances that such measures will be enforced, afforestation would be largely a waste of time and money under the conditions which exist here.

The Gaza Strip

1. Of the original Gaza District of Palestine an area of only about 200,000 dunums (50,000 acres) now remains under Arab control. It consists of a long narrow coastal strip extending from a few kilometres north of Gaza to the Egyptian frontier in the south. Within this strip the refugees and the normal inhabitants are now concentrated.

2. Along the length of the Gaza strip there stretches a line of sand dunes which are a menace to the adjoining arable land through blowing sand. It is said that every year these sand dunes encroach a few yards more on the arable area. Much of the latter is already under cultivation, whilst the remainder appears to be land of good quality requiring only an adequate irrigation supply to produce profitable fruit, vegetable and field crops. The fixation of the sand of these dunes by tree planting is a project which will be of lasting benefit to the agriculture of the area, apart from the contribution which it will make in due course in fuel and timber. The area of dunes requiring sand fixation in this strip is considered to be as much as 100,000 dunums (25,000 acres).

3. The Palestine Forest Department some years ago introduced its own system of fixing the dunes by planting trees directly at the outset without waiting to first introduce a cover of grasses. In

their method seedling plants of rapidly growing kinds of trees, such as eucalyptus and acacia, are used. It is stated that within one year of sowing the seed in the nurseries seedlings of these trees attain a height of about 80 cms. (32 inches). When planting them out, half their length is put in a pit underground and half remains above ground. This deep planting is said to avoid the dangers to which a smaller seedling, planted at a relatively shallow depth, is subject, of being uprooted or covered with sand.

4. In 1947 the Palestine Forest Department brought into effect a 10-year programme of fixing 100,000 dunums of sand dunes in the Gaza area at the rate of 10,000 dunums a year. Before this programme had made much progress hostilities in the area brought it to a standstill and no further progress has been made.

5. It is proposed that this project be revived because of the long-term benefits which it will confer on the agriculture and people of the tract. The possibility of doubling the rate of progress proposed in the Palestine scheme, thus raising 3 million nursery seedlings and planting 20,000 dunums (5,000 acres) annually was considered,

but it was felt that the project as originally conceived is as much as the present local staff, of one forest officer and sixteen others (rangers, etc.), is likely to be able to handle effectively in the early years, since the project has to be worked up from the foundation.

6. It seems likely that none of the items of cost included in the present calculations will be forthcoming from local funds since the permanent future of the territory is not yet determined and Egypt holds it only temporarily at present. Detailed calculations will be found in appendix I.

SUMMARY OF PROJECT FOR THE GAZA STRIP

First year

To raise 1½ million forest nursery seedlings, mainly of Eucalyptus and Acacia.

Second year

(a) To plant 10,000 dunums (2,500 acres) with the seedlings raised in the first year;

(b) To raise another 1½ million seedlings.

Third year

Two months only: to plant 10,000 dunums (2,500 acres) with the seedlings raised in the second year.

Year	Project	Area Dunums	Man-days of labour	Men required daily	Cost £P or \$	
First						
	Nursery work	—	8,400	28	21,975	61,530
Second						
	Planting	10,000	70,000	1,170 ^a	17,500	49,000
	Nursery work	—	8,400	28	21,975	61,530
Third						
	Planting	10,000	70,000	1,170 ^a	17,500	49,000
		20,000	156,800		78,950	221,060

NOTES.

^a For 60 days only: all others for 300 days.

4 dunums = 1 acre; 10 dunums = 1 hectare.
Conversion rate: 1 Palestine pound = 2.8 dollars.

Jordan

1. Jordan is bounded on the west by the Jordan River, the Dead Sea and a line extending from the Dead Sea to the Gulf of Aqaba. The Jordan Valley is well below sea level—over 1,200 feet where the river enters the Dead Sea and progressively less as one goes north. From the valley floor, which is variable in width, the land rises sharply to a plateau which is broken by a series of wadis running from east to west into the Jordan. Some of these wadis are narrow, deep and precipitous, while others have been eroded into valleys where many farms are located. The largest of these valleys is in the watershed of the Wadi Zerqa.

2. The economy of the country is almost entirely agricultural. Apart from a relatively small area cultivated by irrigation, crop production is entirely dependent on winter rainfall which rarely exceeds 450 mm. (18 inches) in the best agricultural areas. The irrigated land is limited to an area in the upper reaches of the Jordan Valley and to small holdings here and there along the beds of some of the wadis.

3. That part of the country which has sufficient rainfall for crop production lies between the Jordan Valley and a north-south line west of the Amman-Mafraq road: it extends from the northern frontier to some distance below the Dead Sea. Much of the northern part is gently rolling plain

where most of the cereal crops are grown. Farther south the country is hilly with some steep slopes and rough and stony land. Farming in this latter area is largely devoted to grapes, olives, fruit trees, vegetables and some tobacco.

4. A considerable number of refugees at present finds shelter in Jordan. If they are taken in conjunction with those in adjoining Arab Palestine, in which the refugee population so closely approaches the number of local inhabitants that it may be necessary to provide work for some of them in Jordan, the urgency of finding work projects in the latter country is obvious.

5. The survey which was made in Jordan by the agricultural consultants of the Mission indicated on the purely agricultural side two types of development which are suitable as work projects, namely terracing and afforestation. Each of these undertakings is of primary importance to the agricultural development of the country.

TERRACING

A high proportion of the land in the area suitable for crop production can be devoted more profitably to horticultural crops than to the cereals, legumes, and other field crops now grown. This is because the slopes are steep and the land rough and stony. When such land is terraced and planted to horticultural crops, it is highly productive. Terracing is advantageous also as a means of water conservation, this being of great importance under the prevailing semi-arid conditions. Hence, terracing is regarded as an essential requirement of agricultural development in this area. A common characteristic of the hilly tracts is the central village surrounded by terraced slopes. These terraces are almost entirely of the stone-wall type.

There is very large scope for land improvement by terracing in many parts of the country from the north to the limits of cultivation in the south. Assurance was given that the people themselves will co-operate fully as they are convinced of the advantages: they also endeavour to extend the area under terraces as they are able. It is desirable, however, in the interests of the development of the country, to greatly expedite the rate at which this extension is now taking place. In this connexion refugee labourers can give material assistance.

It is considered that a target of 105,000 dunums would be a suitable two years' terracing programme for Jordan. If no project for the intensive development of a specific tract should be undertaken, terracing operations will be spread over different parts of the country where the need is greatest. A project for the complete development of the catchment area of the Wadi Zerqa, how-

ever, is likely to be proposed. If it materializes, much land in that area will require terracing and afforestation and it is proposed that priority be given to it. The exact area to be thus treated can only be determined after a survey is made, but it is probable that much of the two years may be devoted to it, as the drainage area covers several hundreds of square miles.

Summary of terracing project

Year	Area dunums	Man-days of work	Men required daily	Cost £P
First	52,500	1,575,000	5,250	806,400
Second	52,500	1,575,000	5,250	806,400
Total	105,000	3,150,000	5,250	1,612,800

AFFORESTATION

There are many areas in Jordan where afforestation could be undertaken on lands entirely unsuitable for any other purpose. A successfully afforested area was inspected where the trees were planted about 15 years ago, and a large demonstration area, recently established by the Gradoni method planting, was also seen. That the Government is interested in extending the work is evident by the fact that 2 million nursery seedlings are available for this purpose. Assuming that two years are required to produce a seedling, this means that 1 million seedlings are available for planting out annually. As previously stated, however, the amount of planting which can be accomplished during the next two years, is limited by the number of seedlings in the nurseries at the present time. As is proposed for terracing, such afforestation as is possible in this period should be concentrated in the catchment of the Zerqa basin.

The Project

First Year

Planting out 1,000,000 seedlings.

Area: 10,000 dunums.

Labour requirement: 90,000 man-days.

Number of labourers required daily: 300.

Cost of planting per dunum: £P3.22.

Total cost for preparing and planting 10,000 dunums: £P32,200.

Note: No provision for nursery production is made, on the assumption that the Government of Jordan will continue to undertake this operation.

Second Year

Same as first year.

Summary of afforestation project

Year	Area dunums	Man-days of labour	Men required daily	Cost £P
First	10,000	90,000	300	32,200
Second	10,000	90,000	300	32,200
	20,000	180,000	300	64,400

SUMMARY OF ALL PROJECTS FOR JORDAN

<i>Year</i>	<i>Area dunums</i>	<i>Man-days of work</i>	<i>Men required daily</i>	<i>Cost £P or \$US</i>	
A. TERRACING					
First	52,500	1,575,000	5,250	806,400	2,257,920
Second	52,500	1,575,000	5,250	806,400	2,257,920
TOTAL	105,000	3,150,000	5,250	1,612,800	4,515,840
B. AFFORESTATION					
First	10,000	90,000	300	32,200	90,160
Second	10,000	90,000	300	32,200	90,160
TOTAL	20,000	180,000	300	64,400	180,320

NOTES.

Conversion rate: 1 Palestine pound = 2.8 dollars.

4 dunums = 1 acre; 10 dunums = 1 hectare.

Men required daily are for 300 days in the year.

Arab Palestine

1. The territory in that part of western Palestine which is now associated with Jordan consists of a strip of country whose frontier lies just outside Jenin in the north, is bounded by the railway line on the western outskirt of Tulkarm, passes through Jerusalem and ends just south of Hebron. This area includes the towns of Jenin, Tulkarm, Nablus, Ramallah, Bethlehem, Hebron and part of Jerusalem.

2. Agriculturally this stretch of country is probably amongst the poorest land in former Palestine. From north to south it consists of a succession of hills. Some of them have become so eroded through the ages that they are now only bare rocks; others carry soil only in patches and it is so shallow that it is a matter for wonder that it is capable of producing cereal crops even of the low standard which it carries at present. Agriculture has to depend on rainfall. Except in occasional small areas and in gardens there is generally no irrigated farming.

3. There are bright spots, however, to this gloomy picture. Occasionally flat areas, many of them of no great size individually, occur in the valleys and usually they are rich and fertile: some hills, thickly planted with olives or carrying a fine stand of grape-vines, afford practical proof and demonstration of what this poor soil can really produce when it is properly utilized; contour terracing has reached a fine art in many areas.

4. One's main impression is that the general standard of cultivation stands at a higher level than is generally associated with most Middle East cultivators. Obviously those responsible for this satisfactory feature know from hard experience that it is only by such means and such exertions that a living can be got from the soil

under the hard conditions which maintain throughout this area.

5. The distribution of rainfall follows the pattern of that in the adjoining territories. Precipitation is restricted to the winter months. In quantity it varies widely over the country. In the north the normal annual rainfall of 25 inches at Nablus and of 22.5 inches at Jerusalem is adequate for the practice of rain-fed cultivation. Hebron in the south has an average rainfall approaching a similar figure. The 6 inches at Jericho, however, are insufficient to support plant life. Here the growing of field and garden crops is impossible unless under artificial irrigation. Apart from gardens and small areas in the vicinity of the main towns, there is relatively little irrigated agriculture. There is scope, however, for increasing the area under irrigation, in such areas as the western bank of the River Jordan, if it should be found possible to store the winter flood waters of the three main wadis which enter the valley—the Qilt, the Auja and the Fara, by building dams at suitable sites on the wadis.

6. As may be expected under these conditions, the north contributes most to the agricultural production of the country, but, though within that region there are fertile valleys and well-covered hills, there also are large areas of bare rock and thin soil. The cereals, wheat and barley, constitute the principal winter field crops. Sorghum, vegetables, cucumbers and melons appear prominently amongst the summer crops.

7. The whole region, however, is first and last a fruit-growing area. Olives, vines and figs take priority, though considerable quantities of apricots, almonds, pomegranates and other fruits also are grown. It is obviously in fruit growing that the main economy of the country lies in the future.

8. Some of the finest examples of maximum land use in the Middle East are to be found in

this region. It is a joy to see the care and efficiency with which whole countrysides have been terraced and planted under olives and vines. Villages such as Qabatia, Zababdeh, Sileb el Dahr and Fandaqmieh demonstrate the capacity of this relatively poor soil for production when adequate and well-planned measures are adopted for the conservation of soil and rainfall moisture. They should be regarded as the type of target at which future development in the surrounding villages should be aimed and as the model on which the future economy should be based.

9. It is in pursuance of such a policy that it is proposed to utilize refugee labour. It can make a valuable contribution in the preparation of land for new orchards and in the improvement of land already under fruit through terracing. The development of land by this means has been one of the foremost aims of the last Government of this country. To encourage terracing, competitive prizes were offered annually on a considerable scale. It is said that an individual prize sometimes amounted to £P50. The present project, therefore, merely proposes to accelerate progress in what is a well recognized need. There is also ample scope for the useful employment of refugee labour on works designed to improve existing forests and in the planting of new forests in different parts of the country.

TERRACING

It is estimated that:

(a) The total area under fruits of different kinds in Arab Palestine is 738,500 dunums (184,000 acres) of which 75 per cent is planted with olives and grape-vines.

(b) Fifty per cent of this area, or 369,000 dunums (92,000 acres) requires repairs to existing terraces or reterracing.

(c) A further area of not less than 30,000 dunums (7,500 acres) will be planted to fruit and for this purpose requires terracing.

This gives a total terracing programme of 400,000 dunums (100,000 acres).

The labour force required to achieve such a project would amount to 12 million man-days of work. On a two years' basis and working 300 days a year, the man-power required would be 20,000 daily.

The cost would be £P6,144,000.

In the view of the Director of Agriculture, however, the maximum labour force which could be

controlled and supervised is 16,000 labourers a day. Hence the project recommended is based on that figure.

The principal data are:

	Area to be terraced thousand dunums	Man-days of work (thousands)	Cost (thousands £P)
First year	160	4,800	2,500
Second year	160	4,800	2,500
Total	320	9,600	5,000

Detailed calculations will be found in appendix IV.

AFFORESTATION

Afforestation needs in Arab Palestine include both an extension of the present area under forests and the restoration of several of the existing forest reserves.

The programme which has been proposed caters for fourteen such areas and is divided as follows:

1. The afforestation of 24,560 dunums (6,140 acres) by sowing seed;
2. The afforestation of 15,000 dunums (3,750 acres) by planting seedlings.

Appendix V gives details of man-power required and costs.

These may be summarized as follows:

(a) *Sowing 24,560 dunums*

Man-days of work: 181,500.

Man-power required: 302 men daily for 2 years of 300 days each.

Cost: £P56,595.

(b) *Planting 15,000 dunums*

- (1) This involves the raising of 1.5 millions of nursery seedlings as the first step.

Man-days of labour: 16,800.

Manpower required: 2,245 men for 60 days.

Cost: £P43,950.

- (2) These seedlings will not be ready for planting out for two years. The present two years' work project for refugees will have concluded before then. Either this U.N. two years' project will have to be extended for two months in the third year, or the local government will have to meet the cost.

The requirements in either case are:

Man-days of labour: 13,500.

Period of planting: 50 days.

Number of men required daily: 2,245.

Cost: £P48,000.

SUMMARY OF ALL PROJECTS FOR ARAB PALESTINE

A. TERRACING

Year	Area thousand dunums	Man-days of work (thousands)	No. of men daily (thousands)	Cost	
				£P (thousands)	\$US
First	160	4,800	16	2,500	7,000
Second	160	4,800	16	2,500	7,000
Total	320	9,600	16	5,000	14,000 ^a

B. AFFORESTATION

Year	Project	Area dunums	Man- days	Men required daily	Cost	
					£P	\$US
First	Sowing	12,250	90,772	302	28,298	79,200
Second	Nursery	—	16,800	56	43,950	123,100
Third	Sowing	12,250	90,772	302	28,297	79,200
Fourth	Planting	15,000	135,000	2,245 ^b	48,000	134,400
Total		39,500	333,344		148,545	315,900 ^a

NOTES.

^a Conversion rate: 1 Palestine pound = 2.8 dollars.

^b For 60 days only: all other for 300 days.
4 dunums = 1 acre: 10 dunums = 1 hectare.

Lebanon

1. Of the superficial area of Lebanon 70 per cent is mountainous. It has been said that this country was designed by nature to support trees and that, given conservation of soil and water it can have a reasonable economy based mainly on intensive fruit growing. Certain it is that much of the hilly country is not most economically used when cereals are grown on it and that it could be turned to much more profitable account if planted to various fruits for which it is admirably suited, after first taking the necessary steps to protect the soil against erosion and to conserve the natural rainfall which it receives. That the benefits of such treatment are known and appreciated is obvious from the amount of terracing which is a feature of many parts of the country, but there is need in many areas for an extension of that treatment.

2. Nor has the growing of trees on slopes and in areas unsuitable for general or specialized farming received adequate attention so far, though special thought has been given to it recently. Demonstration of afforestation by the Gradoni method of strip terracing and sowing seed have been given in some parts of the country, whilst it is understood that in one area in the hills an experiment in broadcasting the seed of cedars by aeroplane has been carried out before the snow-fall, in the expectation that when the snow has melted there will be a large number of cedar seedlings on the ground. In their tours through the country the agricultural consultants saw various regions where a carefully

planned and prepared policy of afforestation could be carried out with great benefit.

3. In these circumstances the consultants would have made proposals for a works programme relating to soil and water conservation in different parts of the country on lines similar to those recommended for adjoining territories, but they were given to understand that the Government of Lebanon does not view with favour at the present time the employment of refugee labour on projects which are identified closely with the land. For this reason alone, and not because there is no great need for such projects, nor that they would not have immediate and lasting benefit to the economy of the country, no proposal is made.

4. For the utilization of refugee labour the Government of Lebanon appears to visualize only construction work on irrigation, hydro-electric and, possibly, railway projects. These pertain to the field of engineering and will be considered by the appropriate consultants.

5. In view of this strict limitation the agricultural consultants regret that they are unable to propose any works projects for refugees in the Lebanon.

Syria

1. Syria, with its area of approximately 72,500 sq. miles (18,560,000 hectares or 46 million acres) is the largest of the countries under consideration. The configuration of its terrain and the distribution of its rainfall have combined to divide this country into several zones which largely determine the character of its husbandry.

2. The highest rainfall occurs in a narrow strip of mountains and coast paralleling the eastern shore of the Mediterranean; it extends from Mount Hermon and the Anti-Lebanon range through the Alouite Mountains of Latakia. Rainfall decreases both toward the east and to the south. The result is a second zone of cultivable, rain-fed land beginning with the Jebel Druze and Horan areas in the south, becoming very narrow or disappearing entirely in the east of the Anti-Lebanons, then reappearing as a broad band north of the Lebanon to the Aleppo area, and extending from this point to the east in a zone of varying width along the Turkish border to the Tigris in the north-east. Roughly parallel to this cultivable, rain-fed area is a third zone in which winter rainfall is sufficient to produce good grazing, but insufficient for cereal crop production. This tract, together with stony areas in the two zones previously noted, contributes the pasture of better-quality grazing land. The remainder of Syria to the east and south is usually classified as desert. Here the winter rainfall produces a sparse growth of grass and brouse with consequent use by the nomadic tribes as second-quality range.

3. Rain falls in Syria only during the winter months. Summer growth of crops is wholly dependent upon the water-storing capacity of soils and upon irrigation. Even in the areas of highest rainfall its unequal distribution makes irrigation and water conservation practices highly desirable. Of the total area of Syria less than 1.75 per cent, and of the cultivable land less than 6 per cent is now irrigated.

4. Within the present cultivated zone there are large areas of hilly country, often with very steep slopes. The chief of these areas from the agricultural point of view are situated on the slopes of Mount Hermon, west of Damascus, in the Latakia area and parallel to the coast along much of the western fringe of the country. Within some of these areas excellent examples of land use and soil and water conservation covering whole hill-sides can be seen. Terracing has been done to a state approaching perfection, whilst the thoroughness with which the planting of trees, mostly fruit, has been carried out, leaves a lasting impression on the mind of the traveller through such regions.

TERRACING

1. What has been accomplished in these directions, however, is only a fraction of what is needed. There remains vast scope for a soil and moisture

conservation programme of land terracing as a preliminary to a large expansion in the area under fruit and forestry trees in Syria. By such a programme soil now inefficiently utilized for cereal growing, for which it often is poorly suited, can be made highly productive under olives, vines and a variety of other fruits; land unsuited for such purposes can produce valuable timber. Such a project offers an excellent means of employing refugee labour on a short-term basis for the economic good of the country.

2. The project which has been drawn up, therefore, has for its object the treatment, by one or other form of terracing, of a considerable area of land for its better utilization for forest purposes and growing fruit trees suited to local conditions; olives and figs will be prominent amongst them.

Detailed calculations will be found in appendix VI.

The principal features of the terracing project are:

Year	Area to be terraced hectares	Man-days of labour	Men required	Cost £S
First	42,500	3,765,000	12,550	12,355,000
Second	42,500	3,765,000	12,550	12,355,000
	85,000 (850,000 dunums)	7,530,000	12,550	24,710,000

AFFORESTATION

1. Large areas in such regions of Syria as Mount Hermon, the Anti-Lebanons, and parts of the Latakia mountains, unsuitable for cultivation under field or orchard crops, would become in time a source of much economic value to the country if entirely planted under forest trees. The terracing programme just described, makes provision for the treatment of 50,000 hectares (125,000 acres) of land, to improve it for afforestation. Part of the area is already planted.

2. Afforestation is done in two ways: (a) by planting seedlings; (b) by sowing seeds.

(a) By planting seedlings

3. The planting of seedlings presupposes the existence of nurseries and if a large planting programme is to be undertaken the production of nursery seedlings on a great scale will be necessary.

4. Existing departmental forest nurseries in Syria are of very limited capacity and the annual production of seedlings is small. Afforestation of large areas under *pinus halepensis* and *pinus pinea*

will, therefore, require the establishment of a number of temporary nurseries.

5. Seed sown in the spring of one year will not produce seedlings which are ready for transplantation till at least eighteen months and possibly two years later. Obviously no increase in the afforested area by planting seedlings on a scale of any importance is possible within the two years' term of the present refugee works projects. By the time the first year's sowings could be ready for planting out, the two years of the contemplated works projects for refugees would have ended. For this reason no project in this aspect of afforestation is proposed. If, however, Syria is to undertake large-scale afforestation by seedlings of desirable trees such as pines, the establishment of new nurseries is indispensable and should be undertaken by the Government of the country now.

(b) *By sowing seed*

6. Afforestation by this method consists merely of dibbling the seed, mainly of oaks and wild pistachios, in holes made in the soil. As a project

for the employment of labour, its absorptive capacity is unimportant.

7. Local officers concerned are confident that the amount of seed which can be collected in the country will suffice to sow no more than 1,000 hectares of land in the first year. Any increase in that area will be possible only if seed can be obtained from outside sources.

8. Because of this internal limitation and the uncertainty of supplies from outside, the proposed afforestation programme is restricted to the sowing of 1,000 hectares (2,500 acres) in each of the two years of the project.

The relative data as follows:

Year	Area hectares	Man- days	Men required	Cost £S
First	1,000	12,000	200	41,000
Second	1,000	12,000	200	41,000
	2,000	24,000	200	82,000

NOTE. The 200 men are required for only 60 days each year.

SUMMARY OF ALL PROJECTS FOR SYRIA

A. TERRACING						
Year	Type of terrace	Area hectares	Man- days	Men required	Cost £S or	\$US
First	Without stones	25,000	1,200,000	4,000	3,725,000	1,079,700
	Single row stones	10,000	900,000	3,000	3,200,000	840,600
	Stone wall	7,500	1,665,000	5,550	5,430,000	1,573,900
	Total	42,500	3,765,000	12,550	12,355,000	3,494,000
Second	As for 1st Year.					
	Total	85,000	7,530,000	12,550	24,710,000	6,988,000

B. AFFORESTATION

Year	Area hectares	Man-days	Men required	Cost £S. or	\$US
First	1,000	12,000	200	41,000	11,900
Second	1,000	12,000	200	41,000	11,900
Total	2,000	24,000	200	82,000	23,800

NOTES: Conversion rate: 3.45 Syrian pounds = 1 dollar.
The 200 men for afforestation are required for 60 days only each year.

Cost of tools is not included as this item should be provided by the Government of Syria.
1 hectare = 10 dunums.

APPENDICES

I. The Gaza Strip

Project to afforest 20,000 dunums (5,000 acres) of sand dunes.

The project will be carried through in just over two years; 10,000 dunums to be planted each year.

Number of seedlings required for 10,000 dunums; 1.5 million.

Number of working days annually in the nursery; 300 or 10 months.

First year

To produce 1.5 million nursery seedlings.

Labour, materials and costs to produce 1 million seedlings:

	Cost per month £P	Cost per annum £P
Labour		
20 ghaffirs at £P10 each.....	200	
5 nurserymen at £P10 each.....	50	
2 clerks at £P15 each.....	30	
1 surveyor* at £P45.....	45	3,250
Supplies and services, repairs to tools, transport, etc.	70	700
Capital expenditures on tools, instru- ments etc.		1,500
Materials		
Pots, £P6,000		
Soil, £P300		
Manure, £P700		
Labour, £P1,000		
Water, £P1,200		9,200
Total cost		14,650
Therefore, total cost of raising 1.5 mil- lion seedlings: $14,650 \times 1.5$		21,975

*The surveyor will mark out the land to be planted.

Total requirements and cost for first year: men-days of labour, 8,400; number of men, 280; cost, £P 21,975.

Second year

A. Planting out 1.5 million seedlings (10,000 dunums or 2,500 acres) (seven men plant 150 seedlings (1 dunum) in one day).

Manpower. Man-days to plant 10,000 dunums, 70,000; Period of planting, 60 days (January and February); Number of men daily employment over 60 days, $70,000 \div 60 = 1,170$.

Cost. At 25 piastres per man per day: $70,000 \times 25 \div 100 = \text{£P } 17,500$.

B. Nursery raising of 1.5 million seedlings.

As for first year: man-days, 8,400; cost, £P 21,975.

Total requirements and cost for second year: man-days of labour, 78,400; cost, £P 39,475.

Third year

Planting out 1.5 million seedlings (10,000 dunums or 2,500 acres).

Labour and cost as shown in second year: man-days of labour, 70,000; number of men, 1,170; cost, £P 17,500.

Summary of manpower required and cost

Year	Man-days of work	Cost £P
First	8,400	21,975
Second	78,400	39,475
Third	70,000	17,500
TOTAL	156,800	78,950

II. Jordan

TERRACING

Total area to be terraced, 105,000 dunums (26,250 acres); average length of terrace per dunum, 60 metres.

Unit of labour and cost:

	£P	
12 unskilled labourers at 30 piastres each a day	3,600	
15 semi-skilled labourers at 40 piastres each a day	5,200	
15 donkeys at 15 piastres each a day.....	2,250	11.05

Rate of work: One unit of labour will stone-terrace 50 running metres a day.

Cost per running metre:

	Piastres
(a) Labour: £P11.05 + 50.....	24.8
(b) Supervision and transport: £P98.50 + 13.500	.76
TOTAL	25.56

Cost per dunum: $25.56 \text{ piastres} \times 60 = \text{£P } 15.36$.

Man-days of labour per dunum: $25 \times 60 \div 50 = 30$.

First year

Area to be terraced, 52,500 dunums (13,125 acres).

Man-days of labour, $52,500 \times 30 = 1,575,000$.

Working days in the year, 300.

Number of men required daily, $1,575,000 \div 300 = 5,250$.

Cost, $\text{£P } 15.35 \times 52,500 = \text{£P } 806,400$.

Second year

Same as first year.

Area, 105,000 dunums.

Man-days of labour: 3,150,000.

Number of men required daily, 5,250.

Cost, £P1,612,800.

III. Jordan

AFFORESTATION

First year

Capacity of nurseries: existing nurseries can produce 1 million seedlings of planting age a year, sufficient to plant 10,000 dunums.

Labour requirement: a unit of 8 men and one foreman can make Gradoni trenches and plant seedlings on 1 dunum in one day. Total man-days to complete 10,000 dunums: $10,000 \times 9 = 90,000$.

Total number of men required daily on the basis of 300 working days per year: 300.

Cost per dunum:

	£P
8 unskilled men at 30 piastres.....	2.4
1 foreman at 40 piastres.....	.4
Total labour	2.8
Add 15 per cent for supervision.....	.42
Total cost	3.22

Cost for preparing and planting 10,000 dunums,
£P32,200.

Second year

Same as first year.

Complete project for two years

Area to be planted, 20,000 dunums (5,000 acres);

Man-days of labour, 180,000;

Men required, 300;

Total cost, £P64,400.

IV. Arab Palestine

TERRACING

I. Requirements of complete programme

Total area to be terraced, 400,000 dunums (100,000 acres); average length of terrace per dunum: 60 metres.

Unit of labour and cost:

	£P	
12 unskilled labourers at 30 piastres each a day	3,600	
15 semi-skilled labourers at 40 piastres each a day	5,200	
15 donkeys at 15 piastres each a day.....	2,250	11.05

Rate of work: One unit of labour will stone-terrace 50 running metres a day.

Cost per running metre:

	Piastres
(a) Labour, £P11.05 ÷ 50.....	24.8
(b) Supervision and transport, £P98.50 ÷ 13.500	.76
TOTAL	25.56

Cost per dunum: 25.56 piastres × 60 =
£P15.36.

Total cost of 400,000 dunums: £P6,144,000.

Man-days of labour per dunum:
25 × 60 ÷ 50 = 30.

Total man-days for 400,000 dunums: 12 million.

Number of men required: 20,000 for 2 years of 300 working days a year.

II. Project proposed

Maximum labour force which the Department of Agriculture can control and supervise: 16,000 labourers daily.

First year

Man-days of work in a year of 300 working days, 16,000 × 300 = 4,800,000

Man-days work per dunum, 30

Number of dunums per year, 160,000.

Cost per year, 160,000 × £P15.36 =
£P2,457,600 (say, £P2.5 million).

Second year

Same as first year.

Complete project for two years

1. Area to be terraced, 320,000 dunums (80,000 acres).

2. Man-days of labour, 9,600,000.

3. Number of men required, 16,000.

4. Total cost, £P5 million.

V. Arab Palestine

AFFORESTATION

Fourteen forest reserves and new areas are to be afforested partly by sowing seed and partly by planting seedlings as follows:

1. Area to be sown with seed, 24,500 dunums;

2. Area to be planted with seedlings, 15,000 dunums.

A. Sowing project

To be sown in 20 years, 24,500 dunums (6,125 acres).

Labour requirements and costs to sow 10,000 dunums:

	£P
215 unskilled labourers at 30 piastres each per day..	64.56
32 semi-skilled labourers at 40 piastres each per day	12.80
247	Daily cost 77.36

Average wage per day, 312 millemes.

Man-days to sow 10,000 dunums,
247 × 300 = 74,100.

Cost, £P77.36 × 300 = 23,200.

Hence, for 24,500 dunums:

Total man-power days, 74,100 × 2.45 =
181,545.

Number of working days, 600.

Men required, 302 daily for 2 years.

Cost, £P56,595.

B. Nursery production

Seedlings not available—have to be produced.

Number of seedlings required; 1.5 million.

Labour required and cost (based on Gaza data).

Whereas the seedlings of the quick-growing kinds of trees used at Gaza are ready for planting out

in one year, the oak and pine seedlings to be produced in Arab Palestine require two years. The Gaza costs have, therefore, to be doubled as follows:

Man-days of labour, 16,800.

Cost, £P43,950.

C. *Planting out nursery seedlings in third year* (based on Jordan data)

Nine men plant 1 dunum in 1 day.

Total man-days, $15,000 \times 9 = 135,000$.

Period of planting, 60 days.

Number of men required per day, $135,000 \div 60 = 2,245$.

Cost per dunum, £P3.22.

Total cost, £P48,000.

VI. Syria

TERRACING

Areas to be terraced:

(1) 250 sq. kilometres on the eastern slopes of Mount Hermon, south-west of Damascus.

(2) 200 sq. kilometres west of Damascus on the road to Beirut.

(3) 400 sq. kilometres in the Latakia foothills.

Total area: 850 kilometres or 85,000 hectares.

Types of terrace proposed:

(a) Light terraces without stones: 50,000 hectares.

(b) Terraces with single row of stones: 20,000 hectares.

(c) High stone terraces: 15,000 hectares.

Estimates of labour and costs

I. Light terraces without stones

Land to be used for afforestation with oaks and pines: mainly in Mount Hermon region.

Area to be terraced: 50,000 hectares.

Length of terrace per hectare: 20 of 100 metres each = 2,000 metres.

Rate of work: 1 man can terrace 50 metres per day.

Labour requirements per hectare:

Man-days

1. For building terraces, $2,000 \div 50 = 40$.

2. For laying terrace contours, 8.

Total man-days, 48.

Man-days of labour for 50,000 hectares: $48 \times 50,000 = 2,400,000$.

Number of working days in a year: 300.

Number of men required: $2,400,000 \div 300 = 8,000$ for 1 year of 300 days.

Duration of project: 2 years.

Number of men required daily: 4,000 for 2 years of 300 days each.

Cost per hectare:

	£S
(a) Labour: 48 man-days at £S3.....	144
(b) Supervision: 1 man-day at £S5.....	5
TOTAL	149

Labour cost of 50,000 hectares:

$50,000 \times £S149 = £S7,450,000$.

Analysis:

Year	Area hectares Thousands	Man-days of labour Thousands	Men required daily Thousands	Cost in thousands £S
First	25	1,200	4	3,725
Second	25	1,200	4	3,725
	50	2,400	4	7,450

II. Terraces with single row of stones

This type to have high priority. Land to be planted to olives, figs, grapes, etc. in Anti-Lebanon west of Damascus.

Area to be terraced: 20,000 hectares.

Man-power required per hectare:

(a) Levelling and contouring land (as in I above) 48 man-days;

(b) Collecting and laying stones, 42 man-days;

Total man-days, 90.

Total man-days of labour, $20,000 \times 90 = 1,800,000$.

Working days in a year, 300.

Total number of men required: $1,800,000 \div 300 = 6,000$ for 1 year of 300 days.

Duration of project, 2 years.

Number of men required daily, 3,000 for 2 years of 300 days each.

Cost per hectare:

	£S
90 unskilled labourers at £S3 each.....	270
10 supervisors at £S5 each.....	50
TOTAL	320

Labour cost of terracing 20,000 hectares:

$20,000 \times £S320 = £S6,400,000$.

Analysis:

Year	Area hectares Thousands	Man-days of labour Thousands	Men required daily Thousands	Cost in thousands £S
First	10	90	3	3,200
Second	10	90	3	3,200
	20	180	3	6,400

III. Heavy stone terracing

Land to be planted to olives. Mainly in Latakia tract.

Area to be terraced, 15,000 hectares.

Length of terrace per hectare, 1,000 metres.

Average height of terrace, 80 — 100 cm.

Man-power required per hectare:

Labourers for terracing, 60;

Contour levellers, 8;

Labourers for stone building, 100;

Labourers to provide stones, 50;

Supervisors, 4.

Total man-days, 222.

Donkeys to transport stones, 25.

Total man-days for 15,000 hectares,
 $15,000 \times 222 = 3,330,000$.

Working days in the year, 300.

Number of men required, $3,330,000 \div 300 =$
 11,100 for 1 year of 300 days; or 5,550 men for 2
 years of 300 days each.

VII. Syria

AFFORESTATION

Man-days: 12 man-days are sufficient to sow the

seed, protect plants from wind and sun and give
 one hosing to one hectare.

Total man-days for 1,000 hectares: 12,000.

Sowing is done in January and February only
 —say 60 days.

Number of men required per day: 200 for 60
 day only each year.

Cost per hectare:

	In £S
12 labourers at £S3.....	36
1 supervisor at £S5.....	5
TOTAL	41

Cost for 1,000 hectares: $1,000 \times \text{£S}41 =$
 £S41,000.

Section C (continued)

DETAILS OF SOME POTENTIAL WORK RELIEF PROJECTS

(b) ENGINEERING

Short-term Projects for Palestinian Arab Refugees

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Introduction

This report presents the findings of the engineering staff of the United Nations Economic Survey Mission for the Middle East. The material covers generally a short-term work relief programme.

The short-term programme covers possible work projects to be executed in the near future to provide work for the Arab refugees in Jordan, Arab Palestine, Syria, Lebanon and the Gaza Strip. It is found that for an expenditure of about \$US25 millions for engineering projects, work, totalling about 37,500 man-years of labour, can be provided. It is further estimated that some 14,000

men could be at work in approximately six months after funds are made available, and that in about one year some 25,000 men could be at work, with numerous possibilities for expansion. Useful projects to put a substantial number of refugees to work can be initiated in every country with the exception of the Gaza Strip, where a large number of refugees are concentrated in a small area.

Purpose and Scope

The engineering staff of the United Nations Economic Survey Mission for the Middle East has visited the countries and areas included in the

Mission's terms of reference for the purpose of ascertaining:

1. To what extent it would be possible to undertake short-term engineering projects which would provide refugee employment opportunities and contribute to the welfare of the different countries, without conflicting with long-term projects forming the basis for a more complete economic development.

2. A rough estimate of funds required to complete the projects.

3. The amount and duration of employment which could reasonably be expected to result from such short-term projects.

This report covers only the possibilities of engineering projects to employ labour usefully on transportation and communication structures, irrigation and drainage work, public utilities, housing schemes, water conservation structures and other public works. It does not cover the possibilities for employing labour on other phases of development, such as agriculture, terracing and afforestation which are discussed in a separate report.

In view of the varying nature of the engineering work in the different localities, each country or area is treated separately in this report.

Jordan—Arab Palestine

AREA INCLUDED IN FIELD SURVEYS

The first inspection tour was made in Jordan and Arab Palestine from 27 September to 1 October, 1949. Contact was made with officials of the Jordan Government, who were most co-operative, and readily made available information and facilities at their command.

The inspection trips in Jordan covered an area extending from Amman to the Allenby Bridge on the south, and the Yarmuk River on the north. In Arab Palestine, an area was covered extending from Jerusalem and the Allenby Bridge to the south and the borderline near Jenin and Tulkarm to the north. On the Jordan side the roads traversed were dirt tracks with the exception of the stretch of road from Amman to the Allenby Bridge and a stretch of the main Haifa-Baghdad highway west of Irbid, which were asphalted. In Arab Palestine all the roads traversed were asphalted, with the exception of a stretch of non-asphalted road from the village of Badan north to Jenin.

At this time of year the dirt roads are passable, but it is said that during the winter season many of the roads would present difficulties for motor traffic. The roads generally are in good condition,

and all necessary earthwork seems to have been completed. Numerous wadis were crossed, which at this time of year are at low-flow stage.

An inspection was made of a completed headworks structure on the Wadi el Arab, which is the northernmost wadi in Jordan, and of the headworks structure under construction on the Wadi Ziqlib. Construction work is well executed, and the main irrigation canals leading from the headworks structures are partly concrete-lined and partly masonry-lined.

The flow at the Wadi el Arab was stated to be approximately 1 cubic metre per second, and it was also observed that a considerable volume of water was flowing in at least ten of the major wadis. The low flow of the wadis is used for irrigation purposes, and the contrast of the areas under irrigation with the barren unirrigated lands is striking.

Plans are in existence for the construction of headworks on an additional seven wadis in Jordan. Apparently no plans have been made thus far for storing and conserving surplus waters of the wadis. The headworks structures are now designed generally for low-flow conditions, and these structures make no substantial contribution towards increasing the water supply for irrigation purposes, their function being merely to control the distribution of the flow. The completed headworks structure of the Wadi el Arab was stated to cost approximately £P34,000.

In case storage dams are constructed on the wadis, the capacity of the headworks structures as now constructed or planned would be insufficient. It would seem advisable to postpone further construction of these structures on other wadis until a decision has been reached regarding the storage developments.

In Arab Palestine possible dam sites for the conservation of water were inspected on three major wadis, Wadi Qilt, just above Jericho, Wadi Auja and Wadi Fara. The flow of Wadi Qilt is now partially used for irrigation purposes, but considerable additional area could be brought under irrigation by complete regulation of its stream flow. Wadi Qilt flows through a deep gorge where there are apparently numerous possibilities for the construction of a dam.

In Wadi Auja a considerable portion of the land is said to be privately owned in large tracts. A dam site suitable for an earth-fill or a rock-and-earth-fill dam was observed. However, the reservoir site appears to be under cultivation.

On Wadi Fara there are at least two possible dam sites, but any dam on this wadi would neces-

sitate relocation of the existing road. The entire low flow of the Wadi Fara has been diverted into an irrigation canal.

PROJECTS RECOMMENDED

As will be shown in the discussion of the long-term development programme, the proposed future projects are not ready for execution, with the possible exception of the road programme which could be undertaken upon relatively short notice.

Adequate highway communications are unquestionably necessary for full economic development in any country, and particularly in an agricultural country, in order that the produce may move freely to the markets. However, highways by themselves do not necessarily bring about an improvement in the economy; that is to say, there must first be a sound base for agricultural development before highways can be of much value. In Jordan and Arab Palestine such agricultural development is not yet in existence in many of the areas traversed by the proposed highway network.

For this reason it is believed that the highway development should proceed simultaneously with improvement in agriculture. For the short-term programme, it is therefore proposed to develop a comparatively small area completely instead of proceeding solely with an extensive highway programme. The area considered most suitable for such development is the catchment basin of the Wadi Zerqa, the largest of the wadis east of the Jordan River. Its basin is located north of Amman. The distance from Amman to the Wadi Zerqa road-crossing is about 35 kms. The drainage area of Wadi Zerqa at the road-crossing is approximately 1,600 sq. km. (620 sq. miles); the total drainage area at its confluence with the Jordan River is about 2,100 sq. km. (810 sq. miles).

For the short-term work programme it is proposed to develop this area completely as a unit; that is, to build all necessary roads into the area, to provide water for perennial irrigation, to build the necessary small check dams on principal gullies to minimize siltation, to do all necessary afforestation work, terracing and planting of fruit trees where this seems to be feasible. A centrally located village should also be made a part of the scheme in order to provide adequate housing facilities for the refugee construction workers, and which, in the future, would serve the permanent settlers in the area.

It would appear that this programme could be completed within two years from the start of

work. The experience gained in the development of Wadi Zerqa may be usefully employed for the development of other wadis in Jordan and Arab Palestine.

As soon as funds become available, an immediate start could be made on improving the road network within this area, as follows:

- (a) Suweleh-Jerash, 35 km;
- (b) Salt-Damya, 30 km;
- (c) Shuna-Kureima, 50 km;
- (d) Kureima-Jerash, 60 km.

In order to conserve the waters from Wadi Zerqa, a dam would have to be constructed, probably immediately upstream from the Suweleh-Jerash road-crossing. One year of stream flow records is available,¹ and maps to a scale of 1:50,000 cover the entire area. As seen from the Jerash road, the river flows in a deep valley. An apparently sound dam site is located approximately 1 km. upstream from the highway bridge. Rock outcrop (apparently a hard sandstone) was observed on the right bank and rock outcroppings could also be seen on the opposite bank. Immediately upstream from this site the river valley widens out and would provide a suitable storage reservoir. No geological information on the dam site is available at present, and additional topography for the dam site and reservoir would also have to be obtained. It is suggested that the necessary geological and topographic surveys should be undertaken at the earliest possible moment and completed within three months' time, so that work on the dam could start probably early in the spring of 1950. In view of the inadequate information available on stream flow and silt content of Wadi Zerqa, it is proposed that the dam be built initially to a minimum height, with adequate provision for a future increase in height.

The final top elevation of the dam can only be determined after a record of several years of stream flow and silting has been obtained. From the sketchy information now available, it appears that a dam approximately 35 metres high should provide sufficient capacity for the initial operation of the project for a period of about ten years. It seems quite possible that in the future the dam may have to be raised by as much as 10 metres.

The dam should be of the rock-fill type with an impervious random-rubble masonry upstream face, backed by a layer of hand-laid rock-fill, while the lower portion of the dam may be dumped rock.

¹ Ionides Report, p. 157.

During construction of the dam, water would be diverted through a short tunnel or conduit, which would later be utilized for an outlet conduit with sluice gates at the upper end and high pressure conical discharge valves at the downstream end. The spillway would be located on the opposite bank from the diversion tunnel. The downstream leg of this spillway could be located in a manner that would make it useful for the future spillway after the dam has been raised.

There does not appear to be time available for a thorough geological investigation such as usually would be undertaken for a structure of this kind. In order to overcome this difficulty, it is recommended that a competent geologist be employed during the construction of the dam, and that the construction superintendent also be thoroughly experienced in heavy construction work on foundations where considerable grouting may be required in order to make the foundation watertight. As soon as the location of the dam site has been finally determined, a trench should be opened in the rock for the entire length of the structure. This trench, which would serve as cutoff, would provide the geologist with an opportunity to observe foundation conditions. In addition, boreholes should be made along the length of this trench to a depth to be determined by the geologist in the field. Simultaneously with the digging of the trench, the diversion tunnel would be excavated and this will provide the geologist with an additional opportunity to observe the geologic structure at the dam site.

These operations should be completed towards the middle of the year, so that the actual construction of the dam itself may be well advanced prior to December 1950, the beginning of the high-flow period.

In addition to the storage dam, a headworks structure would be required where the wadi enters the Jordan plains. This structure would lead the water into the main irrigation canal, which should be concrete-lined, and thence into the secondary and tertiary canals, which should probably also be concrete-lined in order to obtain maximum use of the waters made available. However, the canals cannot be made a part of the short-term programme, because their capacity and length will depend on results obtained from the agricultural programme, which would only become available after several years of research.

As soon as feasible, a programme for terracing and afforestation should be prepared for the entire drainage area.

It is roughly estimated that by means of storage and regulation the volume of water for irrigation purposes can be approximately doubled as compared with present low-flow conditions.

An engineering development programme similar to that proposed for Wadi Zerqa may be undertaken for Wadi Qilt in Arab Palestine.

A large tract of government-owned land west of the Jordan River and immediately south of the Jericho road is now being prepared for temporary refugee settlement.³ In this area drilling operations are now in progress to determine the feasibility of obtaining irrigation water by means of pumping. It was stated that in the first borehole water was found at a depth of only 14 metres. However, the second bore, 100 yards removed from the first borehole, had reached a depth of 50 metres without encountering water.

The possibilities of a pumped water irrigation scheme do not appear promising, and it is believed that irrigation water for this tract of land can better be obtained by conserving the surplus waters of Wadi Qilt, and conducting the water to the tract by means of a concrete-lined canal.

The storage dam on Wadi Qilt could be of the same type as described for Wadi Zerqa. Details could be prepared in a relatively short time.

The third project suggested for a short-term works programme is improvement of the airport at Amman, to bring it up to standard for a Class D international airport. Plans for this work could also be prepared in a relatively short time, and it is believed that execution of the work in the near future would not far anticipate the need.

Estimated cost

The following table shows the estimated costs of the proposed short-term projects. Costs of afforestation, terracing and other agricultural aspects of the unified development programme are given elsewhere.

Description	Total cost	
	£P (Thousands)	\$US
Wadi Zerqa		
Dam	355	1,000
Headworks and portion of main canal	100	280
Check dams	50	140
Roads	700	2,000
Village	250	700
Wadi Qilt		
Dam	300	850
Headworks	40	110
Main canal	20	60
Airport, Amman	200	560
TOTAL	2,015	5,700

³ This scheme is being undertaken by Musa Bey Alami, with the sanction of the Government. The tract is said to contain some 20,000 dunums.

Amount and duration of employment

The amount of labour required for the execution of the proposed short-term engineering programme is estimated as follows:

Item	Man-years totals	Estimated no. of men working	
		After 6 mos.	After 1 yr.
Wadi Zerqa			
Dam	2,000	500	1,000
Headworks:			
Main canal ...	400	100	250
Check dams	300	100	150
Roads	3,500	1,500	2,000
Village	1,000	400	600
Wadi Qilt			
Dam	1,700	500	1,000
Headworks	150	80	100
Main canal	80	30	50
Airport, Amman ..	700	300	500
TOTAL	9,830	3,510	5,650
Say	10,000	3,500	6,000

It is not believed feasible to propose additional projects without considerable expansion in the Jordan and Arab Palestine Public Works Departments, and it is probable that the proposed works exceed the normal work loads in these departments. However, if additional work projects should be deemed desirable as the programme progresses the project proposed for the Wadi Zerqa could be repeated for another ten wadis in Jordan and Arab Palestine. In addition there is considerable highway work in Jordan and Arab Palestine which might be undertaken. The rate of progress would depend upon the expansion which could be achieved in the Public Works Departments and the outside assistance which could be obtained.

Lebanon**AREA INCLUDED IN FIELD SURVEYS**

During their stay in Lebanon from the middle of September to the beginning of November 1949, members of the engineering staff have surveyed practically the entire area of the country.

Lebanon is generally a mountainous country of which only one-quarter of the land is cultivable, excluding lands which might be brought under cultivation by terracing. Practically all the cultivable lands are now being utilized and an increase in agricultural productivity is possible only through betterment of cultivation on the land now being worked.

Agriculture is important in Lebanon because it provides the means of livelihood for two-thirds of the population. There are no minerals of any importance, and at present industrial development is small. Complete development of the water re-

sources of the country is essential to the future economy, as it will be the means of increasing agricultural productivity through irrigation, as well as creating opportunities for a greater industrial development by utilizing low-cost hydro-electric power.

Conferences were held with officials of the Lebanese Government, who made available data and reports on the resources of the country and indicated needed short-term projects.

PROJECTS RECOMMENDED

The short-term works projects which will contribute to the welfare of Lebanon and on which it appears feasible to utilize significant amounts of refugee labour in the near future consist of three irrigation projects, and one combined water supply and irrigation project.

Irrigation projects

South Beqaa. This project is located in the southern part of the main Beqaa. It extends over the presently irrigated land in this area eastward and southward and lies partly east, but mostly west, of the Litani River. It is crossed by the main highway between Beirut and Damascus, Syria. The area to be irrigated is 11,000 hectares.

The land lies well for irrigation and the soil is deep and fertile. The lower portions of the area have formerly been subject to flooding and lack of drainage, but this condition is being improved by river channelization and drainage works. Construction problems should be relatively simple, with no major structures required. The detail plans are about one-half completed and can be completed within three months.

Akkar Plain. The Akkar Plain project lies in the north-west corner of Lebanon, extending along the sea coast from Tripoli to the boundary with Syria. It is a gently sloping alluvial plain crossed and served by four rivers, the Nahr el Kabir, the Nahr el Ostouene, the Nahr el Arka, and the Nahr el Bared. The area to be irrigated is 11,000 hectares. Portions of the area are now irrigated by canals diverting from the Nahr el Bared.

The plans provide for four canals which utilize the water from each of the rivers mentioned. Construction will be simple with no major structures required; all canals will be lined with concrete.

The Tyr-Saida. The Tyr-Saida project provides irrigation for a long narrow strip adjacent to the sea coast, and extending from Saida in the north to a point about 10 km. south of Tyr. It is fairly level and lies well for irrigation; its eastern or inland side rises steeply into the adjoining hills. Its main source of water supply is the Nahr

el Litani, although wells at Rass el Ain contribute a substantial amount. The area to be served with irrigation water is 5,000 hectares, of which 500 hectares will be reached by pumping.

The project as a whole is already largely completed, with most of the major works already constructed. The works remaining to be constructed consist in the main of the secondary canals and distributaries.

Combined water supply and irrigation project

Chekka-Tripoli project. This project is relatively costly and involves tunnel construction to utilize an underground source of water supply which at first will furnish domestic water for the Tripoli area. Thereafter, it is expected to supply irrigation for an area along the coast south of Tripoli to a point about 4 km. south of Chekka. Plans for the irrigation portion are yet to be developed and will depend on the amount of water developed by the tunnel.

Estimated cost

The following table shows the estimated cost of the proposed short-term projects:

Description	£L (Thousands)	\$US
Irrigation		
South Beqaa	4,000	1,270
Akkar Plain	7,600	2,410
Tyr-Saida (completion) ...	3,000	950
Water supply-irrigation		
Chekka-Tripoli	1,500	470
TOTAL	16,100	5,100

Amount and duration of employment

The amount of labour required for the execution of the proposed short-term engineering programme is estimated as follows:

Item	Total labour required (Man years)	Estimated no. of men employed	
		After 6 mos.	After 1 yr.
Irrigation			
South Beqaa	1,800	900	1,400
Akkar Plain	3,400	1,700	2,500
Tyr-Saida	1,300	600	1,000
Water supply-irrigation			
Chekka-Tripoli ..	600	300	400
TOTAL	7,100	3,500	5,300

If additional employment should be required, an additional source of labour could be found in the development of water supply systems for numerous villages, and after further study a portion of the work required for the enlargement of Beirut harbour might also be started.

Syria

AREA INCLUDED IN FIELD SURVEYS

An inspection tour was made in Syria between 13 and 18 October 1949. After a short stay at Damascus where contact was made with Syrian officials and the different development projects were discussed, the party proceeded by road to Aleppo, passing through Homs and Hama. On the way a halt was made at Homs, where the municipal waterworks were inspected. In this installation, water from the Orontes River is passed through filter beds and then piped to the city. The supply is inadequate for the needs of the city, and improvements and extensions are under consideration, but this detailed scheme is not yet ready.

At Hama a stop was made at the Agricultural Experimental Station, and irrigation works in the vicinity were inspected. These appeared to be of a high standard of construction, the canals being concrete-lined and well maintained.

From Hama an inspection was made of a few kilometres of the Hama, Masyaf, Banyass road.

On the road between Homs and Aleppo, a good deal of cultivation was seen, a fair proportion of the land being either under irrigated crops or ploughed ready for sowing with the winter rains. Vineyards and orchards of olives and figs were fairly common. On the following day the service reservoir of the Aleppo water supply was inspected; also the site proposed for a new reservoir and the alignment of the aqueduct which will form part of the proposed scheme for pumping water from the Euphrates. It appeared that the terrain would present little difficulty in the construction of the scheme.

The party then proceeded by road to Latakia, visiting on the way the Madkh Swamp, the site of an irrigation scheme on the Qouaik River. The scheme was discussed with local officials and the existing diversion weir, the headworks and regulators of the canals inspected. The former is an old work requiring to be remodelled, but the canal works are new and in good order. It appeared there is a possibility of storage on the Qouaik for improved control of the river. This scheme should be investigated further.

En route, the party saw the Rouadj Valley in the distance and observed there a high intensity of cultivation. Later they had a similar view of the Ghab Swamp prior to crossing the Orontes at Gisir el Chaggour.

In the evening the Latakia Harbour was visited. A report on the scheme for the improvement of the port was discussed with the harbour master.

On 17 October, the party returned to Damascus via Banyass and Tartouss, along the coastal road to Tartouss and later the existing hill road via Tel Kallakh and Homs.

From Banyass the coastal end of the Homs, Banyass road was inspected. This section is a hill road with sharp curves and steep gradients. The formation, drainage works and soling course were complete in this section and material had been collected for the macadam surface. No work was in progress.

During the later period of the journey the alignment of the proposed new Homs, Tartouss road was seen in reaches. This alignment passes through rather difficult mountainous country.

On 18 October, the short-term development projects were further discussed with Syrian officials before returning to Beirut.

PROJECTS RECOMMENDED

In general a good deal of investigation concerning future development has been carried out in Syria, including the preparation of a number of detailed projects. Consequently, work is ready to start at an early date on a good many short-term projects, and also on certain parts of long-term projects.

Among the works which could be initiated, the following are suggested as suitable for relief work.

Roads

1. *Banyass, Masyaf, Hama.* This is an important secondary road connecting the coast with the hinterland. Its total length is 90 km. comprising at present 45 km. macadam pavement, 20 km. formation completed and 25 km. of rough track. It is required to be completed with formation width of 8 m. and asphalt pavement 6 m. wide.

2. *Homs, Talkalakh, Tartouss.* An important secondary road required to connect Homs with the southern coastal road. A road already exists from Homs via Talkalakh to Tripoli, but the Homs, Talkalakh section of 52 km. is not suited to the heavy traffic either as regards to alignment or strength of pavement. It is proposed therefore to construct a new road in this reach. New construction is also required in the Kalakh, Tartouss reach of 28 km., for which the alignment has been settled and the earthwork constructed. The road throughout will have a formation width of 10 m. and pavement width of 6 m. Total length is 80 km.

3. *Khan Abou Chamat, Iraq Frontier.* This is part of the road connecting Damascus with Baghdad. Its length is 200 km. At present it is a desert tract which is to be asphalted. Formation

width will be 10 m. and pavement width 5 m.

4. *Salamiye, Soun, Bilass.* This road connects a newly developing region with Hama. At present it is a track 65 km. long. A macadam pavement 4 m. wide is required. Formation width will be 8 m.

Irrigation and drainage

The Madkh Swamp. This is a depression flooded by the waters of the Qouaik River, which has no outfall. The project provides for canals to take off from the river some 40 km. above the marsh to irrigate an area of some 15,000 hectares, and also for embanking the marsh to limit its area to some 10,000 hectares, making the balance available for cultivation. About 60 per cent of the canal construction is already completed.

Water supply

Aleppo. This is part of the long-term Aleppo water supply project.

The Syrian Government desires to proceed with the construction of the gravity section of the Euphrates-Aleppo aqueduct, which comprises a concrete conduit of 1 cubic metre sec. capacity, 73 km. in length. Work would be carried out by contract but could not start until five or six months after sanction to proceed has been obtained.

Airports

Mezze Airport. It is desired to lengthen and widen the runways and taxi tracks at the Mezze Airport at Damascus, the major international airport for the Near East.

Harbours

Latakia Harbour. It is proposed to initiate the construction of the breakwater and filling for the quays at Latakia as part of the scheme for remodelling this harbour. A length of 1,080 m. of the breakwater with water depth varying from 6 to 16 m. is proposed. Tenders will have to be called for, based on preliminary plans, and eight to ten months would be required before work could start. During this time a study to clarify the economic justification for the harbour improvements should proceed.

Estimated costs

The following table shows the estimated costs of the proposed short-term projects:

Description	Total cost	
	£S (Thousands)	\$US
Roads		
Banyass-Hama	2,600	750
Homs-Tartouss	5,100	1,480
Khan Abou Chamat-Iraq frontier	11,400	3,410
Salamiye-Bilass	1,700	490
Other work		
The Madkh Swamp	2,000	580
Aleppo water supply	12,000	3,480
Mezze Airport	1,800	530
Latakia Harbour	8,500	2,470
TOTAL	45,100	13,190

Amount and duration of labour

The amount of labour required for the execution of the proposed short-term engineering programme is estimated as follows:

Item	Man-years total	Estimated no. of men working	
		After 6 mos.	After 1 yr.
Roads			
Banyass-Hama .	900	400	700
Homs-Tartouss .	1,900	850	1,400
Khan Abou Chamat-Iraq .	4,300	1,900	3,200
Salamiye-Bilass .	900	400	650
Other work			
The Madkh Swamp	1,500	770	780
Aleppo water supply	4,000	500	2,500
Mezze Airport ..	700	300	500
Latakia Harbour.	3,600	500	2,000
TOTAL	17,800	5,620	11,730
Say	18,000	6,000	12,000

Gaza Strip

FIELD SURVEY

The Gaza area was visited on 5 November 1949.

After preliminary discussions with officials of the local administration, the party visited the Gaza forestry station and proceeded down the main north-south road to within a few miles of the Egyptian border.

Stops were made at the Wadi Gaza, which was dry, and at a well pump which was being used for irrigation and water supply. At the southernmost point of the trip, a halt was made on high ground from which the nature of the ground up to the Egyptian frontier could be seen. Returning to Gaza, the party proceeded north to the Israeli frontier north of Jabaliye, and finally visited the Gaza Harbour.

From inspection and inquiries, it appears that the agricultural possibilities of the area have not been neglected. Every field suitable for cultivation is being cultivated, but on the greater portion of

the area only a winter crop, dependent on rainfall, is being produced. A small proportion of the area is irrigated from wells, and in these areas intensive cultivation is practised.

PROJECTS RECOMMENDED

Under present unsettled conditions, the determination of work projects involves a major policy decision. Moreover, it is quite obvious that in the small area there is not enough work to employ the large number of refugees now in the area. However, from an engineering standpoint, the following projects could be considered as part of a short-term programme offering at least some possibility for refugee employment.

Roads

The area is a coastal strip some 6 km. wide by 30 km. long, north of the Egyptian border. A good road traverses the centre of the area. The only road work which could be undertaken is the completion of a road from Khan Yunis to Bam Suhula, about 1 km. long, and metalling of the road from Gaza to Beit Saliya, a distance of about 6 km. In addition, in the towns of Gaza and Khan Yunis some 50 and 25 km. of road respectively might usefully be metalled.

Drainage system

At the present time the town of Gaza does not have a drainage system, but detailed plans are available for its construction. The drainage system would consist chiefly of open drains leading to a pumping station discharging through a high-level channel into the Mediterranean.

Estimated costs

The following table shows the estimated costs of the above projects:

Description	Total cost	
	£P (Thousands)	\$US
Roads	164	458
Gaza drainage system	62	174
TOTAL	226	632

Amount and duration of employment

The amount of labour required for the execution of these projects and the number of men who may be expected to be employed after six months and one year from the date the sanction to proceed has been obtained are given in the following table:

Item	Man-years total	Estimated no. of men employed	
		After 6 mos.	After 1 yr.
Roads	1,500	500	1,000
Gaza drainage	800	100	100
TOTAL	2,300	600	1,100