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PALESTINE

AND THE

EMPIRE MARKETING BOARD

Sir JOHN RUSSELL, F.R.S.

AND

Dr. J. B. ORR, D.S.O., M.C.

On Agriculture in Palestine

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PALESTINE AND THE EMPIRE MARKETING BOARD

THE first report of the Empire Marketing Board is an interesting record of work in its three main activities; scientific research, economic investigation, and publicity. Palestine may not be coloured red on the Board's map, "Highways of Empire," and Palestine cannot, therefore, share in the Board's publicity schemes. It was, however, early recognised by the Empire Marketing Board that Palestine can offer a valuable field for research in certain fundamental problems of agriculture, with results that might prove not only valuable to Palestine itself but to parts of the British Empire enjoying more or less similar climatic conditions. The Research Committee of the Empire Marketing Board considered that stock-rearing problems in Palestine were of this nature, and agreed to contribute up to an amount of £1,500 for the first year for this purpose with an equal contribution from the Zionist Organisation. A joint committee from the Board and the Organisation was formed, which selected three scientific agriculturists to conduct the research work. The workers appointed were:—

(1) Mr. John Crichton, M.A., B.Sc., of the Rowett Research Institute, Aberdeen.

(2) Dr. Herzberg-Fraenkel.

(3) Dr. Magasanik.

The first two proceeded to Palestine early in April, whilst Dr. Magasanik remained to conduct work in Aberdeen and Rothamsted.

In order to lay down the general lines of research and to make a preliminary study of the problems, Dr. John Orr, the Director of the Rowett Research Institute, and Sir John Russell, the Director of Rothamsted Experimental Station, visted Palestine in April, 1927, together with Major Elliott, M.P., the chairman of the Research Grants Committee.

By the courtesy of the Empire Marketing Board, we are permitted to publish the reports of Dr. Orr and Sir John Russell.

* * *

AGRICULTURE IN PALESTINE

By SIR E. J. RUSSELL, F.R.S.

THE immediate purpose of the visit was to discover more particularly the nature of the problem presented to the Empire Marketing Board in connection with Palestine agriculture and described as one of defective animal nutrition; it was therefore assigned to the Rowett Institute, Aberdeen. Mr. Arthur Crichton, who visited the country in December, 1926, expressed the view that the trouble was due to lack of animal food generally rather than to any special deficiencies, such as cause the various "deficiency diseases" of animals in South Africa and elsewhere. The problem being thus one of soil fertility, it was decided that Rothamsted should be associated with the work from the outset.

With this view I entirely agree. The great need of the country, especially for the Jewish colonists, is to increase the output from the land; while there may be a "deficiency" problem it is entirely subordinate to this dominating necessity.*

* Col. Sawer states that the local grass hay is preferred by imported stock to imported hay.

The problem falls into two parts:—

(a) *Education.*—Many of the colonists have no great knowledge of agriculture, and in consequence during their first years do not obtain as much from the land as they might. Much educational work is already being done. I had the opportunity of seeing the Girls' School at Nahalal, the agricultural school at Mikveh-Israel, and of meeting some of the members of the extension staffs of the Government, and the Zionist Organisation. In all these institutions the work appears to be on good lines. The Girls' School is under the management of Dr. Meisel-Schochat, a lady who insists on a practical training in poultry, dairy, vegetable production, etc., most of the time being spent in the actual work itself. At Mikveh the course is arranged more on the lines of a college, the teaching being partly in the class-room and partly in the field. The extension service appears to be somewhat on American lines: the officers struck me as keen men anxious to do their work well. It should, however, be considered whether fuller advantage could not be taken of the knowledge possessed by the good farmers in the old German colonies, Sarona, Wilhelmina, Beth Lahm, and those who in the Zionist and the Pica colonies have proved very successful; also whether some system of farm pupils as advocated by Col. Sawer would be useful.

(b) *Investigation.*—Although one of the oldest countries in the world, Palestine has only recently been opened to modern methods of agriculture, so that much still remains to be discovered as to the most suitable methods, crops, etc. I saw the experimental farms and have studied the reports. I was concerned wholly with the production of crops. Incidentally, however, I could not fail to observe the high cost of rearing calves on the present system—the figures given me were £27 in the first year, £23 in the second, and £17 in the third, making a total of £67 before any return in milk is obtained. Moreover, the quality of the meat, poultry and eggs is open to

considerable improvement. These matters will be dealt with by Dr. Orr and Mr. Crichton.

Present System of Agriculture in Palestine.—Three groups of people come into the agriculture of Palestine :—

(1) The Bedouin, a nomad pastoral people wandering about with their flocks and herds, grazing on whatever herbage they can find, and also spreading diseases among live-stock.

(2) The Arab cultivators, hard-working peasants using home-made implements and spending practically nothing on the land, so that their returns are almost wholly profit.

(3) The Jewish settlers.

The Arab cultivators, aiming at being self-sufficient, produce all the food that they need for themselves and their animals, and therefore adopt the same system of husbandry all over the country just as did the farmers of mediæval England. The system of crop production practised by the Arabs is determined by the fact that the rainfall is confined to the winter months of October to March or sometimes April,* while the summer months, April to September, are dry, usually rainless, and, of course, hot. Crops can be sown, therefore, only between September and April. A two-course rotation is adopted by the Arabs all over Palestine :—

(1) A winter crop : wheat, beans, or on light land barley, or on very sandy soil, Lupins : sown in January or February and harvested in May or June. The land is then left bare till the following April, when there is sown :—

(2) A summer crop : durra, melons, or, on better land with more moisture, sesame, or kersennah (a kind of lentil used for cattle). This is harvested in August. It is common for the cultivator to sell the wheat and eat the durra. In two years, therefore, the land is :—

First year.—January-May : In winter crop ; rain falling till April. June-October : Fallow—dry ; no rain.

* The April rain is said to be particularly good for crops and is called by the Arabs "the rain of gold."

Second year.—October-April : Fallow—rain. April-August : In summer crop. August-December : Fallow ; rain begins in October.

At the time of my visit the wheat and barley were in full head and almost beginning to ripen, while the land was being ploughed and cultivated for the summer crop.

This rotation gives no summer fodder crop, so that from June till the rainy season the animals subsist on straw, while in the winter they simply graze on such wild vegetation as can be found. It would cause the land to become very weedy, but the Arabs resort extensively to hand-weeding, using the weeds to fatten their sheep. If the Arabs could manure their land properly they might have reasonably good yields ; they have, however, allowed some of the animal manure to accumulate in heaps, some of which appear to be of great age,* they are also selling a large proportion of their supplies for use on orange groves.

The manure contains about 0.5 per cent. nitrogen and per cent. P_2O_5. The Arab makes no hay nor does he attempt any other method of fodder preservation. The Government does what it can to help with the live-stock, issuing quarantine and other regulations ; Col. Sawer is also endeavouring to find means of educating the Arab stock-feeder.

The Jewish settlers, being traders, aim at producing for exchange and, therefore, are under no necessity for uniformity, but can vary their systems to suit the conditions. They have, however, begun with a tolerably uniform system, which produces more fodder crops and is less costly in the matter of weeding than that of the Arabs. In place of the two-course system of the Arabs a three-course rotation is proposed by the Tel-Aviv experts :—

First year.—October : Rain begins ; November : Sow berseem (Trifolium Alexandrinum) for green fodder, or vetches for hay. Early spring : Begin cutting berseem

* See Dr. F. Menchikovsky's circular on Arab manure.

(green fodder), three or four cuttings, till May. April: Rain ends; harvest vetches as hay; plough land immediately 15-18 cms. deep, and it keeps moist all through the summer. May-October: Fallow.

Second year.—October-March: Fallow. April: Sow maize. Rows 1 m. apart, so as to allow of cultivation. June-August: Cut the maize as green fodder.

Third year.—November: Sow wheat; rain till April. May or June: Harvest the wheat.

The system involves a whole year's fallow, at first sight a rather wasteful proceeding. As against this, the rotation has the advantage of keeping the land clean, as the maize, being spaced, can be cultivated by implements almost all its life, while the berseem grows very luxuriantly.

The system provides the following crops per 100 dunams:—

I. *Without irrigation*:—

Human food: Wheat, 33 dunams.

Animal food.—March-end of May: Three or four cuttings of *Trifolium Alexandrinum.* June-August: *Maize,* 33 dunams. July-autumn: *Pumpkins.* Autumn-Winter: Vetch hay (said to be some difficulty in curing). There is some difficulty in tiding over till the first cutting of berseem, the period from August.

II. *With irrigation*:—

Human food: Wheat, 33 dunams.

Animal food.—November-end of May: Six or seven cuttings of *Trifolium Alexandrinum.* June-October: Maize sown from April to July. September-November: Beets to supplement maize. June-November: Lucerne has done very well on light land, but not on heavy. Gave five cuttings in first year and nine in second.

On the irrigated land there is no difficulty in providing animal food all the year round, but on non-irrigated land there is some difficulty from September

to March, vetch hay being the only food available.* Possibly silage might meet the difficulty.

The Possibility of Improving the Utilisation of the Land.

My visit was, unfortunately, too short to permit me to make as close a study as I should have liked of the possibilities of improving on this proposed system. I saw, however, the experimental work in progress, and, thanks to the detailed programme drawn up for me by the officers of the Government and the Palestine Zionist Executive, I was able to use my time to the fullest advantage.

The problem of increasing the output of land in any country consists in adapting the crops as closely as possible to the natural conditions, and it is solved by:—

(1) Finding varieties of crops and animals suited to the conditions and marketable at a satisfactory price;

(2) Discovering the factors limiting the growth of these crops and devising methods of overcoming them;

(3) Grouping the products into an economically sound system of husbandry.

The discovering of suitable crops and live-stock and the devising of a proper system of husbandry are both necessarily slow, and the work has to be continuous because the markets are continually liable to change and a system satisfactory at one time may prove unprofitable later on, owing to developments of transport, changes in the public taste, etc. Examples are found in the complete change in British agriculture that came about towards the end of the 19th century, resulting from the opening-up of the United States, Canada, etc. The search for new crops is made by Dr. Warburg, and the improvement of the farm crops by the Zionist organisation experts is in charge of Dr. L. Pinner, assisted by Mr. A. Malzeff, at Jibatah. The native sorts of wheat and barley apparently form a satisfactory basis for improvement, and large numbers of varieties from other countries are being tested. Some

* The absence of grazing and hay land is a great handicap to the Jewish stock farmers. All cattle, even dry cows and young stock, have to be hand-fed.

ten or twelve crops are under investigation, and the results seem very promising. The work is extensive rather than intensive, but this is probably the better procedure at the present time.

The improvement of the live-stock is steadily going on, successful crosses having been produced between the Beirut and Damascus cows, and the Frisian and other European bulls. Some Hereford bulls are also being used.

The grouping of crops into systems suited to the local conditions has only recently begun, and it will prove an interesting problem. Palestine, though only the size of Wales, presents almost as great a range of physical conditions as Australia. The rain varies from almost nothing up to 28 inches, the range of cultivated land is from 2,000 feet above sea-level to 1,000 feet below it, while the soils vary from sand-dunes to a type much heavier than would be cultivated in Europe. The rain comes from the S.W., it is highest in the N.W. part of the country (*i.e.*, the coast about Haifa and Acre), where it amounts to 700 mm. per annum (27.3 inches); it is less toward the east and the south; at Nazareth and Tel-Aviv it is only about 400 mm. (14.75 inches); at Tiberias and Gaza it is only about 300 mm.; at Jerusalem less (236 mm. in 1925), while in the southern part of the Jordan Valley it is still less, Jericho having only 128 mm. in 1925 and Beersheba but little more. Eastwards of the Jordan, in Transjordania, there is a rainy strip, but farther east there is the desert. Southwards from Palestine comes the desert, as also westwards from El Arish right across the Sinai peninsula.

Soils.—In the region south of the Acre-Tiberias line which I visited I saw at least seven different kinds of land:—

(1) Hill land lying towards the Jordan, uncultivated and possibly uncultivable, though perhaps suited to afforestation;

(2) Hill land in Judea and Samaria receiving only rain-water; divided by terraces into small patches, some

planted with olives and figs, others used for farm crops, but cultivated remarkably closely by the Arabs, who send their " nail " plough round the stones and utilise every square yard of land;

(3) Terraced hills planted with fruit trees, vines and vegetables, and irrigated;

(4) Sand-dune areas and desert sand;

(5) The coastal strip of light land, moderately level;

(6) The large plains, such as Jezreel and Sharon; level stretches of heavy soil surrounded by hills;

(7) The Jordan Valley, cultivable as far as water is available.

Of these, the unirrigated *hill land* is being studied by Col. Sawer and his staff, and experiments are being made on the afforestation wherever this is desirable. If successful this would represent a great asset to the country, directly for the supply of food and of timber, but also indirectly in preventing erosion of soil during the rains and conserving the rain-water for the plains. Indeed, the plains and valleys would probably gain as much as the hills.

For the hill land the most important problem appears to be the planting with trees; either timber trees, olive, fig, carob or other food or fodder-yielding trees, such as tree lucerne (Medicago arboreus), etc. The supply of cattle food from trees sounds strange to Europeans, but Mr. Elazari-Volcani informed me that 100 carob trees, which will grow on one hectar, will supply food for one cow.

The level land of the plain falls into two great groups according as it can or cannot be irrigated, and each with the two divisions: light and heavy.

Irrigated land—light soil.—This is pre-eminently suited to oranges, the culture of which is being developed extensively. The system is obviously successful and is, indeed, one of the brightest spots in Palestine agriculture. Grapes and other fruits also do well. On

these light soils irrigation with the water available causes no injury to the land. I was told of land near Jaffa that has been irrigated for 40 years without any signs of alkali or other deterioration.

Heavy soil.—This presents somewhat more difficult problems. Unfortunately, oranges are not so successful here, but bananas do well. In order to compete with other countries, especially Egypt, it is desirable to seek continuous improvements in the quality of the fruit by the recognised methods of finding new varieties. It would, however, be unwise to rely exclusively on bananas. Other products, fruit and vegetables, must be sought assiduously. The experiment at Daganya on the cultivation of sugar beet deserves watching, as this crop employs large numbers of people.

The conditions seem favourable also to the production of high-class dairy produce.

Under irrigation heavy land is often liable to suffer deterioration, for well-known physico-chemical reasons; this is under investigation by Dr. Menchikovsky. Three factors in Palestine will, in my opinion, delay even if they do not prevent, the setting in of serious trouble: the possibility of exposing the soil to the baking heat of the sun for part of the year; the high percentage of calcium carbonate in the soil—there being often as much as 14 per cent. to 30 per cent.; and the good quality of the water, so far as I was able to judge. I could not discover how much water could be obtained, but it is highly desirable, both on medical and agricultural grounds, that all available supplies should be utilised; for this not only increases the wealth of the people, but also their health by getting rid of malaria, the result of draining the swamps.

Careful direct experiments on the land itself are needed to determine the "duty" of the water. Indirect methods are insufficient, owing to the great influence of environmental conditions. Any excess of water beyond what is absolutely necessary is not only wasteful but is liable to damage the soil. In view of the great importance to Palestine of irrigation, I consider that this investigation should be put in hand at once. The appointment of an irrigation officer is highly desirable; one who will deal with the whole country.

The non-irrigated land.—In all countries where there is a long dry season this presents difficulties. The usual methods of utilisation are:—

(1) *Less than* 10 *inches of rain.* Ranching over large areas.

(2) 10 *to* 18 *inches of rain.* Either afforestation or dry farming; cropping during and immediately after the rainy season; having a cultivated fallow during the dry season. The general tendency in the dry parts of Canada is to seek a reduction of the fallow area and substitute some tilled crop sufficiently widely spaced to allow of adequate cultivation.

These methods, on the whole, proved satisfactory where large areas of land are available. In Canada 160 acres per family is possible, but 320 is better. Cultivation is easy and cheap, and in good seasons a sufficient balance can be made to meet the bad years—often, however, the farmer sells out in a good year when crops are looking well.

It being impossible as yet to decide how far irrigation will go in Palestine, we cannot say how important the residual, non-irrigated areas will ultimately be. But at present they play a large part in the economy of the country.

The non-irrigated heavy land is being cultivated for the production of grain and some fodder crops. The latter have the advantage of providing organic manure, very valuable for the maintenance of soil fertility; moreover, animal products are concentrated and usually profitable. The possibilities for cereals, however, are very limited. The cornfields of the plain of Sharon are not easily forgotten, and if each family could have 100 acres there might be much prosperity. But I do not consider cereal production suitable for the Jewish farmer, for the following reasons:—

(1) Cereals can be and are grown in many places in the world under conditions of low farming, with low yields and low costs of production.

(2) Cereal production requires only manual labour and does not call for the intelligence, mental vigilance and individualism which are among the great assets of the Jewish community.

I recognise the difficulty of finding substitutes: many of the newcomers have not yet had time to learn the more difficult branches of husbandry, and I am not pre-prepared to controvert Mr. Elazari-Volcani's view that cereal production is a necessary stage in the development of the land. But I consider that it should be regarded strictly as temporary and should not be allowed to grow into a permanent method. Mr. Sawer urges that the grain would be better converted into animal products, while Dr. Soskin urges an extension of small-holding culture. The simplest change would be to retain the fodder crops and the animal husbandry; large or small animals, poultry or cows, according to circumstances, and to find some more valuable crop in place of the cereals. The raising of good-class animal products, especially for large animals, would necessitate the discovery of some way round the difficulty of providing foodstuffs from August till the first cut of berseem is ready; this might involve the curing or storing as silage of fodder crops, such as berseem, fodder mixtures, lucerne, whichever proved the heaviest yielder under a proper system of tillage and fertilisation.* Mr. Elazari-Volcani's tillage experiments at Jibatah promise to help in this problem. An animal industry would necessitate some co-operation with the moister districts, so that in seasons of drought the animals might be transferred without loss of life, as was done in 1927.

The substitution of high-priced crops for the cereals would necessitate numerous trials of the kind Dr. Warburg has in hand.

The light land that cannot be irrigated presents

* Also the provision of hay (see p. 380.)

greater difficulties which I am not at present prepared to discuss.

General impressions.—My general impression of Palestine is that the prospects are good. Three factors seem to me to affect the problems in the same way:—

(1) The mental alertness of the people and their need for mental activity, which simple cereal farming could never satisfy.

(2) The fact that the available land is limited in area, so that each family can be allotted only about 24 acres (100 dunams) of land.

(3) The deep attachment of the people, and especially of many of the younger ones, to the land, which would enable them to do much more than ordinary pioneer farmers.

This distinguishes the Jewish colonisation of Palestine from any other with which I am acquainted: the nearest approach, which, however, is a long way off, being the Mormon colonisation of Utah. In any part of Canada or of the United States (apart from Utah) a farmer will loudly sing the praises of his farm, describing it as undoubtedly the best spot on earth, and will then immediately offer to sell it, so that he can go elsewhere. Farmers are perpetually moving from East to West, from South to North and *vice versa*. In Palestine, so far as I could see, this is not happening. Now these factors are much more consistent with intensive highly specialised systems of cropping than with extensive agriculture. For cereal production the Jew has no special advantage over the Syrian peasant, the Arab fellah on the hills, or the emigrant recently out in Canada or Australia. But for intensive cultivation he has special advantages, as shown by the development of the Palestine grape industry and the Palestinian domination of the market for Jaffa oranges.

In my view, therefore, the aim should be towards the production of special products of high quality or earliness, marketed in a special way and maintained distinctively, not simply merged in the general world supply of goods of moderate quality. There is no fear

that the market will become glutted: the country is too small to produce more than can be absorbed. Two great markets lie open:—

(1) The large and increasing tourist traffic;

(2) The British, European and high-class Egyptian markets.

The high prices obtainable for early produce in the European markets show what can be done, as also do the Ben Shemen experiments on the production of early and therefore high-priced tomatoes. It would, of course, be necessary to ensure that the grower had an adequate share of the profit and that the middleman should not take too much.

Dr. Warburg has indicated a number of fruits which could be grown, and there are various other possibilities, such as the production of early or of high-class vegetables, e.g., asparagus (especially on salty land); of flower seeds or plants produced to suit the conditions of the Levant and Egypt, using the native plants as starting material and improving on them; crystallised fruits attractively got up, and many others. For any one of these there might be room only for a limited number of producers. But in my view the best hope for the Jewish cultivator is to discover these high-quality or early markets and to cater for them; if possible to dominate them.

It would, of course, take time to develop these industries, and meanwhile the production of grain and fodder crops is probably the most feasible course to adopt for the new settlers.

Recommendations.

The following problems are, in my opinion, urgent and should at once be attacked:—

(I) *Irrigated land—Duty of water.*

This should be fully studied at the earliest moment in the field and by direct methods. If Dr. Menchikovsky, with his profound knowledge of soils, and Dr.

Oppenheim, with his great experience of plant physiology, could be combined in this investigation, I feel sure they would obtain results of great value, not only to Palestine, but to many other places where fruit is grown under irrigation.

On heavy soil there is the possibility of alkali trouble. This should, if possible, be studied by Dr. Magasanik at Rothamsted, so that he would be in a position to help Dr. Menchikovsky. Samples of the available waters would be needed for analyses.

Systematic organisation of the irrigation of the whole country is very necessary.

(II) *Non-irrigated land—Plant selection and breeding.*

This work should be continued and gradually made more intensive, a larger number of pure lines being followed up as opportunity allows.

Attempts should be continued to find some crop that will grow in what is now the fallow year, and some more profitable substitutes for the cereal crop.

Soil problems.

The Jibatah cultivation experiments should be extended so as to allow studies of the effects of the various cultivations on moisture and nitrate content and on the soil texture.

As the present arrangements are inadequate I suggest that Dr. Magasanik should spend sufficient time at Rothamsted to study

(1) Rapid methods of estimating soil moisture;

(2) Rapid methods of estimating soil nitrates;

(3) The use of the dynamometer and the working up of the records.

For (1) and (2) it would be necessary to send about 50 to 100 kilos of the Jibatah soil to Rothamsted. For (3) it would be necessary to purchase a dynamometer so that Dr. Magasanik could calibrate it and know it thoroughly before going out to Palestine.

(III.) *General system of agriculture.*

Hitherto the United States has been taken as the model, because of a certain similarity in climatic conditions; I consider, however, that Denmark affords a much better model because of the close similarity in the human conditions. Denmark is a small country where the holdings must be limited: its people are intensively devoted to the land and desire to make a good living out of it. They have studied the markets and now produce certain commodities of high quality of which they have a virtual monopoly, so that they can always command a high price and sale, even when lower quality goods are abundant and low in price. These are the conditions to which in my view the Jews in Palestine should aspire.

(IV.) *The cost of the settlement.*

Every settlement of a new country is bound to be costly, especially when, as in Palestine, there had previously been much mismanagement and misgovernment. The price may be paid in money or in human suffering. In older settlements the first colonists, especially the women and children, have often suffered greatly: the story of the first years of the Red River settlement, now one of the richest parts of Canada, while a stirring record of human achievement, is a pathetic tale of human suffering: the Mormon settlers endured some tragic episodes in the beginning, as also have others. In Palestine, the price of colonisation has been paid in large part in money: the Palestine Zionist Executive and the other agencies that have provided the funds have the satisfaction of knowing that the human suffering has been minimised. I have rarely seen healthier looking children than in the Jewish colonies.

Admitting this, it is essential that the work should be done economically, because there is need to develop irrigation, afforestation and scientific production and marketing to the fullest possible extent, and this must require money. I recommend, therefore, that the costs

of the various colonies should be set out on sound accounting lines in such way as to show the financial value of the various systems of husbandry that have been tried. If possible, all the various organisations should be included in the inquiry, so that the whole of the accumulated experience might be available. The result should be examined by a small body of experts. The information would show what products are economically unsound and should be discarded; and in what directions future developments might take place.

My own feeling is distinctly hopeful. The conditions for success are there, and I believe that success can be attained if the colonists and their supporters can maintain their faith and their courage through these early years of trial and disappointments, and strive always unitedly to overcome the obstacles and the difficulties that now confront them.

* * *

STOCK FARMING IN PALESTINE

By Dr. J. B. ORR, D.S.O., M.C.

I travelled by car over a good part of the country. I also visited the laboratories and experimental stations both of the Government and of the Zionist Organisation, and had the opportunity of discussing the local problems of animal husbandry with officials and research workers, both individually and at two formal conferences. At the conferences other agricultural problems were discussed, especially those affecting citrus fruits and afforestation. These will be referred to by Sir John Russell in his report. The present report is confined exclusively to animal husbandry.

Suitability of Palestine for Stock Farming.

The climate of Palestine is excellent for animals;

there is no evidence of any mineral or other deficiency in the natural pasture; and losses from endemic or epidemic diseases do not appear to be greater than those found in other countries where stock feeding is being successfully developed. The chief obstacle to the development of stock farming is the scarcity of pasture, due to the long dry season. Owing to the erosion of soil from the hills, the land there, except in pockets, is almost completely devoid of useful vegetation. In my opinion, however, there are several districts in which intensive animal husbandry on modern lines could be developed with profit. Further, there is a local market to absorb a considerably increased production. There are imported annually for slaughter, 200,000 head of sheep and 45,000 head of cattle, and, in addition, animal products, chiefly milk and milk produce, to the value of about £160,000 (figures for 1925), and eggs to the value of £40,000 (figures for 1926).

High Cost of Production.

Stock farming is being developed in the Jewish settlements, but the present cost of production is much too high to enable the farmers to compete in the world's market or even permanently to compete successfully with importers in the Palestine market. According to costings accounts shown to me, the cost of rearing a cow to the time of her first calving is £67, and the cost of producing milk, exclusive of interest on capital, is equivalent to about 1s. 9d. per gallon on the farm. These costs are double those of countries exporting dairy produce. They must be reduced before the industry can develop and so afford profitable employment to new settlers.

Cause of High Costs.

The chief causes of the high cost of production appear to be (*a*) scarcity of fodder and pasture; (*b*) lack of sufficient high-grade animals; and (*c*) imperfect organisation of the industry.

(*a*) *Forage and Pasture* : The Tel-Aviv Station in par-

ticular, is devoting much attention to this question, and through its efforts both the acreage under forage and the yield per acre are being rapidly increased. It is difficult at the present early stage of this successful work to form an accurate estimate of what the ultimate production will be, or of the nature or value of the improvements in methods which will be devised for carrying over supplies from seasons of luxurious growth to seasons of drought and scarcity. Even now in irrigated districts, six to eight heavy crops of clover can be cut in the year, and in some districts from two to four crops are obtained without irrigation.

With regard to natural pasture for grazing, it may be possible by such means as physical treatment of the soil, the application of fertilisers, or the breeding of plants more suitable to the climate, to increase the quantity of pasture and also to increase the length of time the pasture remains green after the rainy season. The problem of natural pastures is, however, full of difficulties, and is interlocked with problems of afforestation and irrigation, and no hopes of immediate improvement should be entertained. But every encouragement should be given to efforts to extend the research work in forage crops, to include as part of the research a systematic investigation on the improvement of natural pastures. It is of interest to note here that some of the work on pastures in Australia, being begun at the instigation of the Empire Marketing Board, will have a direct bearing on the pasture problem in Palestine.

(*b*) *Grading up Cattle* : The native Arab cattle are small and the average milk yield of cows is low. In the Jewish settlements the dairy stock is being graded up with imported Frisians, and at the Government Stud Farm a beginning has been made to improve the native cattle for beef and work oxen by the use of imported Devon bulls. This importation of foreign stock involves a danger of introducing certain European diseases into a country which is relatively free from them. The danger has been foreseen by the Government officials and the necessary precautions are being taken.

There are, however, in the country native animals which appear capable of rapid improvement by selective breeding. The fact that these animals have evolved in the country and are relatively immune from local diseases makes them of special value for the country. While the average of the cattle is rather poor, there are some good individuals amongst them. There are Damascus cows which give over 800 gallons of milk a year, an amount considerably above the average for British cows. Even among the small Arab cattle there are bullocks much above the average size, and cows which give over 400 gallons a year. Selective breeding from the best of these animals would, within a reasonable time, lead to a marked improvement in the native breed, and would ultimately produce a breed as suitable for the country as imported European breeds.

There is a large number of sheep in the country. These are mostly in the hands of the Arabs. The wool crop is light and of coarse quality. The animals, however, look healthy, and the native breed appears to be capable of improvement by cross breeding with imported rams. Rams are being imported for this purpose by the Department of Agriculture.

Poultry do well. First crosses between imported cockerels and native hens have an egg yield of about 150 per annum. Poultry kept at the Government Experimental Station at Acre as a demonstration of modern methods of poultry keeping showed a handsome profit. In the report from the Station it is stated that " there seems no reason why poultry farming should not become one of the most important and profitable branches of husbandry in Palestine."

(c) *Organisation*: The chief object of the Zionist Organisation has been to settle immigrants on the land, and organisation of stock farming in the settlements has developed in accordance with this object. When it is remembered that prior to the establishment of the Jewish settlements there was little or no stock farming on modern lines in the country to serve as a model, and that most of the settlers have had no previous practical

experience of handling stock, the development attained so far must be regarded as satisfactory. A difficult period in the history of the settlements has been got over through the energy and ability of the Zionist officials and the enthusiasm of the settlers. The time has now come, however, to give the industry its head, and to allow it to develop in accordance with economic factors, the right line of development being indicated by profit and loss accounts, and not by political considerations. The objective should be the development of an industry which can compete in the world's markets. This development will involve a number of changes in methods and in the organisation. The nature of these changes cannot be predicted with certainty. It would be futile at this stage to outline a scheme of development which could only be based on theoretical considerations. The industry must grope its way, guided by economic facts as they appear, and must be prepared to make mistakes and to experience disappointments and failures before there is evolved an organisation suited to the resources of the country and the genius of the people.

Suggestions.

Experimental Stock Farm: The best way of reducing to a minimum the losses which are bound to occur when new methods are being tried is to have an experimental stock farm, not for scientific research, but for practical tests of methods thought to be suitable to the country. The failures in this one farm would prevent further losses along lines proved to be wrong, and the successes would serve as guides to those settlements which are in districts where animal husbandry is likely to be developed so soon as it has been shown to be commercially profitable.

It is suggested that such a stock farm should be established. This farm would serve not only as a centre for grading up the stock of the country, but also as a centre from which settlers could obtain at reasonable prices cows in milk, and to which they could, if they

so desired, sell back calves to be reared. Records for breeding purposes could be kept, not only of the cows on the farm, but all those bred there and sold to farmers.

In addition to the valuable work in rapidly grading up stock in a systematic way, the farm would serve as a demonstration of modern methods of feeding and handling stock and marketing the products. It might also serve to some extent as a training centre for new settlers who wish to specialise in some branch of animal husbandry.

The farm could begin on a small scale with, say, 40 or 50 head of cattle, and an attempt should be made to make it self-supporting as early as possible. So soon as it was self-supporting it should be allowed to expand and include work on sheep and poultry.

The chief object of the farm would be the devising of methods whereby costs of production would be reduced and the results obtained would be a valuable indication of the extent to which animal husbandry could be developed profitably in Palestine. It is suggested that the adoption of new methods on the farms should be officially encouraged only to the extent and only in the direction which the pioneer work of this proposed experimental farm has shown to be commercially profitable.

Experimental work to be begun immediately :

(*a*) *Calf Rearing* : An experimental farm would take some time to establish. In the meantime, work should be begun upon which appears to be the most urgent problem, viz., the high cost of rearing cattle. It has been arranged that a series of experiments on calf rearing will be carried out by Mr. Crichton and Dr. Herzberg-Frankel, both at the Government Station at Acre and at Ben Shemen. The object of these experiments is to determine whether methods of feeding which are cheaper than those in use in the settlements would be successful in rearing good stock. The general scheme for this work has been approved by the Director

of Agriculture for Palestine and the Director of the Tel-Aviv Station.

It should be noted that owing to local difficulties, especially the lack of the necessary facilities, the attempt to carry out these experiments, simple though they be, will be expensive, and the immediate results may be meagre. But even though they may prove unsuccessful from a scientific point of view, the practical information and experience gained will be of very great value to the workers and officials associated with them locally in enabling them to carry out investigations of this nature in the future.

(*b*) *Pastures* : It is suggested that Dr. Magasanik who is at present studying pasture problems at the Rowett Institute, should continue to devote himself to that subject. He should make himself acquainted with the extensive literature of the subject and with the work proposed to be done under the various schemes of research promoted by the Empire Marketing Board. After a period of six to eight months' study at the Rowett Institute and at Rothamsted, he should proceed to Palestine and transfer to the Tel-Aviv Station, where he would work in co-operation with the research workers there engaged in cognate problems.

Animal Husbandry Problem in Adjoining Countries.

Some information was gained about the problems of animal husbandry affecting parts of the Empire adjoining Palestine through interviews with Mr. Sale, of the Department of Agriculture of Cyprus, who came to Jerusalem to attend the Conferences, and from Major Elliot, who visited Transjordania and met some of the officials in conference there. It is evident that there are many problems common to all the countries in that region, and that there are large tracts of the Empire in the near East where animal husbandry is of economic importance and is capable of further development. An exchange of cattle and sheep takes place in the countries between the Soudan and Iraq. This wide region there-

fore, to some extent, forms a unity, and developments in Palestine will have an influence on stock farming in adjoining countries. It is suggested that if the occasion should arise for considering stock problems in any of the parts of the British Empire in that region, the problems should be considered in the light of the conditions affecting all the adjoining countries, and further, that the officials in the adjoining countries should be kept informed of the results of work done in Palestine.

In conclusion I wish to express my appreciation of the value of the work being carried out by the Department of Agriculture for Palestine and by the Tel-Aviv Experimental Station, and of the keen interest shown by all the research workers and officials in discussing problems of agriculture affecting the country. I was specially impressed by the broad comprehensive view of the agricultural problems of the Near East taken by the Director of Agriculture, and by the foresight shown in dealing with these problems, especially those connected with the prevention of disease. It was a real pleasure to visit the Tel-Aviv Station, where research workers, full of enthusiasm, are accumulating valuable scientific information which is even now proving of great value in the agricultural development of the country.

The Rowett Research Institute,
Bucksburn, Aberdeen.
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