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The Agricultural Development of Baluchistan.*

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THE object of this paper is to record briefly the results obtained at the Fruit Experiment Station, Quetta. This work was begun in 1912 in consequence of proposals put forward by Mr. H. R. C. Dobbs (now the Hon'ble Mr. H. R. C. Dobbs, C.S.I., C.I.E., Agent to the Governor General in Baluchistan) when Officiating Revenue Commissioner. It was arranged by the Government of India that we should be placed in charge of the work and that we should reside at Quetta each year during the months May to September.

An area of 25 acres of land was acquired near Quetta towards the end of 1911 which has since been utilized for experimental work in agriculture, fruit growing and vegetable culture. The site chosen was a sloping piece of ground, about two miles from Quetta situated between the military road to the Bolan and the North Western Railway. This area was laid out in terraces, a small laboratory and quarters for the staff were erected and a set of borings for artesian water were undertaken, two of which were successful. A further supply of irrigation water was purchased from the zamindars.

From small beginnings, the investigations have rapidly expanded and the demonstration to the zamindars of the results obtained now demands the services of a whole-time officer. At the same time, our work in India has increased beyond all expectation so that the time has come to sever our connection with Baluchistan problems. Before doing so, it appears desirable to record very briefly a statement of the progress made and of the results obtained. The principles established not only apply to local conditions and to similar tracts in neighbouring countries but it is considered they may prove to be of use to investigators who may have to deal with loess soils and with a set of climatic conditions somewhat outside the beaten track.

I. THE AGRICULTURAL FACTORS OF THE QUETTA VALLEY.

The agricultural conditions in the Quetta valley are quite different from those of India and resemble, to a considerable extent, those of

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large areas of Central Asia. The valley is about 5,500 feet above the sea and is surrounded by high mountains. There is a considerable slope from the sides to the centre and the main drainage line is westward. Surface drainage is easy.

Soil. The soil is a loess deposit, apparently formed by accumulations of wind-blown dust, mixed with the fine particles washed down from the mountains by the winter rains. On the slopes near the hills, the subsoil often consists of beds of gravel and pebbles which borings show also occur at varying depths right through the valley. The soil readily runs together on the surface and loses its porosity after heavy rain or frequent surface flooding. There is a marked response to such aerating agents as organic matter, green manure or additions of wind-blown sand. Small areas of alkali land are common. Any tendency to overwatering, particularly on the heavier soils, leads to the production of these injurious salts. Fertility is maintained by fallows and by the addition of large quantities of farm-yard manure.

Water-supply. The total rainfall is low, about 10·5 inches a year (Table I). The volume of irrigation water is small and cannot easily be increased. Most of the precipitation takes place during the winter months, November to March, often in the form of snow. Besides the winter rains, there are some other sources of water for agricultural purposes—*karezes*, reservoirs, artesian bores and the subsoil water.

TABLE I.

Rainfall in inches at Quetta, 1912-19.

	1912-13	1913-14	1914-15	1915-16	1916-17	1917-18	1918-19
September	nil	nil	0·02	nil	nil	0·40	0·10
October	nil	0·19	1·87	nil	nil	nil	0·01
November	0·03	0·95	1·91	nil	nil	0·03	0·07
December	1·50	0·90	1·16	nil	0·08	1·02	2·40
January	0·69	1·70	0·43	2·61	2·14	0·15	0·85
February	3·73	3·29	0·45	1·53	0·08	1·79	1·15
March	2·69	1·20	1·44	0·28	2·03	4·19	0·58
April	0·12	0·97	1·96	1·99	0·10	0·42	0·78
May	nil	0·55	nil	0·75	0·38	nil	0·93
June	0·08	0·46	nil	nil	nil	nil	nil
July	0·19	0·76	nil	nil	nil	0·14	0·99
August	0·12	nil	nil	1·33	2·50	0·06	0·15
TOTAL	9·15	10·97	9·24	8·49	7·31	8·20	8·01

The usual means of irrigation is the *karez*—an underground ditch on sloping land which collects the subterranean water in the fan taluses near the hills and discharges it on to the surface. The reservoirs are constructed for storing storm water and the unused surplus carried off by the rivers. The artesian bores are from three to four inches in diameter and are rarely more than 200 feet deep. They tap the water from underground streams so that this method of supplementing the rainfall is largely a matter of chance.[1] Very little use is made of the subsoil water for irrigation purposes on account of the expense and trouble of lifting it.

Climate. There is a well-marked winter at Quetta and from November to March the general temperature is low. The summer months June, July and August are hot and dry and the days are long. During this period, the minimum temperature is high. The mean varies from 40°F. in January to 78°F. in July. The diurnal range is considerable and varies from 21·8°F. in January to 32·7°F. in November. The humidity of the air is generally low, much lower than in many parts of the plains of India. There is a great deal of air movement, often from the west. Evaporation is therefore rapid so that in fruit and vegetable growing, devices for checking the effects of the dry hot winds are essential. Mud walls, wind-breaks of Persian roses and trees (like seedling apricots and almonds) and cover crops like lucerne which shade the ground, can be used for this purpose. In vineyards, the plants are grown in deep trenches and so receive still further protection. The growing season is a short one and the transition between winter and summer conditions is generally rapid. The absence of any real spring and the occurrence of late frosts in May often render the raising and transplanting of seedlings a matter of some difficulty. Early flowering fruit crops like almonds and apricots are frequently destroyed by the cold. Early frosts sometimes occur in September so that the season is often exceedingly short.

Labour. There is often a shortage of labour at Quetta particularly during the summer when the demand is sometimes greater than the supply. Apart from the rougher agricultural operations connected with such crops as wheat, barley, maize and lucerne and the care of the flocks, the Agency is largely dependent on external sources, such as Afghanistan, the Punjab and Oudh, for its labour. This fact and the presence of a large garrison render agricultural operations expensive.

[1] Experiments, carried out by the Military Works Department at the Fruit Experiment Station in 1912-13, showed that the discharge of an artesian bore can be greatly increased by means of a centrifugal pump working at the ground level. After pumping for a few hours, the natural flow stops for a short time and then begins again as before.

II. AGRICULTURE.

The chief problem underlying the improvement of Baluchistan agriculture is the discovery of the maximum duty of water. The rainfall is low and is mainly confined to the winter months. The volume of irrigation water is small and cannot easily be increased. The ordinary losses due to evaporation are considerably accentuated by the general dryness of the air and by the constant wind. In summer, the long hot days and the clear skies help still further to reduce the moisture in the soil and to increase transpiration. These are not the only reasons for the saving of water. The soils are exceedingly fertile if they are merely baptized but they do not give the best result under constant irrigation. The texture is, as a rule, too stiff, the surface readily runs together after wetting and contracts on drying, forming a thick hard, impermeable crust. Any tendency to overwatering, particularly on the heavy soils, rapidly leads to the production of injurious alkali salts. Thus the rapid loss of water cannot be made up for by frequent irrigation and there is no ultimate advantage to be obtained in concentrating the water available on to a small area. The solution of the difficulty is to apply as little as possible and to reduce the losses by evaporation and transpiration to the lowest point. As there can be no great development, either in agriculture or in fruit growing unless a good deal of the water now used can be saved, a considerable amount of attention has been paid to the means by which such a saving can be accomplished.

Improvements in Irrigation Practice.

Although land is abundant and water is scarce, the local methods of handling irrigation water are wasteful. The channels leading down the slopes from the *karezes* zigzag a great deal in order to reduce corrasion. This increases their length and adds to the losses by percolation. No attempt is made to brick these portions and to reduce the section of the channel. Besides being too large, the channels are frequently weak and bursts occur. Too much water is often applied to the land at a time, consequently the edge effect in crops like wheat and barley is everywhere very marked.

An improved method of irrigation has been worked out and applied successfully to local conditions at the Fruit Experiment Station. This is described in detail in Quetta Bulletin No. 7. The land to be watered is laid out in long oblong plots 100 feet broad and from half to one acre in area. Great care is taken in grading so that the irrigation water will flow slowly over the whole surface and lead to even percolation. For

this purpose, the slope is about 1·5 inches in 100 feet. The plots are provided with strong turfed channels with wide berms running down their short sides (Fig. 1). The area to be irrigated is divided into long compartments (*kiaris*), about 12 feet wide, which are watered from one end.

The advantages of this method of irrigation are considerable. The duty of water is increased, the labour involved in distribution is small, percolation is uniform and even crops result. The carefully graded oblong plots dry evenly after irrigation and the area is large enough for the use of water-saving and tilth-producing implements, such as lever harrows, spring tine cultivators and iron ploughs. When the grading is completed, a valuable permanent improvement has been effec-

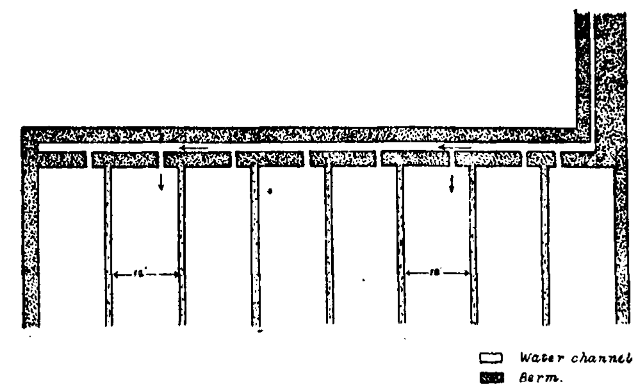

Fig. 1. Irrigation with long, narrow compartments. The water is controlled in the channels by means of the canvas dam in use in the United States. This is merely a piece of canvas or stout cotton cloth like drill fixed to a strip of wood or bamboo. The wood is laid across the berms of the channel and the canvas, when weighted by a brick, checks the water completely.

ted and no more expense or trouble is needed. Once the levels are adjusted they do not change. The only expense is the labour of the zamindar and that of his oxen.

Water Saving in Wheat Growing.

The crop on which the largest amount of water can be saved by direct means is wheat. The work on this subject is dealt with in detail in the Second Edition of Quetta Bulletin No. 4, published during the present year (1919).

In Baluchistan, irrigated wheat is watered six or seven times in all and the yield varies from 15 to 25 maunds[1] to the acre according to the

[1] One maund = 40 seers = 82·27 lb.

richness of the soil. The dry crop is precarious, the yield of grain rarely exceeding 5 maunds to the acre. It was first found at the Experiment Station that crops of wheat, between 18 and 20 maunds to the acre, could easily be raised on the preliminary irrigation only even in a year when the winter rains were unfavourable. Two new implements are required for this work—the spring tine cultivator for producing a perfect tilth before sowing and the lever harrow for breaking up rain crusts after the seed has germinated. These machines are well within the means of the people. These water-saving methods were then applied to cultivators' fields and as much as 22 mds. 33 seers of wheat to the acre was obtained on the preliminary irrigation.

Recently, the procedure has been simplified, the yields have been improved and a further increase in the duty of water has been secured. This was obtained by carefully grading the land and by the employment of a leguminous rotation. In 1918-19, on land carefully graded and after a summer fallow preceded by a cold weather crop of Persian clover, a yield of 32 mds. 27 seers (2,686 lb.) of grain and 57 mds. 13 seers (4,715 lb.) of straw was obtained on an acre plot on the preliminary watering only. The land was irrigated before sowing on October 12th and cultivated lightly with the spring tine cultivator, followed by the beam, on October 16th as soon as ever the surface was dry enough for this purpose. Under the thin mulch so produced, the soil dried slowly and a perfect tilth was produced by natural means when it was ploughed with iron ploughs on October 19th. Before ploughing, the seed was scattered broadcast on the surface and after the whole area was ploughed once, the beam was run over the land both ways. Besides the saving in cattle power, this method of combined tilth production and seed covering, by means of the iron plough, involves the minimum loss of moisture. Afterwards, rain crusts were broken by the harrow several times, the last operation taking place on April 15th, 1919. Side by side, about three acres of similar land, which was only roughly levelled and which had not borne a clover crop, were treated in the same way. The yield in this case was much lower—19 mds. 31 seers (1,625 lb.) of grain and 33 mds. 15 seers (2,745 lb.) of straw to the acre. This great difference in yield of 12 mds. 36 seers (1,061 lb.) of grain to the acre in favour of a previous clover crop, combined with careful grading, is very striking and is of considerable significance in the future development of wheat production. Results like this bring out the enormous waste of water in wheat growing in Baluchistan and the general low standard of agriculture.

Besides the growth of a wheat crop on one irrigation, a further point of considerable importance was discovered at Quetta. It was

found that after the second irrigation, water ceased to be a limiting factor and that further additions began to depress the yield. This point is well illustrated by the results obtained on the land (unmanured) of a zamindar at Quetta in 1917 (Table II).

TABLE II.

The introduction of a new limiting factor after irrigation.

Number of waterings	Area in acres	Total weight of produce	Total weight of grain	Yield of grain per acre	Percentage reduction
		lb.	m. s.	m. s.	
One	3·99	10,367	52 6	13 2	0
Three	2·65	6,620	25 15	9 23	26

In 1916, a beginning was made in the work of applying the water-saving methods worked out at Quetta to the conditions of North West India. The first experiments were made at Gungapur and Haripur in the Lyallpur District and at Sargodha in the Jhelum colony. An average yield of nearly ten maunds to the acre was obtained on the preliminary irrigation, a second irrigation increased the crop to 16¼ maunds while a third watering *reduced* the average yield by a maund. Similar results were obtained by Main[1] at Mirpurkhas in Sind but here the yields obtained on the preliminary watering were as high as 2,062 lb. to the acre. On soils with good texture, a second watering *reduced* the average yield by 152 lb. to the acre. In the season 1918-19, Clarke at Shahjahanpur obtained a yield of 36·5 maunds of Pusa 12 to the acre with only one watering applied in November. Taking all these Indian results together there can be no question that the principles worked out at Quetta on water saving in wheat and the methods by which they were obtained apply to the conditions of North West India, where vast volumes of valuable irrigation water are now poured on the land by the cultivators to little or no purpose. After a certain point, further additions of irrigation water begin to produce a negative result and to lower the yield. The importance of this matter to India needs no argument.

The Extension of the Area under Leguminous Fodders.

The most effective use of the water saved on the wheat crop is a matter of great importance. To produce the best results it should

[1] *Agricultural Journal of India*, Vol. XIII, 1918, p. 653.

bring in an immediate return and the crops grown should also improve the texture of the soil. These objects are best achieved by the extension of the area under leguminous fodder crops like Persian clover (*shaftal*) and lucerne. Persian clover (*Trifolium resupinatum*) is a rapidly growing annual which does best if sown in September before the temperature falls too low. It gives four or five cuts before the end of the following June. Its growth period corresponds with that of wheat so that it is well adapted for increasing the fodder supply and for the utilization of any irrigation water saved. Besides, it improves the soil texture and provides a useful rotation. At present, the zamindars manure their wheat direct and use most of the autumn and spring water on this crop. After harvest, the fields have to be thrown out of cultivation for a year for the land to recover from the evil effects of frequent irrigation. A better system would be to manure for *shaftal*, to plough this crop up early in July and to follow it by wheat on a single irrigation for two seasons with a summer fallow in between. In this way, the output would be increased, the land would have a longer rest from irrigation and the texture and fertility would improve.

Any great extension of the area under *shaftal* and lucerne involves the proper preservation of the fodder as the local demand for green food is limited. A considerable amount of attention has therefore been devoted to the drying and baling of the hay. The detailed results are to be found in Quetta Bulletins 5 and 6 and in a paper published in the *Journal of Dairying and Dairy Farming in India* in 1917. The difficulties in this work are twofold—the prevention of loss of leaf in a dry atmosphere and the close baling of a brittle product. The loss of leaf is avoided by completing the hay-making process in bulk instead of on the ground. The baling difficulties are overcome by moistening and covering the heaps about twelve hours before the bales are made. In this way the fodder can be compressed to 90 c. ft. to the ton (the Army standard for baled fodder) without loss of the valuable foliage. Bales so pressed are found to possess excellent keeping qualities.

During the past four years, trials of these fodders have been successfully carried out by various units of the Fourth Division at Quetta. The results obtained in 1915 and 1916 were published in Bulletin No. 6. Those of 1917 and 1918 were equally successful and showed that the saving of weight is as high as 40 per cent. while the cost of feeding is slightly reduced. In all cases, the comparisons were made with the active service ration. Considering the importance of transport in military operations in North West India and in the East generally, the military advantage of this work is obvious. One of the objects of these

army trials was to bring in the military authorities as purchasers for these fodders so as to stimulate their production and sale. The first results were published in 1915 and 1916. Since then, the idea has been adopted in Egypt and no less than 150,000 tons of leguminous hay have been baled for use by the armies in Egypt, Palestine and Salonika. This fodder proved of the greatest use in the recent campaigns in these areas. The military aspect is of course only a part of this question. Good leguminous hay is required in large quantities for use in the towns and villages of North West India, for all road transport work, for dairy animals and for work cattle. It would help materially in solving the fodder problem which at present is keeping up the price of cattle and hindering the adoption of agricultural improvements.

Now that the preliminary work on these fodders has been completed and extensive trials have been successfully carried out, it remains to place them on the market in bulk. We have suggested that a drying and baling centre should be started in Baluchistan under Government agency and that these fodders, either pure or mixed with an equal weight of *bhusa*, should be pressed and afterwards sold to the public at places like Quetta and Karachi. On account of the high prices ruling for green fodder, Quetta is not a suitable baling centre at present. Mastung, in the Kalat State, would appear to be a better site for the undertaking. The object of this work is to make these fodders widely known with a view to their ultimate adoption on the large scale throughout North West India.

The Improvement of the Texture of the Soil.

The duty of water can also be increased by improving the texture of the soil. By this means the root range is extended and a larger crop is obtained without any increase in irrigation. The quality of the produce is also improved. This point is well illustrated by a comparison between the crops grown at Mastung and at Quetta. In the former case, the texture of the soil has been lightened by additions of wind-blown sand, the aeration has improved and in consequence the valley possesses a reputation for the quality of its produce. This view is confirmed by the fact that the addition of Mastung sand to Quetta soil markedly increases its productive power. Such methods of improvement however are only of limited application but they are of value in indicating the direction of progress. The great difficulty in the Quetta valley is to keep the soil open and to check the consolidating effect of continuous surface flooding. The porosity is easily destroyed and if flooding is continued for a few years, alkali salts begin to make their appearance. The utmost use should therefore be made of all aerating materials (including organic matter, leguminous rotations[1] and green manure) by which the soil texture can be maintained and improved. The land should also have rest from irrigation as frequently and as long as possible. The supplies of farm-yard manure should be conserved and only added to the soil when thoroughly decayed. As is well known, this manure often has less effect on the soil if applied fresh than if allowed first to decay in a moist state in the absence of air. At present at Quetta, the fresh manure is allowed to dry in heaps before application and the full benefit is not obtained. In addition, it produces an acrid dust which is detrimental to health. All such manure should be kept moist in pits for about a year and the air should be excluded by a thick layer of soil. In this way, much better results can be obtained than by the application of dry, undecayed manure wh ch, under the arid conditions of Baluchistan, is incorporated into the soil with great slowness and which frequently interferes with growth.

The Formation of Alkali Soils.

One of the most striking characteristics of the soil of the Quetta valley is the tendency to form alkali salts. Particularly is this the case if it is constantly cropped without the addition of farm-yard manure or without frequent fallows.

It is commonly supposed that alkali lands are the natural result of a light rainfall insufficient to leach out of the soil the salts which are formed by the processes of weathering. Our observations on this subject in Baluchistan, in Sind, in the canal irrigated tracts of North West India and in Bihar, suggest a different origin which is now put forward in the hope that it will provide a fresh point of view and so stimulate further detailed investigation of this important question in India. A light rainfall is not essential for the production of white alkali (impure sodium sulphate) in injurious amounts as this salt occurs all over North Bihar where the average annual rainfall is about 50 inches a year. The essential condition for the production of alkali soils appears to be defective soil aeration, the first result of which is a reductive hase, often accompanied by the formation of the bluish green iron compounds so characteristic of ill-drained soils. Subsequent oxidation appears to result in the formation of white alkali. According to Hilgard,[2] reduction is connected with the anaerobic bacterial fermentation of the organic matter in the soil. In the stiff soils at Pusa, where alkali salts are produced, and in similar soils in Baluchistan, the blue and green tints, which are caused by the stagnation of water and which indicate a lack

[1] The beneficial effect of the lucerne rotation is largely due to the annual dressings of farm-yard manure applied to this crop during the autumn and winter.

[2] Hilgard, *Soils*, 1906, pp. 45 and 232.

of aeration, are of frequent occurrence.[1] Towards the surface of the ground, brown rusty patches, indicating the presence of ferric oxide, are common. That reduction is the first stage in the formation of white alkali and that the sodium sulphate is mainly produced by *subsequent* oxidation processes in the presence of moisture and air appears to be indicated by the following facts :—

1. White alkali is produced in Bihar by anything which consolidates the stiff soils for long periods such as the presence of trees and bamboo clumps or the traffic on an earthen road.[2] The effect is most marked in the case of trees with a dense root system near the stem such as the *pipal* (*Ficus religiosa* L.) and the tamarind (*Tamarindus Indica* L.).[3] On removal of the trees and bamboos and when an old road is brought into cultivation, there is, *after a time*, a copious efflorescence of impure sodium sulphate on the surface of the ground. While trees like the *pipal* are standing and while earthen roads are in use, white alkali is seldom evident on the surface and this is not produced in quantity till a considerable period of time has elapsed after their removal. The removal of the bamboo clumps and trees and the cultivation of an old road always markedly increase the white alkali. Further, percolation is very slow in the soil under bamboo clumps and *pipal* trees indicating that aeration is also poor. In all these cases, natural aerating agencies appear to be put out of action, a reductive phase is then set up which continues till oxidation is again possible when the site comes into cultivation. One of the first results of aeration is the formation of white alkali. When this is completed and the salts are removed by drainage, these alkali spots become exceedingly fertile.

2. When watercourses (*vialas*), the sides of which are in turf and which show no signs of white alkali on the surface, are brought into cultivation in Baluchistan, alkali is apparent the following year. The old course of the *viala* can then be traced by a definite strip of alkali soil while the land on either side is quite normal. The frequent use of the watercourse appears to have set up a semi-swamp condition and a reductive phase in the sub-soil. Afterwards, oxidation results with the formation of impure sodium sulphate.

3. When soil under grass from an undrained and partially water-logged area at Quetta, on which no saline efflorescence could be seen, was used to fill up pits, the filled in portions became alkali patches the following year.

[1] At Pusa, the tunnels left by fine roots in the subsoil are often, after the monsoon, surrounded by a bluish zone.

[2] Jatindra Nath Sen, *Agricultural Journal of India*, Vol. XII, 1917, p. 390.

[3] Other trees like the *sisoo* (*Dalbergia Sisoo* Roxb.) in which there is no dense formation of roots near the stem do not give rise to alkali patches in Bihar after they are removed.

4. When the turf from lowlying damp areas, on which no salt accumulates, is used to line watercourses, a copious efflorescence of sodium sulphate appears on the turf some time after the new channel is used for carrying water. Afterwards, when the salt is removed by wind, the growth of grass is exceedingly luxuriant and no further alkali is to be seen.

5. If alkali spots on lowlying areas at Quetta are examined, the subsoil shows the greens and blues described by Hilgard in the case of poorly aerated badly drained land in which a reductive phase is present. Above is a zone of brown ferric oxide while the surface is encrusted with white alkali.

These observations agree both with the natural occurrence of alkali soils in various parts of India and their formation after excessive irrigation or when the natural surface drainage of the country is interfered with by an obstruction like a railway embankment. The essential first cause appears to be the stoppage of soil aeration and the production of a reductive phase. Afterwards in the presence of moisture, oxidation takes place at the surface with the formation of alkali salts. The agents which check soil aeration are many. The excessive consolidation of an earthen road by traffic, the cutting off of the soil under dense masses of roots from natural aerating agencies, poor surface drainage and the accumulation of surface water for long periods, leading to an alteration in the texture of the soil, the checking of natural drainage by embankments, the waterlogging of fine close subsoils either by the rise of the ground water for long periods or by excessive irrigation are all followed by the formation of alkali salts. If our view of the matter is correct and if defective soil aeration is found to set up a reductive phase in the soil which is followed by the production of impure sodium sulphate, the alkali problem in India assumes a more hopeful aspect. The origin of alkali in India is a matter which obviously requires investigation. If, as we anticipate, defective aeration is found to be an important agent in the case, the prevention of the spread of alkali will require attention in the development of Indian agriculture and in all future irrigation projects. It seems probable that if soil aeration is provided for in the first instance, there will be no alkali to remove.

The subjects dealt with in this chapter have been discussed in greater detail in the following bulletins and papers :—

1. Soil ventilation. *Bulletin No. 3, Fruit Experiment Station, Quetta*, 1915.

2. The saving of irrigation water in wheat growing. *Bulletin No. 4, Fruit Experiment Station, Quetta*, Second Edition, 1919. (*Bulletin No. 118, Agri. Res. Inst., Pusa*, 1921.)

3. Clover and clover hay. *Bulletin No. 5, Fruit Experiment Station, Quetta*, 1915. (Reprinted in the *Agricultural Journal of India*, vol. IX, 1916, p. 71.)

4. Leguminous crops in desert agriculture. *Bulletin No. 6, Fruit Experiment Station, Quetta*, 1916.

5. The irrigation of alluvial soils. *Bulletin No. 7, Fruit Experiment Station, Quetta*, 1917.

6. Note on the baling of lucerne and *shaftal* hay. *Journal of Dairying and Dairy farming in India*, vol. 5, 1917, p. 61. (Reprinted in the *Agricultural Journal of India*, vol. XIII, pt. IV, 1918.

III. FRUIT GROWING.

The two chief problems involved in the improvement of fruit production in Baluchistan are (1) the introduction of better methods of fruit packing and (2) the discovery of the lines of advance in fruit growing.

Fruit Packing.

The question of improving the methods of packing was taken up first as it was recognized that as soon as proper facilities existed for transporting the fruit in good condition to markets all over India, an immense stimulus would be given to the industry as a whole. Any increase in the number of orchards planted must depend on an increased demand from India. When this work was first started in 1912, there was only one fruit merchant at Quetta who made any attempt at scientific packing. Most of the fruit was sent away in a very unripe state in baskets or old kerosene oil boxes and, in consequence, very low prices were obtained. A good deal of time was therefore spent in devising special fruit boxes and crates suitable for transport on Indian railways. Satisfactory patterns were finally evolved, and for the last few years improved fruit boxes, in which delicate fruits like peaches, grapes, cherries and apricots will travel undamaged to such distant markets as Calcutta, Bombay and Madras, have been supplied to the dealers at cost price. The demand for these boxes has increased every year. In 1919, boxes and crates to the value of Rs. 8,000 were sold, and if the stock of certain types had not been exhausted early in the season, the amount would easily have risen to Rs. 10,000. Since the introduction of the new boxes, the number of fruit merchants at Quetta dealing in small, well-packed consignments, has increased very considerably and this in turn has affected the demand for the available fruit. The amount of fruit is now insufficient for the trade and new orchards are springing up in all directions.

Two types of package have been adopted—cardboard boxes and crates. Three sizes of ventilated cardboard boxes—with 12, 20 or 24 compartments—are in use for peaches, nectarines, cherries and apricots. The outsides of these boxes as well as the inside fittings are collapsible, the boxes pack flat and are imported ready for use. Three sizes of non-returnable crates—holding 8, 16 or 24 two-pound punnets—and one returnable crate with 24 punnets are now on sale at Quetta. In all these crates, the unit is the punnet—a chip basket holding about a seer of fruit. These pack into the crates in layers, each layer being separated by a lath floor, and the weight of the upper layers is supported by the edges of the punnets. In this way, all crushing is avoided and thorough ventilation is provided for. The packing material is well retted *san* fibre which has been found cheaper and more satisfactory than cotton wool or wood wool.

It is expected that the improved packing will give the greatest stimulus to grape-growing, the fruit which is best suited to the conditions of Baluchistan. When grown on the slopes of the valleys where the subsoil consists of beds of gravel and pebbles, the drainage and soil-aeration so essential for the vine are provided for naturally. The trench system avoids the use of wooden supports, protects the plants from the sun and, by checking evaporation and transpiration, reduces the volume of irrigation water needed. Flowering is late and damage by frost is rare. The vine is also resistant to alkali salts. The only serious danger, and this is unusual, is heavy rain during the ripening period which destroys the flavour and injures the keeping qualities. The work involved in grape cultivation after the trenches are dug and the vines are established is small. The crops are purchased for a lump sum by fruit contractors, and railway transport is provided by the State. Such a cultivation is therefore eminently suited to the present conditions of the local agriculture. Now that a method of packing has been devised by which Baluchistan grapes travel undamaged to the most distant markets of India, the chief obstacle to the extension of grape growing has been removed. The Quetta dealers have readily adopted the new grape crates and many of them think that the Kandaharis will take them up and pack direct into punnets in the vineyards of Afghanistan. This, however, may take some time.

Before the new fruit boxes and crates could be taken up generally, certain transport difficulties had to be overcome. The cost of the packing materials at Quetta (where local supplies do not exist) is so great that the solution of the transport question is to be found in the adoption of returnable packages which can be used several times. This not only reduces the cost of packing for each consignment but also enables