The sandy loams of the Arowhenua series have less available phosphate than the silt loams of the same series, but this is only to be expected, since they have a greater proportion of unreactive material.

(*b*) *Potash.*—Available potash figures show medium values on the average, with some figures definitely low and others quite high. There does not appear to be any definite correlation between potash status and soil type, and, with no farm records available, no explanation can be advanced on this point.

The available potash is slightly lower in the Levels series than in the Arowhenua, but with phosphate brought to a satisfactory level on the former type one would expect that potash would be required in about the same amounts in both cases. The total potash figures are of the same order as the available, but are high enough to suggest that there is a good reserve of potash in the soils. The indications from the two top-dressing experiments mentioned above are that very little response has been obtained from potash dressings.

(*c*) *Lime Status.*—The pH values show that all soils have a medium degree of acidity. Although the occurrence of acidity in the soils of a proposed irrigation scheme can be regarded as a good fault, since there will be no likelihood of alkaline salts in the subsoil being redistributed by upward movement of irrigation water, nevertheless the figures show that liming is necessary in many cases, especially where lucerne or crops susceptible to club-root are contemplated.

(*d*) *Magnesium.*—Replaceable magnesium values are all high compared with the replaceable calcium. Sample 1005 gives a very high figure, but this is to be expected, since soils affected by sea-water always show abnormally high magnesium figures.

(*e*) *Nitrogen.*—Total nitrogen figures are normal, and while a nitrogen response can be expected, only top-dressing experiments can tell if the use of nitrogenous fertilizers is likely to be a profitable one on irrigated soils.

3. *Relationship of the Soil Types to Water.*

A number of laboratory experiments have been made to ascertain what difference varying textures in the soil types will make in the duty of water. While recognizing that these laboratory tests could not hope to fulfil the function of properly conducted field tests, it is to be anticipated that the same difference found on a laboratory scale can be demonstrated in the field, even though the absolute figures obtained are not the same.

The moisture equivalent was estimated on all soils. The value obtained, which is only approximate, can be regarded as a similar figure to field capacity, since it measures the retentive power of the soil for water against an external downwards pull, such as gravitation or suction. From the analyses it will be seen that the silt-loam types of both the Arowhenua and Levels series have similar figures, but with slightly higher values for the heavier silt loams of the Arowhenua series. Sand, of course, reduces the moisture equivalent, while humus, as exemplified by sample 1005, increases it considerably. A low-moisture equivalent indicates that the soil will have a low power of retention of water; that for the same amount of water, movement will take place sooner into the subsoil; and that, since the storage capacity is less, more frequent applications, but of smaller amounts, will be needed than with the soils showing higher values.

Similar information is given by percentage moisture at the sticky point, maximum water-holding capacity, and pore space. Clay content and humus largely govern the figures obtained, so that a knowledge of the mechanical analysis is helpful in predicting the water relationships.

A comparison of the average field capacity of 27·6 on the silt-loam type at Ashburton (Grange, 5th Annual Report of Soil Survey, 1934–35, p. 21) with the laboratory-determined moisture equivalent of 31·5 for the loessic silt loam of the Levels County suggests that the duty of water as determined at Seafield may be utilized in irrigation control on the Levels scheme, since climate and rainfall are similar, but it must be remembered that the Seafield soil is a shallow one, and that, despite the similarity of material used for analysis, the presence of stones near the surface must considerably affect the storage capacity of the soil for water. One would predict that on the Levels silt loam less frequent application of water would be necessary, but greater quantities could safely be used each time.

In conclusion, it must be stressed that laboratory results are not enough in themselves and that field experiments both on the duty of water and the optimum combinations of lime, phosphate, potash, and nitrogen are necessary, and should be started before irrigation is practised on an extensive scale by the farmers. It must be realized that the successful utilization of irrigation water will be dependent upon the greater use of fertilizers than has been customary in the past under dry farming methods.

Summary.

(1) A report has been made on the soils of the Levels Irrigation Scheme from the viewpoints of texture, nutrient status, and water relationships.

(2) The soils are all suitable for irrigation.

(3) No obvious deficiencies that would hamper the optimum use of irrigation have been disclosed, but the phosphate status of the Levels series is low enough to warrant immediate commencement of top-dressing experiments. Liming should be practised wherever crops not tolerant of acid conditions are proposed.

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