

IRRIGATION IN THE SOUTH ISLAND.

Wm. C. Stafford,

Department of Agriculture, Timaru.

Agriculture in the South Island, especially in Canterbury, is due in the next decade to undergo a change. During the last five years irrigation schemes amounting to 217,000 acres have been commenced. Seventeen thousand acres are now ready for irrigation, and for the remainder water will be available within the next five years. These, in addition to the irrigation schemes of Central Otago and the contemplated scheme of the Maniototo Plain, (80,000 acres) must, to a large extent affect the farming policy, and at the same time increase the productivity of the South Island. By 1945 the areas under irrigation will have increased to 360,000 acres.

Developments in Central Otago are taken as a matter of course; The value and necessity for irrigation is seldom, if ever, questioned; what is questioned is the cost of the water and the lack of a sufficient supply. Similar developments in Canterbury, however, have led to a great deal of controversy and there can be no doubt that the majority are questioning the necessity for it. To this is added the fact that there is a tendency to enlarge on the problems that will arise from the adoption of irrigation, but it will be shown later that the difficulties of the future are fully appreciated.

This paper is presented with the hope that as far as Canterbury is concerned it will assist the development of irrigation projects at present in hand. If it does not achieve this object it will at least assure the community at large that these projects are not being entered into merely as a means of absorbing labour, but are being carried out in order that the farmer will ultimately benefit. The necessity for irrigation, provided the land is suitable, is determined by the following; -

- (1) Where the annual rainfall is insufficient to supply the plants moisture requirements.
- (2) Where there is such variation in the monthly rainfall that at certain periods there is insufficient soil moisture to maintain the plants in a productive state.
- (3) Where, through certain climatic conditions, there is an abnormal loss of soil moisture through evaporation.
- (4) Where there is such variation in the annual rainfall that periodic years of drought are experienced.

The first point provides the 'reason for irrigation in Central Otago, while the last three provide the reason for it in Canterbury. If, therefore, water suitable for irrigation purposes can be supplied cheaply there can be no doubt that agriculture will benefit. In Canterbury there is available an unlimited supply of water suitable for irrigation. This can be taken from the rivers by means of cheap gravity intakes, in contrast to the expensive dams which have to be built in Central Otago. These rivers with their unfailing supply of water from the huge catchment areas of the Southern Alps flow at their height during the months that water will be required for irrigation purposes. The nature of the ground enables engineers to construct cheaply the necessary races. The presence of these big rivers enables large and comprehensive schemes to be undertaken,

thereby diminishing the cost per acre. The result of these advantages is reflected in the low cost of water,

The following are the irrigation schemes as far as Canterbury is concerned :

(1) The Redcliff area of 5,130 acres: This comprises that portion of land from what is known as the Stone Wall on the west, to the Valley Farm on the east, and bordered by the Waitaki river on the south, and Pentland Hills on the north. The source of the water supply is the Waitaki river, and the capacity of the main race is 55 cusecs. The land, which varies from light stony silt to heavy clay loam, is entirely flat. Water was made available here for the first time last season. The results obtained have made even those farmers who were originally opposed to the idea, optimistic of the future. Ten per cent. of the area was irrigated last season,

(2) The Levels Plain area of 13,000 acres: This comprises the triangular piece of land bounded by the sea, the Opihi river and the Washdyke-Fairlie railway line as far as Pleasant Point. The source of the water supply is the Opihi river and the capacity of the main race is 180 cusecs. The land, with the exception of 160 acres which is a clay loam, is all flat and is a light stony silt. Water will be available for the first time this season.

(3) The Ashburton area of approx. 200,000 acres: This comprises all the light lands of the Ashburton Plains. The source of the water supply is the Rangitata river and the capacity of the main race is 900 cusecs. Originally the scheme was confined to 32,000 acres in the Winchmore district and it was intended to take the water for this from the south branch of the Ashburton river. On the completion of the Redcliff area in 1936 a start was made with the distributory races for this scheme. It will now, however, be linked up with the major scheme. Water should be available in 1941.

On all the above areas farms will be supplied with eight cusecs of water whenever it is required, and there is no compulsory water-rate whatever on the land. A comparison of the charges of these and other schemes in the South Island and also in other countries is interesting:

Charges for one-acre foot of water.

Country	Scheme	Cost per ac. foot
NEW ZEALAND	Galloway	8/- compulsory
	Manuherika	8/- "
	Olig Terrace	8/- "
	Rippon Vale (private scheme )	15/- "
	Ardgour	7/6d. "
	Redcliff	2/6d.
	Levels	3/-
	Ashburton	3/-
AUSTRALIA	Bacchus Marsh	12/- compulsory
	Werribee	12/- "
	Maffra	10/- "
	Gouldburn	8/- "
AMERICA	Yakima Valley	7/8½d.
	Southern California	72/-

The development of irrigation in these areas which have a rainfall averaging 20 to 30 inches must of that necessity be slow. Those living on such land have by experience evolved a system of

agriculture which under the existing conditions has proved successful. This system depends on farming a sufficient area of land, the frequent renewing of pastures, the growing of supplementary fodder crops (e.g. turnips and rape) the washing of fertility by the growing of wheat and by Under-stocking. It is not likely to be supposed that such a system, which everybody must admit is highly specialised, and when carried out by the recognised methods a highly profitable one, is going to be overthrown by another system of which the man on the land is ignorant. Nevertheless results in other countries have shown that where it has been possible to supply irrigation water at reasonable cost such a system of modified dry farming as practised in Canterbury has been replaced by irrigation farming. In Canterbury it is well-known that there are periods during which the soil moisture is insufficient to supply the plants requirements. These periods are mainly confined to December, January, February and March. The wintering of stock, as far as Canterbury is concerned, causes the farmer no trouble. His carrying capacity is limited by these dry months. On account of these well-known periods he is unable to stock his farm to the extent that he would could he be assured of a plentiful supply of feed during these months. It is during this period that farmers will learn the value of an adequate supply of soil moisture. This period of the year will cease to become a menace to them, rather will it become a time of plenty during which they will be able to not only supply stock with sufficient food but also to conserve surplus fodder by means of hay or ensilage in a manner which has not been possible before. In order to do this, however, it will be necessary for them to understand thoroughly the principle of applying water to the soil. There can be no doubt that in the early stages of development the wide flooding methods must be the ones used. Their simplicity and low cost of land preparation make them the obvious methods for a farmer to adopt in the early stages of the development of any irrigation scheme.

It is only when the value of irrigation has been proved by these crude and inefficient methods that farmers will be convinced that the expenditure of money necessary to prepare land for the efficient method of irrigation by the border dyke system is well worth while.

The development of irrigation means a complete change-over from agricultural to grassland farming, and it means grassland farming with the two main factors - moisture and sunshine - in sufficient supply. High producing permanent pasture will become reality on the light soils of Canterbury and not the 'crock of gold at the foot of the rainbow'. This change-over will bring in its wake problems which will have to be solved and we will find these following on definite lines, namely those of application, utilisation and management. They will arise from improper use of water, poor utilisation of the pasture, and mismanagement of the stock. The present methods of farming on the open gate system will have to be abandoned. Farmers will have again to become shepherds in the old sense of the word.

To a great extent the problems arising from the application of irrigation water can and will be solved prior to any extensive irrigation taking place by farmers on these areas. Correct utilisation and management can also be demonstrated. It is with this object that co-operative demonstration farms have been established on these areas, whereby in return for free use of the water and a certain amount of development work being carried out free of cost the farmer is prepared to irrigate along the lines suggested by the Department of Agriculture and the Public Works Department. These farms vary in size from 300 to, 600 acres. By the gradual development of the properties and the establishment and maintenance of pastures under irrigation an endeavour will be made to show how the change-over from agricultural to irrigation

farming is to take place. It is hoped that farmers in the district, seeing this carried out under conditions similar to their own, will become aware of the possibilities of irrigation. As farmers develop their properties individual problems of pasture utilisation and stock management will, arise. This will happen in the ordinary course as they have always done in any branch of agriculture which has been subjected to a change. The presence of men trained to such work should, however, ensure that these difficulties will be solved for each set of circumstances as they arise. Perhaps the greatest difficulty in connection with the development of these areas will be to convince farmers that they should adopt as soon as possible the efficient method of irrigation, namely the Border Dyke system. Rather than incur additional outlay in the preparation of the land necessary for irrigation by the Border method there will be a tendency to continue with the free flooding methods. Farmers have been further prejudiced against the Border method by the reported heavy expenditure necessary, this being often given as many times more than the, actual, value of the land. This high cost per acre may have been incurred in the past, but by the use of modern implements and machinery and by the use of improved head gated the cost has been reduced to under £2 per acre. During the past eighteen months some 200 acres have been bordered in Canterbury at this price. It must be emphasised that the land prepared was fully representative of the land which is included in the various schemes.

All that is required is the co-operation of the farmer, the scientist and the field officer to enable the South Island to develop thoroughly her potentialities.

DISCUSSION.

MR. R. B. TENNENT, WELLINGTON: -

I feel sure you have all listened with great pleasure to Mr. Stafford's paper on irrigation.

The average individual looks upon irrigation as a very intricate subject. It is really one of the simplest, and probably, one of the most ancient, types of farming.

You are all aware that the main reason why you apply fertilisers and carry out certain improvements to your land, is to supply conditions whereby your plants will grow to fertility and maturity. Otago and Southland farmers go to a great deal of expense in buying fertilisers.

There is one big point to which in the past farmers in the South Island have not given sufficient attention, and that is, the limiting factor of moisture.

If you have not an adequate supply of moisture to make your plants grow, all your efforts are worthless. Consequently each individual farmer must realise that fundamentally the moisture supply is absolutely essential, and he must realise that in districts such as Central Otago, irrigation is bound to play, and does play, a very important part.

--Usually when a farmer is threatened with an irrigation scheme coming on his property, he wonders what it is going to cost him. In all the irrigation schemes in New Zealand, the cost of water is an absolute bugaboo. Even in Central Otago where the water costs are much higher than in other districts, the charge to supply a depth of 24" deep is only equal to the cost of 2 cwt. of Super. so far as the Canterbury schemes are concerned, they are much cheaper than those of Central Otago. For a very low cost (the equivalent of 2/6 to 3/- for 12" and 5/- to 6/- for 24" is being charged on these schemes) the advantages from this expenditure will certainly be warranted.

I was interested in one statement referring to the volume of water which is being provided in some of the areas from the Levels and Ashburton schemes. This was - "on all the above areas, farms will be supplied with 8 cusecs of water whenever it is required". What is a cusec? It, is one cubic foot of water flowing at the rate of one second. If you put it on to an acre of land and allow it to run for 12 hours, you will be putting one inch of water all over your land.

In the past one of the limiting factors for the success of irrigation has been the inadequate supply of a big quantity of water flowing at a time. If you have a little trickle of water, you have to lead it here and lead it there, and it is very difficult to get it over your land. But if you have a big head of water you can let it go on dancing away, and the operation becomes easy to carry out. In Canterbury evidently an adequate head of water is being supplied, and this should reduce labour costs. One of the main difficulties is the cost of labour. The minute water comes on to land it has to be handled, and a man must be in attention all the time. That costs quite a lot.

Now comes the question of wild flooding versus the Border Dyke system. If you have nice gentle slopes of hilly country, this is easy to work. On flat country you must be in attention all the time, shuffling it here, and here, but working the hill country presents no difficulty.

In Canterbury where most of the country is flat, you come upon the real difficulties of irrigation and the distribution of the water. It would be simple to get water to flow over flat land, but what land is really flat? You look at a small flat paddock and turn a big head of water on to it, and you immediately find little humps and hollows which turn the water aside so that it does not flow evenly, but is most inadequate and unsatisfactory, and consequently is productive of bad results. That is one of the difficulties Canterbury farmers will be up against when irrigation takes place.

The Border Dyke system is a definite preparation for irrigation purposes. You have to level your land and cut a ditch. We have done a lot of irrigation with it in Central Otago.

Fortunately, with the new earth-removing implements the cost of preparation for the Border Dyke method has been reduced to somewhere about £2 per acre, including boxes. Under old conditions in Central Otago it cost about £12 to £15 per acre for preparation.

Another important point is the effect of irrigation on the future farming of Canterbury. Our President, in his address, stressed the value of what he termed "milk grass". I maintain that irrigation is going to change entirely the kind of pasture that can be grown in Canterbury.

This is going to be one of the decided advantages. The farmer after irrigation will have no occasion for the annual growing of crops. If he wants water to grow crops, he is on wrong lines. He will not want to be ploughing up his land each year after he has got his dykes established. To my mind irrigation should be used entirely for growing permanent pastures, such as grass and lucerne. In the past the development of our grass lands has been very largely due to top-dressing - in the future I am sure that the further development of our grasslands will be due to irrigation.

MR. HURST, OAMARU:-

I have been carrying on the wild flooding method of irrigation for the last eight years, and I must say I have been getting excellent results. In the first place, the rainfall in North Otago is lower than in Canterbury, and one of the chief reasons why the farmers there are in difficulties is owing to periodical droughts coming along, and not only wiping drops out for one year, but for two or three years. Under an irrigation system you can stock up every year, and there is no danger from the drought. In good seasons everybody wants stock, and we are all buyers, but in bad seasons, if we have no irrigation, we are all sellers-

We get a large amount of fat lamb's away off their mothers. There is always a danger that we will add on more stock than we can carry, but with topdressing we can carry the stock safely.

We have been working for eight years and have never had to renew any pastures, except those which were ploughed out to put in turnips. We use them for swedes and mangels, and get wonderful crops.

Canterbury farmers will find there is danger of foot-rot in heavy growing grass, and they will probably have to leave the half-bred and go on to romneys.

MR. STAFFORD, TIMARU:-

At Redcliff this year there was a 50-acre paddock of 6-year old permanent ryegrass. Only half of it was irrigated. On the irrigated portion there was no sign of the grass grub: at all, but on the portion that was not irrigated the grass grub has taken complete

control, and that part will have to be ploughed up.

Seafield, in the Ashburton County, was different. I do not know if sufficient importance was stressed **on** the fact that in the case of Seafield the pastures were late, good for hay, and the grass grub completely took them away. There is no doubt that where irrigation water has been flowing and the pasture has been kept under control, the grass grub is not a serious menace..

MR. SELLWOOD.

I have always stressed the value of Lucerne to the farmer in North Otago. This is one of its most valuable crops.

MR. STRINGER.

Nobody seems to have sounded a note of warning against irrigation. This point, however, has just occurred to me.

Two years ago I was in India, where irrigation has been carried on for very many years. I was just wondering if New Zealand, after some 20 to 50 years, will meet any of the difficulties they are having now in India. They put in hand many years ago large systems of canals, and thought they had solved their problems as to drought conditions. Perhaps we do not suffer so much from the intense heat out here. A great many of these areas are to-day completely useless for **any** purpose, owing to the saline content of the soil. Unless we have conditions such as Mr. Hurst has, it seems to be **an** idea worth considering whether you can get the water on and get it off. There it passes over the land, which absorbs what it requires and then drains on. I am wondering if there will be any increase in the saline content of the soil in New Zealand.

MR. TENNENT.

We have been keeping a close watch on that in Central Otago. The waters in that district are absolutely devoid of alkali,

DR. DIXON.

I do not think there is any trouble to be anticipated in Canterbury, but the position may have to be watched fairly closely in places **in** Central Otago. Some of those places are only limited in extent, but what we see on the surface is not necessarily any indication of what we may see lower down in the profile., With proper drainage and an adequate supply of water there should be no trouble.