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The Development

OF

WESTERN AUSTRALIAN SAND PLAIN

SOILS FOR AGRICULTURE

By R. P. ROBERTS, M.Sc. (Agric.), and F. L. SHIER, B.Sc. (Agric.)

INTRODUCTION

IN a recently published economic survey of the Australian wheat growing industry, it was reported that nearly two-thirds of the farms surveyed in Western Australia were located on lateritic "sand plain." As a random selection was made of the eighty farms that were visited it is reasonable to conclude that a similar proportion of all the State's wheat producing farms are on that type of country. This constitutes a remarkable change from the earlier days of wheat belt settlement when the sand plain soils were regarded as virtually useless and by-passed for development. It is the purpose of this article to give a brief account of the agricultural development of those soils in the south-western part of Western Australia and to consider the factors which have been responsible for the change.

WHAT IS LIGHT LAND?

In 1921 a conference was arranged in Perth to discuss methods for utilising the large tracts of light land which existed intermingled with the better quality heavier soils on which agricultural development had so far been concentrated. Most of this country lay to the east of the 18 in. isohyet and its low fertility did not constitute a problem until wheat belt settlement began to extend into the lower rainfall regions in the early 1900's.

It was pointed out at the conference that the heavier soils "were characterised by forest growth, and our sandy lands by the growth of scrub rather than trees. The term light land has been broadly applied to all those lands which in their natural state did not produce trees—in effect, the treeless lands. These include sand plain, scrub plain and thicket lands, which range from a poor white sand to a light coloured loam of fine quality. The sandy soils vary in depth from a few inches to many feet, and generally overlie a gravelly or clay subsoil." It was estimated that up till then about 8 million acres of that type of country had been alienated, much of it adjacent to existing railways. Any method of increasing its productivity would be of considerable economic value.

The low fertility of much of the sand plain in its virgin state has often excited comment. In 1931, for example, Prescott noted that some of these soils did not respond to normal fertiliser treatment. Another authority described them in the following terms:

The natural poverty is most acute in Western Australia, where the south western corner is one of the most remarkable areas of poor soil in the temperate zones of the world.

In 1938 a Select Committee enquired into the light land problem. It estimated that at that time there were some 12 million acres of light land within 25 miles of existing railways. However, the Committee adopted a rather wider definition of light land than that given at the 1921 conference and included sandy and gravelly soils which carried a cover of trees of varying density. Also, it did not make clear whether the Committee's estimate referred to all undeveloped light land or only to that which was not alienated.
Example of land classification in Western Australia, south of Southern Cross, based principally on native vegetation. First class country is marginally shaded; second class country, principally carrying mallee, is indicated in black; while sand plain, or third class country, is left white. The map illustrates how the sand plain soils, the remains of the lateritic gravel capping which once covered the country, are intermixed with the better quality soils formed on the parent rock after erosion of the laterite. Scale, 1 in. = 1 mile. (From Prescott: The Soils of Australia in Relation to Climate and Vegetation.)
The area of cleared land has risen rapidly in the past 15 years. It is now more than 24 million acres compared with only about 14 million in 1945.

As used at present the terms "sand plain" and "scrub plain" approximate closely to the definition of light land given at the 1921 conference. Soils of similar texture but carrying trees rather than scrub are an additional inclusion in the term "light land." Examples of the latter type are soils carrying white gum, banksia, jarrah and casuarina. This discussion is mainly concerned with former type, i.e., the sand plain.

THE AGRICULTURAL VALUE OF SAND PLAIN SOILS

Farmers' experiences with sand plain utilisation were described at the 1921 conference. Some had been fairly successful but others had failed. The usual experience was that it would produce a profitable crop in the first or second year but, under ordinary pioneering methods, yields would decrease in succeeding years and the land would soon fail to respond to an application of superphosphate. The deficiencies of the soil in regard to both nitrogen and phosphorus were clearly recognised, as was the consequent need for growing crops for grazing and making wheat growing subsidiary to stock production. The need for a light lands experiment farm was voiced by some of the speakers. An outcome of the conference was the establishment in 1924* of the Department of Agriculture's experiment farm at Wongan Hills in a 14-inch rainfall district. Meanwhile settlement extended farther into the lower rainfall districts and by 1930 most of the forest country in the farming districts has been alienated. Any further large scale progress depended on the more effective

Grey sand overlying gravel is a common profile on sand plain. The better types have some clay in the sub-soil. Where the soil is a leached white sand, and there is no evidence of clay within two feet of the surface, the land may not be worth the cost of developing.

* Other sand plain research stations were established at Esperance (1949), Newdegate (1955), Badgingarra (1959).
utilisation of the extensive areas of light land, so much of which lay in the already settled areas.

EXPERIENCE AT WONGAN HILLS

The advent of subterranean clover in the early 1920's gave the first promise of worthwhile progress in sand plain utilisation. However, clover was not the immediate success in the wheat belt that it had been in the higher rainfall districts of the south-west. This was illustrated by experience at Wongan Hills Research Station, where successful establishment of the early maturing subterranean clover variety Dwalganup, was achieved only after several years of disappointing results. The first experimental sowings were made there in 1935 and it was not until 10 years later that the problems of establishment were surmounted. By that time it was apparent that despite liberal superphosphate applications, both crop production and stock carrying capacity were declining under a four course rotation of bare fallow, cereal crop and two years of volunteer pasture. Soil erosion by both wind and water was clearly evident.

In 1946 a major pasture improvement programme was commenced on the Wongan Hills Research Station. This programme was based on Dwalganup subterranean clover and over the next 10 years the whole of the station was progressively sown with that plant. A ley system of farming without fallow was started in

The importance of eliminating as much as possible of the scrub residues before sowing pasture seed cannot be over-emphasised. This is usually best achieved by rolling and burning the scrub, ploughing and leaving as bare fallow for eight to nine months.
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1951. Since then cereal yields have increased by 50 per cent. In the pre-clover era wheat crops averaged 14.2 bushels per acre; under the clover ley system yields have risen to 22 bushels. Sheep production has doubled from about 1 sheep to 3 acres to 2 sheep to 3 acres.

When new sand plain country is seeded for the first time it produces nothing without superphosphate. Heavy dressings of that fertiliser are necessary in the early stages of development. Trace elements are often an additional requirement.

Similar results to these were being achieved by farmers on the sandy surfaced jam and York gum soils of the 16 in.-20 in. rainfall belt during the same period. The importance of the Wongan Hills work lay in the fact that subterranean clover was successfully established in a 14 in. rainfall, thus indicating the possibilities for improvement of several million acres of sand plain country with similar rainfall. The results obtained at this station provided a strong incentive and stimulus, on the technical side, to the large scale sand plain development which has occurred in the sheep and cereal districts since the war.

IMPORTANCE OF OTHER FACTORS

Several other factors have stimulated interest in the development of these sandy soils.

One of major importance was recognition of the importance of trace elements, particularly copper and zinc. As a result, the productivity of much existing agricultural land was raised and profitable development of large areas of new country became possible. Since the war some 7 million acres, nearly a third of the State's cleared land, has been topdressed with one or both of these elements.

In some areas, notably in the north western part of the sheep and cereal districts, the blue lupin has been used with considerable success instead of clover as the pioneer legume.

Most of the sand plain soils which have been developed so far have a sandy surface.
and a subsoil containing some clay within two feet of the surface. Clover establishment in many cases has not always been so successful as on the better type soils, e.g., jam and York gum. Problems of phosphate needs, trace element deficiencies, soil micro-organism antagonism to rhizobial nodulation, inoculation technique and cultivation and seeding methods have required special study. Phosphate has been a major consideration and rates of application even reasonably approaching the requirement of subterranean clover for maximum growth are generally not possible with the financial resources of the average farmer. Over much of Western Australia this problem has been largely offset by the use of one or two cereal crops as cash crops prior to the introduction of the clover.

From the practical aspect the above procedure has several advantages. It enables some revenue returns in the developmental years which would not be the case if stock grazing was the initial intention; secondly, better seedbed preparation for the clover with the destruction of the harsh native vegetation is possible; thirdly, native poison plants can be largely eliminated by the additional cultivations and stubble burnings; finally, the phosphate status of the soil can be
Lucerne on the Esperance Plains Research Station. Although lucerne was introduced into Western Australia in the early days of settlement it has never been of more than minor importance in the State's agriculture. However, recent work suggests that it may be valuable in districts along the south coast, where the growing season is longer than in the main sheep and cereal areas.

Improved through the residues remaining from fertiliser applied with the cereal crops and cultivation ensures a better distribution of the phosphate throughout the soil—a factor of some importance in clover establishment.

After several years under clover the productive capacity of much of the sand plain often approaches or even equals that of some of the soils of higher initial fertility. In addition sand plain is generally easier to work and underground water is usually found more readily.

This better understanding of the requirements for successful development of sand plain was achieved in time for the post war boom in prices for wool, and to a lesser extent for cereals, to exercise their

A heavy growth of lupins on sand plain country west of Mingenew. Sheep fatten readily on the large protein-rich dry seeds which they pick up from the ground after the plant has ripened and the seed shed.
maximum effect. On account of income tax rebates it became very profitable for the recipients of large incomes to invest in the improvement of land for agriculture. As a consequence, apart from some six hundred thousand acres developed by the War Service Land Settlement Board, private operators have increased the area of cleared land in the State by more than 50 per cent. between 1945 and 1960, the total rising from 14 million to more than 24 million acres. It is not possible to estimate precisely how much of that total can be classified as sand plain in the terms of the definition given at the beginning of this article but it would probably approach 90 per cent. A considerable part of it, principally in the 11-13 in. rainfall belt has been developed without clover, mainly because the rainfall there is sub-marginal for the Dwalganup variety. However, for maximum production from those soils a legume is essential and the importance of finding one that will flourish in that environment is evident.

THE FUTURE

Development of sand plain and other categories of light land will continue to occupy the attention of farmers in the wheat and cereal districts for some years to come. The productivity of considerable areas already cleared can be raised through the establishment of leguminous pastures, and there are several million acres more of similar untouched country in districts where the rainfall is sufficient for agriculture.

MINISTER VISITS THE KIMBERLEYS

The Minister for Agriculture (Mr. C. D. Naider, M.L.A.), recently returned from a visit to the Kimberleys which was undertaken to acquaint him with problems of that area. He said on return that beef production would continue to be of major importance in any foreseeable future.

General quality of the stock reflected the good season of 1959 followed by exceptional favourable rains this year. The Minister said he was fortunate in witnessing large mobs of cattle being driven to Wyndham Meatworks over distances up to 250 miles. Good roads were the greatest immediate need in the opinion of Mr. Naider. He said road transport was being used in the West Kimberley and by comparison with the driven cattle there was not the same loss of quality or weight, and in addition stock were being turned over at a younger age.

Mr. Naider said that in common with the Murchison and Gascoyne districts there was a basic need for pastures of a more permanent nature to enable a greater turnover of stock. Fortunately, pastoralists were recognising this and following methods demonstrated by trials and experiments conducted in collaboration with officers of the Department of Agriculture. There was a keen interest in pasture renovation and management, by the practice of distributing seeds of such plants as buffel and Birdwood grasses and kapok bush. The necessity and economics of sub-division are being freely discussed and appraised.

Mr. Naider said the Kimberley Research Station was very impressive, especially the work now being done for the practical establishment of those crops which research has shown can be grown in the area. A special study was being made of the economic production of cotton, which could become a major crop in any closer settlement scheme. Two experiments of particular interest were economic insect control and the testing of varieties suitable for mechanical harvesting. Yields and quality are already known to be satisfactory.

The Minister said a successful rice crop at Camballan appears to be assured but he was particularly impressed by a crop of Sudan grass which had already been cut for hay with prospects for at least two more cuts for this season. The production of such fodder offers an important advancement to the pastoral industry, he said.

The Minister, who was accompanied by the Director of Agriculture (Mr. G. K. Baron Hay) and the Agricultural Adviser for the district (Mr. K. Fitzgerald), expressed appreciation for the assistance given by local authorities and pastoralists to make the trip possible and for the ready way in which advice was given and records were made available.
OBITUARY

Shortly before this issue of the Journal went to press, the Department of Agriculture suffered a severe loss in the passing of the Editor, Mr. J. A. Mallett, whose death occurred on September 24.

At the age of 17 he enlisted in the British Regular Army and served with distinction in World War I in France, Belgium, Salonika, Rumania, Bulgaria, Egypt and Palestine. At the end of the war he held the rank of Captain and had won the Military Medal.

He migrated to Australia in 1922 and took up a 1,400 acre property at Lake Biddy, later moving to North Nippering. While working his property he began free lance writing under the pen name of “Martingale” and his flair for the written word assisted many farmers to bring their disabilities under the notice of the Governments. He joined the staff of The Western Mail in 1935 and his mutual help pages became an expression of his practical way of looking at problems of the man on the land.

In October 1951, after 16 years as agricultural editor of The Western Mail, he joined the Department of Agriculture as Editor of “The Journal of Agriculture,” and Publicity Officer. At that time the Journal was a quarterly. Under his direction it rose to six copies a year, and this year he realised his ambition in making it a monthly periodical. During these years he made radical changes in its style, always aiming for what he called “readability.”

His interests were varied but nearly all were directed to assisting the farmer and his wife. He broadcasted over the A.B.C., his subjects ranging from farm activities to book reviews. He was a judge or commentator of sheep dog trials and for years he commented over the p.a. system at the Royal Show on the Grand Parade and the sheep dog trials there. He rose to the presidency of Perth Legacy and of the W.A. Guide Dogs for the Blind Association.

He leaves a wife and two children.
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