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LIGHT LANDS IN WESTERN AUSTRALIA

2. THEIR NATURE, DISTRIBUTION AND CLIMATE

By G. H. BURVILL, M.Ag.Sc., Superintendent, Plant Research Division

LIGHT land development for agriculture is a major feature in the story of agriculture in Western Australia. Sixty years ago there was less than one million acres of arable land. The total area planted to all crops was less than 250 thousand acres and the wheat harvest was less than one million bushels.

Cleared farmlands today total nearly 25 million acres and have increased by over 10 million acres since the end of World War II. A large part of the 10 million acres developed since 1945 is light land, which, over the past few years, has been developed at the rate of 700,000 to 750,000 acres a year.

DEFINITIONS

The term “light land” comes from the practice in agriculture of calling soils “light” or “heavy,” depending on the power or draught needed for their ploughing or cultivation. Soil texture, structure and moisture all influence the force required to break, rupture and turn soil in these operations.

Sands and sandy loams are called “light” soils because they are easier to cultivate, dry or wet, than clay loams and clays which have much larger proportions of clay or mineral colloid. Sandy soils weigh more per cubic foot when dry than clay loams and clays. That is the light soils are really the heavy ones.
WESTERN AUSTRALIA

South Western Portion

Showing annual rainfall isohyets ———— 15 in.
Length of effective rainfall period ———— 3.
Areas south-west of the straight line ———— total 65 to 70 million acres.

Light land means soils with sandy surfaces, and there may be considerable variation in the subsoil. Sometimes the sand goes to considerable depth; otherwise it becomes more loamy and often there is sandy clay loam or sandy clay subsoil.

Another important and very common feature of Western Australian light lands is the occurrence of ironstone gravels throughout the soil profile or in the sub-surface and subsoil layers.

Scrub or Sand Plains

Western Australian light lands are often referred to as sand plains or scrub plains because of the sandy soils, the gently undulating topography and the natural scrubby vegetation, which contrasts with the forest growth on the heavier soils.

Eucalypt trees and forest do grow on large areas of sandy and ironstone gravelly soil in rainfalls of 20-60 inches. Most of the jarrah forests grow on such soils.

The terms "light land" and "sandplain" were originated to describe the sandy and gravelly soils of the 12 to 20 inch rainfall country or "wheatbelt." The term "light land" now embraces large areas of sandy and gravelly soils with scrub and mallee vegetation in the areas between Perth and Geraldton, and along the south coast from Albany and Mt. Barker to east of Esperance. Annual rainfalls are between 17 and 30 inches.

In the country from Perth to Albany and Cape Leeuwin, ironstone gravelly sandy soils which receive 20 to 50 inch rainfall, carrying jarrah, marri and
Discing back with a heavy disc implement east of Esperance, November, 1961

wandoo are also being developed. Methods are in some ways similar to those used on the scrub plains in lower rainfalls.

The agricultural regions of Western Australia cover a gross area of 65 to 70 million acres south and west of a line from the mouth of the Murchison River, passing just east of Southern Cross to the south coast about 100 miles east of Esperance. This area has rainfall increasing from 11 to 60 inches, but this article deals mainly with the light lands of the 11 to 25 inch rainfall parts. This means that most of the light lands carrying Eucalypt forests are not included.

32 million acres found 14 million acres of first class land, nine million acres of second class land and nine million acres of third class land. All of the third class land, and some of the mallee country of the second class land, would be light land, a total of about 13 million acres.

Of the remaining 35 million acres or so, general observation and experience show that roughly 25 million acres would be light land, making a total of about 38 million acres in a gross area of 65 to 70 million acres. This also includes the sandy and gravelly soils of the higher rainfall forest areas, State Forests and the coastal sandhills.

EXTENT OF LIGHT LAND

The light lands of the West Australian agricultural areas are scattered throughout nearly every district. They dominate some areas, which, until recently, have remained undeveloped — for instance, Esperance and the sandplain north of Perth and west of the Midland railway.

It has been estimated that they occupy half to two thirds of the gross area of 65 to 70 million acres which have climate suitable for farming without irrigation.

A random selection of 80 farms in an economic survey of the wheat industry reported that nearly two thirds were light land farms. A mapping survey embracing

Cleared Land

Cleared land on farms in Western Australia now totals about 25 million acres and already millions of acres of light land are developed. The difference between 65 million and 25 million acres, even allowing for forestry, towns, reservoirs and useless land, gives scope for a big increase in the cleared area. Most of the new clearing is light land. There are, however, on the drier margins of the agricultural areas, tracts of salmon gum, gimlet forests and mallee with soils of intermediate and heavy texture.

Most farms in the Western Australian wheatbelt have some light land. Early
Well prepared newly cleared land east of Esperance. The whole area was disc ploughed in May, 1961. The area on the left was disc ed again in November, 1961.

attempts to use these sandy and gravelly soils for wheat growing led to failures. About 1917 it was thought that the natural vegetation on the wodgil (Acacia sp.) country left toxic substances in the soil but trace element deficiencies of copper and zinc have since been recognised as the main cause of these failures.

**Trace Elements and Legumes**

Sandy surfaced soils often with associated ironstone gravels occur commonly throughout the 11 to 60 inch rainfall areas where agriculture is practised. They form a complex pattern with medium and heavy textured soils in the older farming areas. These heavier soils proved easier to farm successfully before present day knowledge about phosphate, trace elements and legumes (sub clover, lupins and barrel medic) was applied to the light lands.

**PLANT NUTRIENT DEFICIENCES**

The light lands of Western Australia are notable for several nutrient deficiencies.

**Phosphorus deficiency** is so acute that cereals, most introduced pasture grasses and legumes make no growth without phosphate fertiliser—usually superphosphate. (Total phosphorus is about .003 per cent. in surface and subsoil and practically none of this is available.)

**Nitrogen** is also deficient with total nitrogen about 0.03 per cent. in the surface layers containing humus.

Cereals may be grown with super only on land bare-fallowed for six to 12 months, but nitrogenous fertiliser usually improves yields and is becoming more widely used.

**Copper and zinc** are usually deficient, and additions are recommended for cereals and pasture legumes. The deficiencies are not always acute and are often to some extent offset by the impurities in superphosphate.

**Manganese** deficiency occurs less generally than copper and zinc.

**Molybdenum** deficiency is being more commonly found in the ironstone gravelly soils of the higher rainfall “light lands.”

**Potassium** deficiency has been seen on subterranean clover on light lands in several areas but is not generally a problem. Potassium deficiency is more likely to occur on very sandy and deep soils, but most areas with some increase in clay in the subsoil seem to have enough potassium.
Second year subterranean clover on the Esperance Downs

for grazing and some cereal cropping. For example at Esperance, potassium deficiency has not been found except on some deep white sands.

At Wongan Hills Research Station where some paddocks have now been farmed for over 30 years potassium deficiency has not been seen.

Phosphate Leaching, Retention and Availability

Some investigations of phosphate leaching in sandy soils have led to a fear that applied superphosphate may not build up available phosphate in light lands as it does in heavier soils. Other work on phosphate trials on light land at Wongan Hills, Eneabba and Esperance has however given a more favourable picture.

Sandy soils which become yellow and slightly loamy in the sub-surface and subsoil, or soils with gravel and clay in the subsoil, retain much of the phosphate applied over periods of 10 to 30 years. This can be found in the top one to two feet of the soil profile and is available to cereals.

At Esperance 40 to 60 bushels of oats an acre have been produced without phosphate fertiliser on land which had received from 2 to 12 cwt. of super per acre in the previous nine years. At Wongan Hills light land which has received dressings of super totalling about half a ton an acre will grow good cereal crops without super. Originally the same soils yielded nothing without super.

SUITABLE LIGHT LANDS FOR DEVELOPMENT

Some light lands are better than others for agricultural development.

White siliceous sands darkened by humus in the surface, but without clay subsoils or ironstone gravel, cannot at present be recommended for development.

Brown or yellow loamy soils are quite successfully used, for example the Wongan loamy sand at Wongan Hills and similar soil on Mr. E. F. Smart’s “Erregulla Springs” property at Mingeneew.

Where one to two feet of sand or gravelly sand overlie clay or sandy clay subsoils the land is suitable for farming.

The light lands may include some areas with mallee vegetation. Here shallow sandy surfaces from two to six inches deep may overlie domed sandy clay subsoils either neutral or alkaline in reaction.

THE CLIMATE

Apart from the annual rainfall, which varies from 11 to 25 inches in the area under discussion, there are other important features of the climate.

Rainfall Incidence and Effectiveness

The rainfall has a definite winter incidence, about three quarters falling in the May to October period. Winter rainfall is reliable, but summer rainfall is not; however it is often useful in south coastal areas.
Temperature, and humidity can affect the efficiency of rainfall. Scientists use the term effective rainfall for the minimum amount necessary in any particular month to maintain soils moist enough for crop and pasture growth.

The average length of the effective rainfall period calculated from Prescott's formula—

\[
\text{Effective Rainfall} = 0.54 \left( \frac{\text{Evaporation}}{0.7} \right)
\]

reaches six to eight months along the south coastal strip from Mt. Barker to Esperance with annual rainfalls of 18 to 25 inches. Areas with similar rainfall between Perth and Geraldton have four to five months "effective" rainfall but higher winter temperatures accelerate the growth of crops and pastures.

The four months effective rainfall line calculated from Prescott's formula roughly marks the inland limit of extensive successful plantings of subterranean clover. However the Geraldton strain seems certain to succeed in drier areas, as will Cyprus barrel medic and possibly early strains of rose clover.

Temperature

Winter temperatures are never too low to stop winter growth of cereals and pasture plants like subterranean clover. In southern inland parts, cold weather does hold back growth in July and August but the growing season extends into October and early November.

Water Intake and Storage

Light lands provide good intake conditions for rain water. They are efficient in storing water and preventing loss by evaporation, especially where there are clay subsoils. During winter the surface layers stay moist between falls of rain unless they are pure sands with little humus.

Crop and Pasture Plants

Western Australian light land development has been based so far on high producing annuals such as cereals, Wimmera rye grass, subterranean clover, lupins and barrel medic, as well as volunteer species like capeweed, erodium and barley grass. The possibility of using deep rooting perennials on deep sandy soils is being actively studied. Lucerne, Hyparrhenia hirta and perennial veldt grass, are three possible plants for these conditions.

CONCLUSIONS

Much more could be said about Western Australian light lands. Their natural grazing potential is small but they can be successfully developed for cereals and pastures. In fact, the development achieved in this State is probably the most extensive on inherently infertile soils anywhere in the world. This has been done without irrigation and by the application of scientific research.

Light lands in their virgin state produce some of Western Australia's most colourful wildflowers. Many areas, unfortunately, also grow poison plants of the genera Oxylobium and Gastrolobium. Where these occur they must be eliminated to avoid stock losses.

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