Pasture improvement in south western Australia

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PASTURE IMPROVEMENT IN SOUTH WESTERN AUSTRALIA

By J. W. MALCOLM, Liaison Officer, Information Section

"There is no doubt that Australia's enhanced prosperity in the last 30 years has been dependent in no small measure on the use of legume-based pastures." E. M. Hutton, June, 1968.

THE LAST 30 years have seen an increased interest in pasture improvement which has transformed much of Western Australia. Large areas have been sown to new and improved pasture species—as a result productivity of both livestock and cereal enterprises has risen.

Before the turn of the century there was little improved pasture in W.A. Some pasture plants were introduced either accidentally or intentionally, but there was little conscious effort to improve pastures.

After World War I, the South West developed fairly rapidly. To a large extent, this development was due to the combination of superphosphate and subterranean clover. Farmers found that sowing subterranean clover and giving it regular dressings of superphosphate produced luxuriant annual pastures with considerably more herbage of better quality than volunteer pastures.

Pre-war pastures
In the wetter parts of the South West, in the heavy forest country, indigenous pasture species were practically non-existent. In the 20 to 30 in. rainfall areas there was a sparse distribution of perennial grasses such as kangaroo, wallaby, and "pin" grasses, but these were quickly eaten out as the stocking rate increased beyond one sheep to three or four acres. Before the introduction of subterranean clover, a range of poor exotic annual grasses and clovers had become established but they were relatively unproductive, and gave little response to superphosphate applications.

Fig. 1.—Development of Established Pastures 1945-68

A. Total cleared area. B. Cleared area grazed or in fallow. C. Area under established pasture. D. Crop or newly cleared land. E. Volunteer pasture or fallow. F. Established pasture

* Assistant Chief, CSIRO Division of Tropical Pastures and Past President of the Australian Institute of Agricultural Science. This quote is from his Farrer Memorial Oration.
Subterranean clover

The first variety of subterranean clover intentionally introduced into W.A. was "Mount Barker," a strain discovered at Mount Barker, South Australia in 1889.

By about 1914 subterranean clover was becoming recognised as an outstanding pasture species, and within 10 years was the principal pasture plant in the South West. Great impetus was given to its spread by the vigorous forest clearing and pasture development programme of the Group Settlement Scheme in the 1920's.

The rate of pasture development fell off in the 1930's because of low wool prices. In the late 1940's with the war over, wool prices improved and pasture acreages again increased.

Pasture revolution

In 1952-53, as Figure 2 shows, few wheatbelt properties carried improved pasture. But interest was growing in improving pastures, and "Pasture Improvement Groups" sprang up throughout the farming areas. Many new pasture species and strains were introduced.

Although the area sown to improved pasture increased, the total cleared area increased at an even faster rate.

As Figure 1 shows, the total area of cleared land in the State in 1950 was 16.5 million acres of which 3 million carried improved pasture and 4.7 million were under crop or newly cleared. The remaining 8.8 million acres was land either in fallow or bearing volunteer pasture. Much

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**Fig. 2.—Percentage of Cleared Grazing Land Bearing Improved Pasture 1952-53**
of this land could have borne improved pastures if farmers had been willing to sow them, and if suitable species had been available.

**Improvement gap**

By 1955, the area of unimproved pasture had increased to 10 million acres despite the fact that the area of improved pasture had increased by 50 per cent, over the five years (1950-1955).

During the next 11 years to 1966, the area of established pasture more than doubled. However, the total area grazed increased at a similar rate, so the pasture improvement “gap” remained at 10 million acres.

**PASTURE IMPROVEMENT** is a team effort, requiring improved species from the scientists, finance from the bankers and other financiers, and implementation and know-how from the farmers.

In the last two years the rate of improvement has increased to about 1 million acres of pasture sown each year, but the unpastured areas remain as a challenge to all concerned with pasture improvement.

This issue of the Journal is aimed at stimulating farmers to take a new look at their farms with a view to pasture improvement.
Advances

The last two years have seen a change in the situation. The efforts of farmers and pasture scientists seem to be narrowing the gap. The area of unimproved pasture is now at its lowest since 1929, when only 3 per cent. of pasture was improved. The present distribution of improved pasture (based on statistical returns) is shown in Figure 3. Comparing this with Figure 2 shows that over the past 15 years the inner line, indicating 80 per cent. of all pasture as improved, has advanced about 75 miles. This may not sound impressive, but it works out at about 1 yard per hour!—a snail's pace, maybe, but not bad for clover!

Nevertheless, there is much ground still to be covered. Many farmers still possess large areas of volunteer pasture land—possibly because they are not yet convinced of the value of the available pasture species.

GAINS UNDER IMPROVED PASTURE

It is easy to say that improved pastures should be sown wherever possible—it is another thing to prove it. Here are some figures which should demonstrate the gains to production and soil conservation which improved pasture can bring.

Wool production

Corrigin

Figures from the Shire of Corrigin show that over the past 15 years, farmers who improved pasture have increased their annual wool production by 2 to 4 lb. per acre. This is mainly possible because improved pasture can carry more sheep per acre.

In the Corrigin area, unimproved pastures are carrying roughly 0.8 sheep per acre—probably more than they should be carrying, considering the feed quality of volunteer species. Improved pastures, on the other hand, carry about 1.1 sheep per acre. This difference of about 0.3 sheep per acre means an extra 2 to 4 lb. wool per acre.

Wongan-Ballidu

In the Wongan-Ballidu Shire, the superiority of improved pasture for wool production is even more marked. On the sparse natural pastures the stocking rate is about half a sheep per acre, but on the improved pasture the average rate may be as high as 1.4 sheep per acre. The difference of 0.9 sheep per acre could mean an extra 8 or 9 lb. wool per acre.

“Impressed” pastures

In both these Shires a well established pasture should be able to carry two sheep per acre, so perhaps most improved pastures are understocked. It is also true that too many farmers take insufficient care when establishing pastures and end up with second class swards. If such second class “improved” pastures can pay for themselves it is likely that first class pastures could well double wool production in some areas.

Cereal yields

The effect of legume pastures on cereal production has transformed Western Australian agriculture. In Quairading for example, over the past 15 years, while the area of improved pasture has increased almost five times, the area of land under fallow has decreased to less than one-tenth of what it was 15 years ago. Farm rotations have changed from a fallow-cereal system to a pasture ley system. Experiments at Wongan Hills have shown that in two years a good clover pasture can add 100 lb. nitrogen per acre to the soil. This amount of nitrogen would be provided by 217 lb. urea per acre, costing about $8. Recent research has shown that much of this nitrogen remains in the soil for successive crops.

Crops sown on clover land usually do respond to additional nitrogen, but, even with large dressings of nitrogen fertilisers, crops sown on non-clover land rarely achieve the high yields of clover land crops. From this it appears that clover adds more than just nitrogen to the soil. It may well be that its effect in improving soil structure is also important.

Soil conservation

Aside from feeding sheep and fertilising crops, pastures have the added advantage of being able to cover and protect the soil. Improved pasture gives a better cover over the soil than natural pasture,
so more rain soaks into the ground and less runs off. The roots and organic matter added to the soil also help tie it together, making it less prone to erosion. Erosion is reduced, and water is conserved, producing better pasture growth and better soil conditions.

SPECIES SOWN IN WESTERN AUSTRALIA

Although improved pastures are usually a great advantage, there are some drier agricultural areas where the improved species available may be no great improvement over the volunteer pasture. Nevertheless throughout most of the agricultural areas, big gains can be made by sowing improved pasture. The major sown pasture species in Western Australia are listed below with comments on the range of suitability of each.

Local advisers of the Department of Agriculture are always available to help select the pasture species which best fit particular situations.

PASTURE SPECIES OF WESTERN AUSTRALIA

ALTHOUGH subterranean clover has dominated the development of pasture in W.A. it is by no means the only pasture plant of importance. Many other pasture species have played and will continue to play a vital role in W.A. This article outlines the origins and potential of the major pasture species in W.A.

LEGUMES

Subterranean clover

Of the legumes, subterranean clover is undoubtedly the most important. The plant originated in the Mediterranean countries and probably came to Australia as an impurity in consignments of other agricultural seeds or packing material in the early days of settlement. The first record of subterranean clover in Australia was from Victoria in 1887. There are now 13 strains of subterranean clover for which seed is available commercially or which are included in certification schemes in W.A. Only the main ones are listed here.

Geraldton

The Geraldton strain was first noticed occurring naturally east of Geraldton on the Geraldton-Mullewa road. Seed was collected and bulked and released to farmers in 1959. Geraldton has a fairly high content of oestrogen and is capable of causing clover disease. The newly released low oestrogen strains, Daliak and Uniwager may offer it some competition. However, while it remains the earliest maturing commercial strain it will continue to be sown in large quantities for some years.

Dwalganup

Dwalganup was the original "early" strain discovered by the late Mr. P. D. Forrest on his "Dwalganup" property at Boyup Brook where it was thought to have been accidentally introduced with ryegrass seed about 1890. Graded seed has been available for more than 30 years. Although no longer recommended Dwalganup remains the most widely established strain in W.A., accounting for at least half the total area of improved pasture. Dwalganup is the earliest flowering of the commercial strains and is a more erect and showy strain than Geraldton when not closely grazed. Dwalganup has a high oestrogen level and has caused widespread sheep infertility particularly in the 15 to 30-inch rainfall cereal and sheep districts. Daliak, a low isoflavone strain, is a suitable replacement for Dwalganup in these districts.

Daliak

Daliak was first found on the property of Mr. A. J. Monger, "Daliak," at York in the late 1920's. It was sown to a limited extent, mainly on other properties in the York district, during the 1930's. Daliak was recently "rediscovered" after experiments indicated that it had a low oestrogenic activity. Seed is being built up and Daliak is likely to grow in popularity.
Yarloop

The Yarloop strain was first found at Yarloop some 30 years ago and had come into prominence as a commercial variety by 1939. Yarloop is the only commercial strain which can grow successfully on either well drained soils or on winter water-logged soils. Its high oestrogen content makes it a risk for sheep in the medium rainfall districts but it still has a place in higher rainfall districts on water-logged soils where dairying and cattle raising predominate.

Seaton Park

The Seaton Park strain was first collected from a suburb of Adelaide, more than 30 years ago. It matures about a week later than Yarloop and has erect growth. Seaton Park is low in oestrogen and it seems unlikely that it would cause any marked degree of clover disease. Production of Seaton Park is being compared with that of Yarloop and Dinninup and if it is satisfactory it should largely replace these two high oestrogen strains, except on water-logged soils where Yarloop is still favoured.

Woogenellup

The exact origin of Woogenellup is obscure but it was first noticed growing vigorously as an almost pure sward on old group settlement properties at Manjimup about 1951. Some of the seed for the pastures established on these properties originated from a property at Elgin, Western Australia, where Woogenellup was subsequently found growing. This may have been the site of its first establishment in W.A.

Woogenellup matures about 4 to 6 weeks later than Dwalganup. It has proved extremely well suited to the Western Australian environment and is now the basic pasture species for the 20 to 30-inch rainfall districts. Although the total oestrogen content of Woogenellup is high, its formononetin content is relatively low so it is unlikely to cause serious infertility.

Clare

Clare is a South Australian strain which matures at about the same time as Bacchus Marsh and has a similar growth habit. Because of limited field grazing experience with this strain nothing is known of its effect, if any, on ewe fertility, although oestrogen assay suggests that it would be similar to Woogenellup.

The main usefulness of Clare is that it grows well on neutral or slightly alkaline soils. On the Tuart sands south of Perth and on limey soils along the south coast it is better than any other subterranean clover strain. Clare is in strong demand on the seed export market.

Mt Barker

Mt. Barker is the original subterranean clover strain found at Mt. Barker in South Australia almost 90 years ago. In Western Australia it has been grown since the early 1900's and is still the basic pasture legume in the higher rainfall districts of the lower South-West.

Mt. Barker was referred to for many years as the “mid-season” strain, and it flowers and matures some 5 to 6 weeks later than Dwalganup and a week or so after Woogenellup. It is a very leafy strain which makes most of its growth in spring. Mt. Barker is very low in formononetin and there is little likelihood that it will cause sheep infertility under normal farm conditions.

Tallarook

Tallarook originated in Victoria and is the latest maturing of the commercial strains, flowering in mid-October. It contains high levels of oestrogen and is therefore likely to cause sheep infertility, but this is of little consequence as dairying and beef cattle production are the main activities in districts where Tallarook can be grown.

Rose clover

Rose clover is being produced and used in increasing quantities in south western Australia. It grows well on sandy soils, and is tolerant to acid soil conditions, but will not stand waterlogged conditions for very long. Rose clover is low in oestrogens.

At the present time, nodulation of rose clover is not entirely satisfactory, and this leads at times to nitrogen deficiency in the plant and poor growth during the cold winter.

The erect seed heads are palatable to both sheep and cattle, so grazing should
be controlled, to allow seed to set particularly in the first season.

Sirint

Sirint is the earliest flowering strain of rose clover. It flowers almost 3 weeks earlier than Kondinin, and under Western Australian conditions it starts flowering about the beginning of September.

Kondinin

Kondinin is an early mid-season variety, and flowers in late September or very early October in W.A.

Hykon

Hykon flowers about 10 days earlier than Kondinin.

Olympus

Olympus is a certified selection from the uncertified Troodos mixture. It matures about the same time as Hykon, but has a more prostrate growth habit.

Cupped (Cherleri) clover

The cupped clovers are similar to the rose clovers in growth habit and production. They are tolerant to soil type variations, and have practically no oestrogens.

Beenong

The Beenong variety, introduced from Cyprus, is similar in maturity to the early maturing Sirint rose clover.

Yamina

Yamina, which came from Ben Yamina in Israel, flowers about a week later than Beenong.

Strawberry clover

Strawberry clover is a perennial plant which starts its main period of growth in spring, continues through the summer, and becomes relatively dormant again towards the end of autumn.

The flowers of Strawberry clover are generally pink and are borne in round globular heads. As the seed reaches maturity the outer parts of the flowers swell, making the flowering heads look like strawberries.

Strawberry clover grows best where there is a high water table. It will also thrive over a wide range of soils.

Palestine

Palestine, the main variety of strawberry clover sown in W.A., was introduced into Australia in 1929 from seed collected near the Dead Sea. It flowers in early spring and does well on slightly saline and swampy soils.

White clover

White clover originated in Europe. It was probably first cultivated in Holland and was one of the early species used when clovers were first cultivated in England during the 18th century. There have been many strains developed over the years, and some of the older strains are still to be found in parts of Australia.

White clover makes its greatest growth during spring and early summer, slows up during the hottest months, produces a further smaller flush in autumn, and lies dormant during winter.

Ladino

Ladino, a strain which is growing in importance, originated near Lodi in Italy, and came to Australia, via the United States.

New Zealand

New Zealand is the most widely sown strain in W.A. It flowers throughout the spring and summer months.

Barrel medic

Cyprus

Cyprus barrel medic grows on a wide range of heavier soil types in the wheatbelt of W.A. It sets large quantities of seed, even under harsh conditions, and it has a low oestrogen content. It usually flowers about August.

Jemalong (173)

Jemalong flowers about five weeks later than Cyprus. In W.A. it is probably only well suited to the higher rainfall areas of the wheatbelt and to limited areas of calcareous sandy soils.

Strand medic

Harbinger

Harbinger medic grows well on soils with an annual rainfall of 14 in. or less. It flowers about the same time as Cyprus barrel medic.
Sandplain lupin

Chapman

Native to the shores of the western Mediterranean, the Chapman variety was originally introduced to W.A. as an ornamental plant, but subsequently escaped from private gardens and spread rapidly by natural means.

The value of the plant for grazing and building up fertility in light acid soils was realised in due course and it is now widely cultivated along a 400-mile strip extending from Busselton in the south to Geraldton in the north. The Chapman lupin does best on sandy loams and light soils and is tolerant to a fair degree of acidity. However, it contains alkaloids which make it bitter and unpalatable to stock during its green stage.

New Zealand lupin

Commercial

The Commercial lupin is frost resistant and is widely sown for green manure crops in orchards and vineyards.

Uniwhite

The most recent strain, Uniwhite is free from alkaloids, has white flowers and seeds, and has pods which do not shatter readily, making them more suitable for harvesting. Uniwhite should succeed in areas with an annual rainfall of 18 to 20 inches or more. Crops in lower rainfall districts may succeed but will be less reliable. Uniwhite should be fairly frost resistant and may be planted throughout the South West without serious risk of frost damage. It is intended as a dual purpose variety for harvesting for seed or for summer grazing.

Yellow serradella

Yellow serradella is a prostrate annual herb, outstanding in its ability to grow well on deep infertile sand in areas with over 20 inches annual rainfall. The plant has a deep rooting system and is able to exploit plant nutrients and moisture at depth. It contains no oestrogenic substances and whether green or dry provides palatable high protein feed for livestock.

Pitman

The variety commonly grown in W.A. is Pitman which flowers about late September. Its prostrate growth habit makes it resistant to being eaten out by stock.

Pink serradella

Pink serradella has an upright growth habit and bears the flowers at the top of the plant. Livestock can easily eat out the seed heads so the variety may not persist, even though it has a high germination percentage compared with the Pitman yellow serradella.

Lucerne

Lucerne, known in the United States as "alfalfa," is the most widely sown forage crop in the world. It is grown in Western Australia both under irrigation and as a dry land forage crop.

Tap roots of lucerne penetrate deeply into suitable soils and use sub-surface moisture and plant nutrients. It is one of the few legumes which will establish on the deep infertile grey and yellow sands of the W.A. coastal plain.

Hunter River

Hunter River is the variety most commonly sown in W.A. Its success has been limited by the dry summers.

Common vetch

In the wetter areas of W.A. vetches are useful both for grazing and as conserved fodder. Some varieties can also be harvested for grain.

Languedoc

Languedoc flowers about mid September and yields well. It is best adapted to the 14 to 17 in. rainfall zones.

Nyabing

Nyabing flowers a couple of days later than Languedoc and yields slightly less. It is adapted to the 16 to 18 in. and higher rainfall zones of south western Australia.

GRASSES

Annual ryegrass

Annual ryegrass is a highly productive grass which reseeds abundantly under most conditions.
Wimmera

Wimmera ryegrass is widely sown throughout the South West and the wheatbelt. It can cause serious problems as a weed in cereal crops unless carefully managed. It is not a carrier of cereal take-all root rots.

Merredin Early

Derived from Wimmera, Merredin Early flowers and matures 10 to 14 days earlier and is better suited to the lower rainfall areas. It is preferable to Wimmera for sowing on salty areas.

Perennial ryegrass

New Zealand

New Zealand ryegrass has been persistent and productive under irrigation in W.A., but under dryland conditions it has persisted only in small pockets favoured with fertile soils and long rainfall periods.

Victorian

Victorian ryegrass is also persistent and productive under irrigation and is grown under dryland conditions in some districts with long rainfall seasons.

Kangaroo Valley

Kangaroo Valley ryegrass is the most persistent variety available commercially.

Kikuyu

Kikuyu is a very vigorous perennial grass growing by both underground and surface runners. It produces most feed on fertile soils in moist areas and irrigation areas but will grow on poorer soils and will stand long dry spells. It produces seed in the South West but harvesting seed is impracticable because of its matted growth.

Cocksfoot

Cocksfoot can be established as a perennial grass with subterranean clover pastures in areas with a rainfall of over 25 in. per year and in irrigated pastures.

Akaroa

Akaroa cocksfoot was originally sown in irrigation pastures and has persisted in some of the more fertile soils. It does not persist on non-irrigated soils.

Currie

Currie cocksfoot was introduced from the Mediterranean region and has a winter growth rhythm, as opposed to the summer growth of European and New Zealand cocksfoots. It has been very productive in autumn, winter and late spring in higher rainfall areas on well drained paddocks.