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The certified strains of subterranean clover in Western Australia

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SUBTERRANEAN CLOVER STRAINS FOR WESTERN AUSTRALIA

The above map indicates suggested strains for each zone of the agricultural districts of Western Australia. The boundaries shown should be taken as a general guide only; more specific information on the most suitable types for any locality should be sought from the district adviser of the Department of Agriculture.
The agricultural districts of Western Australia have a typically Mediterranean climate. Most of the annual rains fall in the late autumn, winter and early spring. The winters are relatively warm, with day temperatures between 50° and 80° Fahrenheit, while the summers are very hot and dry.

Climates such as these are restricted to quite a small part of the world and in each instance similar types of pastures are grown. These pastures are based almost entirely on annual species, the legume constituents being mainly lupins, medics and clovers, with the latter the most important group. Crimson, rose and subterranean clovers are used on an extensive scale in some overseas countries.

In Western Australia, subterranean clover is by far the most important species. It is the basic legume in over 90 per cent of the area under improved pastures, other clovers and medics being grown to only a limited extent.

Although subterranean clover was grown as a pasture in Western Australia as early as 1900, the total area increased slowly. By 1940 only about a million acres had been established. However over the last 15 or 20 years the area of subterranean clover pastures has increased very rapidly and now stands at some eight million acres. Most of the increase has been in the cereal and sheep districts.

THE STRAIN COMPLEX

Subterranean clover originates from countries surrounding the Mediterranean Sea. It grows naturally over the whole of southern Europe and North Africa and is also recorded from England and Germany. Within its natural environment there is a considerable variation within the species, a number of different strains being readily recognisable. Many of the European strains are similar in major characteristics to known Australian strains.

The overall variation between the different strains is extreme. White seeded types are not uncommon; others have pink flowers and some have red leaflets, even the mythical “four-leaf” strain has been found.

A most important difference between strains is the particularly wide variation in time of maturity. Some of the early strains flower within three months of germination, while late strains require five or six months.

Up to the present several hundred different strains of subterranean clover have been released. The majority of these come from Europe, with a smaller number from overseas sources. In Western Australia, the area under improved pastures has increased very rapidly and now stands at some eight million acres. Most of the increase has been in the cereal and sheep districts.
have been classified. These include those found growing in pastures in different parts of Australia and those introduced from overseas by the C.S.I.R.O. and other organisations. To these could be added a large group of cross-breds which have been developed by the Western Australian University Institute of Agriculture and by the C.S.I.R.O.

Although many of these introduced and cross-bred types are being tested in various parts of Australia, none have yet reached the stage of being released for general use by farmers.

The strains for which seed is available in commercial quantities all originated from field selections within Australia. In Western Australia nine separate strains have reached the stage of commercial seed production and are recognised under the seed certification scheme operated by the Department of Agriculture.

The nine certified strains differ quite markedly. Some of these differences—such as leaf markings and flower colour—are of vital importance to Departmental advisers carrying out pasture certification, in that they provide a means of identification. To the farmer they are of little more than passing interest. He is concerned more with characteristics such as total growth under grazing, winter production, ease of establishment, and nutritive value. Indirectly he is interested in the time of flowering and hard-seededness in that they determine the long term survival of the strain.

The farmer who is also a seed producer has other more specialised interests. These are discussed later in more detail.

THE CERTIFIED STRAINS

The general purpose of this article is to provide some background information to each of the certified strains, and a means of identification under field conditions. No mention is made of fertiliser requirements, establishment techniques, pest control and so on, as these aspects are adequately covered in other Departmental bulletins, which are readily available on request.

Included is a map of the agricultural areas giving the approximate boundaries within which it is suggested the various strains should be grown.

It is emphasised that these boundaries and the notes on the various strains are to be taken as a general guide only. Soil type, moisture availability and other conditions play such an important part that there are certain to be areas in most districts where strains other than those suggested could and should be grown.

More specific information on the most suitable types for any particular district or locality can be obtained from district advisers of the Department of Agriculture.

GERALDTON

The Geraldton strain is a natural field selection which was released in 1959 by the University Institute of Agriculture. As its name implies it comes from the Geraldton district.

In the Journal of Agriculture of Western Australia (February, 1960) Dr. A. J. Millington recorded that although Geraldton flowers some nine days later than the standard early variety Dwalganup, it matures a week or so earlier. Thus Geraldton is the earliest maturing of all the certified varieties.

In a series of trials at different centres in the cereal and sheep districts, Geraldton consistently outyielded Dwalganup in seed production. The two strains were very similar in leaf and stem production. Geraldton survived in trial plots for four years at Southern Cross, a district on the outer margin of the cereal and sheep districts.

Mr. E. D. Higgs, writing in the South Australian Journal of Agriculture (June, 1961), reported that in the drought year of 1959 in South Australia, Geraldton was distinctly superior to Dwalganup in seed setting ability. He considers that the Geraldton strain will be valuable in extending subterranean clover pastures into the drier areas of the South Australian wheat growing districts.

Geraldton has a rather unusually low, prostrate growth habit, its maximum height at maturity being about six inches. Its superior seed setting characteristics are undoubtedly due to its rather unusual ability to form seed both above and below the soil surface. In this it differs from Dwalganup, which generally will not form viable seed above the soil surface.
Recent tests have shown that Geraldton is an extremely hard seeded variety, suggesting that it should have a satisfactory long term survival ability under field conditions.

Generally it is noted for its early maturity, heavy seed setting under the right conditions, and good winter growth. In the first two characteristics it has been surpassed by the recently released Geraldton strain.

Dwalganup, the original early variety, is the most widely grown strain in Western Australia at the present time. It came from the "Dwalganup" property of the late Mr. P. D. Forrest at Boyup Brook, where it is thought to have been accidentally introduced with ryegrass seed about 1890. Graded commercial seed has been available for over 30 years.

The Dwalganup strain is the earliest flowering of all the commercial varieties, the first flowers normally appearing about mid August.

It reaches full maturity towards the end of September. Even with favourable soil moisture conditions it makes very little growth later in the year.

Yarloop is classified as an early maturing variety, its first flowers appearing some 10 to 15 days after those of Dwalganup. It is a versatile clover, having the ability to grow both on well drained soils and on winter waterlogged soils. For this latter reason it has been used extensively on the heavy clay flats at Waroona, Harvey and Brunswick Junction where other strains have failed. In addition to these areas many thousands of acres have been
established on well drained soils in districts as far apart as Moora, Busselton and Esperance.

Yarloop makes excellent winter growth and generally is an unusually vigorous strain. It has exceptionally long leaf stalks or petioles and these give it an advantage over other strains and species in the interception of sunlight. If it cannot be controlled by suitable grazing management it tends to dominate other pasture species in the sward. This is one of its main disadvantages. Another disadvantage is that it tends to wilt very quickly in the spring.

At present it is grown almost exclusively in the Upper Blackwood district, where several thousand acres have been established.

Dinninup commences flowering one or two days later than Yarloop and some two weeks earlier than the standard early midseason variety Bacchus Marsh. Thus if maturity is based on flowering dates Dinninup should be classified as an early variety. In this instance the classification is rather misleading in that Dinninup does appear to be capable of growing on well into November. With Yarloop it fills a gap between the very early Geraldton and Dwalganup strains and the early mid-season varieties Clare, Bacchus Marsh and Woogenellup.

Dinninup has grown well at Boyup Brook on some poor gravelly and sandy soils. It does not make the excellent early winter growth so characteristic of Yarloop but spring production is good and probably better than Yarloop.

Dinninup is a newcomer to the list of certified strains, pastures being certified for the first time in the spring of 1961.

Dinninup comes from the Upper Blackwood district. Its original habitat, as far as can be ascertained, was the property of Mr. E. A Miller at Boyup Brook. It is known also as Sumner’s strain, after Mr. C. Sumner of Dinninup who has done much to popularise its use over the last five years.
In the Upper Blackwood districts Din­ninup has consistently produced relatively good yields of seed. Recent trials have also shown that it maintains a satisfactory level of hard-seededness through the summer and into the autumn, thus ensuring long term survival.

Dinninup is a relatively new strain and there is still a lot to learn about its characteristics in districts other than Upper Blackwood. The first certified seed will be available this year.

WOGENELLUP

Woogenellup may well be known as the strain of many names. Before its certification it was known in Western Australia as White Flowered Mid. or Pearson’s strain. In Victoria a similar, possibly identical, strain is known as Burnley. In 1958 it was certified in Western Australia under the name Woogenellup. In 1960 it was certified in New South Wales under the name Marrar.

Woogenellup has been growing as an admixture in Mount Barker strain pastures for many years, being quite common at Mount Barker, Bridgetown, Manjimup and Capel. More recently it has been sown in the pure form in a number of medium rainfall districts. It original habitat, as far as can be ascertained, is the property of Mr. W. Scott at Elgin, where it is thought to have been accidentally introduced on imported cornsacks over 30 years ago.

Woogenellup, Clare and Bacchus Marsh are three strains classified as early mid­season types. They flower some four weeks later than Dwalganup and a week or so earlier than the standard midseason variety Mt. Barker. Of the three, Woogenellup is the earliest, flowering a few days ahead of Clare and BacchusMarsh.

Field experience has shown that Woogenellup is well suited to West Australian conditions, although it is sometimes a difficult strain to establish.

It is noted for its good winter production and general vigorous growth habit. When planted into a later maturing Mt. Barker pasture it quickly becomes the dominant strain.

Despite its vigorous growth habit, well balanced pastures can be maintained without much difficulty.

BACCHUS MARSH

Bacchus Marsh is a Victorian strain and was the first of the early midseason group to be certified. It flowers a few days later than Woogenellup and a week or so earlier than Mt. Barker.

Bacchus Marsh was planted on quite a large scale a few years ago in the medium and higher rainfall districts particularly at Capel, Kojonup, Mt. Barker and Esperance.

Field experience has shown that, under favourable conditions, it gives a good bulky growth in the spring and is very palatable both as green and dry feed.

In some districts Bacchus Marsh has been rather disappointing. It has grown well at Esperance and in the Capel and
Benger districts but in some of the Great Southern districts it has tended to fade out after a few years. This could be associated with the fact that it is a very soft seeded type and carries through from one year to the next only a small proportion of hard seeds. Thus it is susceptible to adverse seasons and summer rains.

In view of our short experience with Clare an accurate assessment of its potential as a pasture plant for West Australian conditions cannot be made at this stage. In the Eastern States, where it has been grown for longer periods, it is considered to compare favourably with other strains of similar maturity.

Clare is a South Australian strain and is a relative newcomer to the status of a certified variety in Western Australia. It is an early midseason type flowering at the same time as Bacchus Marsh.

Only a few Clare pastures have been established in Western Australia and these are no more than three years old. Some have been established successfully on heavy clay flats where previously only Yarloop could be grown.

Where soil moisture is not a limiting factor in the spring Clare continues growing much longer than Yarloop.

Mt Barker is the original subterranean clover strain grown at Mt. Barker in South Australia, over 80 years ago. In Western Australia it has been grown since the early 1900's, and is the basic pasture legume of the higher rainfall districts in the Southwest.

Mt. Barker is classified as a midseason type. It flowers some four or five weeks later than Dwalganup and a week or so later than the early midseason strains.

It is a very leafy, productive strain which makes most of its growth in the
Tallarook, as its name implies, comes from the Tallarook district of Victoria. It is a late maturing type flowering in mid October, some one or two weeks later than the Mt. Barker strain.

It is grown to only a very small extent in Western Australia, mainly in the high rainfall districts of the lower South-West. Tallarook is a very leafy, productive strain which makes little growth until the spring. Thus it makes a very poor winter pasture.

In the high rainfall districts it is worth growing on a small scale because of its excellent late spring growth. Some very successful combinations with Yarloop have been established in these districts. Together, the strains provide both early and late growth.

The farmer who is also a seed producer has other more specialised interests. He requires a profitable return not only from grazing but also from seed harvesting. Seed setting characteristics are of direct importance.

Normally, to obtain good seed yields it is necessary to grow a strain under higher rainfall than that required to maintain it satisfactorily as a pasture.

For example, the Geraldton strain is an excellent type for cereal and sheep districts where the annual rainfall is 15 inches or less. In districts such as these it produces enough seed to regenerate the pasture but not enough to make seed har-
vesting a profitable venture. To obtain profitable seed yields it is necessary to grow Geraldton in a district with an annual rainfall of 18 to 20 inches or more.

Similarly, the Woogenellup strain makes a very good pasture in districts with a 20 to 25 inch rainfall, but for consistent satisfactory seed yields it needs to be grown in districts with a somewhat higher rainfall.

The seed producer may find it necessary to concede some of his potential top growth in the interests of profitable seed yields.

Once the seed producer has decided the strain to be grown, it is essential for him to obtain the right seed for planting. At the very least the seed should be certified; for preference it should be certified seed known to be completely true to type.

The certified seed scheme in operation in this State satisfactorily meets the requirements of the great majority of farmers and graziers in that it ensures that the seed is at least 95 per cent. true to type, has a high purity and germination, and is free of weed seeds. Some certified seed is virtually 100 per cent. true to type and it is very desirable that seed producers in particular obtain this high quality seed for planting, even if the cost is slightly higher than that of normal certified seed.

The seed producer is interested not only in total seed yield but also in the position of the burrs at maturity relative to the soil surface.

At present almost all subterranean clover seed is harvested by picking up the burrs off the soil surface with a sheepskin roller. Before this process can be commenced it is necessary to remove the top-growth. Although burning is the easiest and most economical technique, obviously it is only practicable if the burrs are buried below the soil surface and are protected from the fire. After burning, a light harrowing is sufficient to bring the burrs to the surface.

Strains which bury all or most of their burr are thus the easiest to harvest and can be produced in quantity at relatively low cost.

With the certified strains the name “subterranean” clover is frequently a misnomer. While Dwalganup and Geraldton...
bury all or most of their burrs, many of the later maturing strains form most of their seed above the soil surface. In soft, sandy, moist soils these strains will form burrs below the soil surface particularly if the topgrowth is short. If the soil surface becomes hard and compacted soon after flowering the burrs are not buried and seed harvesting is rather a difficult undertaking.

IDENTIFICATION OF THE CERTIFIED STRAINS

NO TWO PLANTS of subterranean clover are exactly the same. If they belong to different strains differences are only to be expected. If they belong to the same strain they will still differ according to stage of growth, soil type, fertiliser treatment, grazing management, degree of competition from other plants and other environmental influences.

Characteristics which vary according to these latter factors are obviously of little value in identification.

Bacchus Marsh, for example, invariably has a distinctive brown anthocyanin flecking on the upper leaf surface when spaced plants are grown in heavily fertilised test rows, whereas under normal pasture conditions this flecking may not be present. As such the identification of the different strains is based on characteristics which do not vary with these external influences.

Terms Used

Before proceeding with the more detailed aspects of strain identification it is necessary to explain the meaning of a...
Fig. 2.-Identification chart to be used in conjunction with Table 1.

- **White Bands**
  - **White Bands Light Green Area**: 
    - 5

- **Handwritten Notes**
  - Pink
  - Green
  - Pink Lobes
  - Veins Green - No Red Colour
  - Veins Red
  - Pink Stripes
  - White with
  - Pattern of Petals
  - Colour of Petals
  - Corolla
  - Colour
  - Calyx
  - Stipple
  - Runner
  - Leaf
  - No Hairs
  - Few Hairs
  - Very Hairy

**Legend**
- S
- 5
- 4
- 3
- 2
- 1
### TABLE 1

**KEY FOR THE IDENTIFICATION OF THE CERTIFIED STRAINS OF SUBTERRANEAN CLOVER**

<table>
<thead>
<tr>
<th>Leaf</th>
<th>Runner</th>
<th>Flower</th>
<th>Seed</th>
<th>Other Distinctive Features</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(a) Pattern of pale central mark</td>
<td>(b) Upper surface hairiness</td>
<td>(c) Petiole hairiness</td>
<td>(d) Stipule colour</td>
</tr>
<tr>
<td></td>
<td>(L1)</td>
<td>++</td>
<td>++</td>
<td>S3</td>
</tr>
<tr>
<td>GERALDTON ...</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DWALGANUP ...</td>
<td>L3</td>
<td>++</td>
<td>++</td>
<td>S3</td>
</tr>
<tr>
<td>YARLOOP ...</td>
<td>L5</td>
<td>+</td>
<td>Hairless</td>
<td>S2</td>
</tr>
<tr>
<td>DINNINUP ...</td>
<td>L1</td>
<td>++</td>
<td>++</td>
<td>S3</td>
</tr>
<tr>
<td>WOOGENELLUP ...</td>
<td>L1</td>
<td>+</td>
<td>++</td>
<td>S2–3</td>
</tr>
<tr>
<td>BACCHUS MARSH</td>
<td>L1</td>
<td>++</td>
<td>++</td>
<td>S4</td>
</tr>
<tr>
<td>CLARE ...</td>
<td>L2</td>
<td>Hairless</td>
<td>Hairless</td>
<td>S2</td>
</tr>
<tr>
<td>MOUNT BARKER</td>
<td>L2</td>
<td>++</td>
<td>++</td>
<td>S2–3</td>
</tr>
<tr>
<td>TALLAROOK ...</td>
<td>L3</td>
<td>++</td>
<td>+</td>
<td>S4</td>
</tr>
</tbody>
</table>
few simple botanical terms such as stipule, petiole, calyx and corolla. This can best be done by reference to Figure 1, which illustrates diagrammatically the meaning of the terms used in the text.

The actual identification is based on the variation in the leaf, runner, flower and seed, together with data on the time of flowering.

These variations are illustrated in Figure 2, where each has been given an index number or symbol. The certified strains are set out according to index numbers and symbols in Table 1. To identify a plant its characteristics as defined by Figure 2 should be tabulated and fitted to the data of Table 1.

To confirm the identification the specimen should be compared to the colour plates included in the text.

The flowering stage is the most suitable time to attempt identification. Before flowering it is not a simple matter and in many instances is virtually impossible.

A brief description of the characteristics used for identification is:

1. Leaf
   (a) Pattern of pale central mark.
   Most strains have some type of marking on the upper leaf surface other than the variable brown anthocyanin flecking. Normally this marking is a pale green colour in the centre of the leaf, while at the margins it is either a pale green or white colour. A diagrammatic description of these markings is given in Figure 2.

(b) Leaf and petiole hairiness.
   The hairiness of the leaf and petiole varies from none at all as in Clare, to very hairy, as in Dwalganup. In Table 1, the degree of hairiness is divided into four categories:
   (i) No hairs
   (ii) Few hairs
   (iii) Hairy
   (iv) Very hairy
   Obviously the division between the latter three groups is purely arbitrary and for this reason the differential degree of hairiness is not used as a definite means of distinguishing between strains. Where a strain is completely hairless the characteristic is used as a differential.

2. Runner
   (a) Runner hairiness.
   The degree of hairiness on the runners has been categorised in the same manner as that of the leaf and petiole.

(b) Stipule markings and colour.
   The stipule type is very variable between strains but very constant within any particular strain. It varies from a greenish white colour with green or red veins to a red colour with red veins. (Figure 2).

3. Flower
   (a) Corolla colour.
   The colour pattern of the corolla or petals can be divided into three types—pure white, white with pink veins, and pink. Only one definite pink flowered type is known to occur under field conditions in this State, the “Pink Flowered” strain, and this is of minor importance. All the certified strains are classified as pure white or white with pink veins. The Dwalganup strain frequently has a decided pink tinge in the petals if the flowers are exposed to strong sunlight but if they are shaded by topgrowth the petal colour pattern is normally white with pink veins.

(b) Calyx colour.
   The colour pattern on the calyx of the flower is one of the most important means of distinguishing between the various strains.

   The colour pattern varies from a striking red band in the Mt. Barker strain to an overall greenish white colour in the Bacchus Marsh and Woogenellup strains. For the purpose of differentiation between the strains this characteristic has been divided into four groups (Figure 2).

(c) Time of flowering.
   The various subterranean clover strains are broadly classified as “early”, “mid-season” and “late” maturing.

   Naturally enough these three general groups overlap one another to some extent. Normally the early maturing types are in full flower before the end of August. The midseason types flower in mid or late September while the late maturing types commence flowering before the middle of October. Although the time of flowering
has some obvious drawbacks as a means of differentiating between strains, at times it is very useful and as such it has been included in Table 1.

4. Seed Colour
The seed colour is a distinctive characteristic only with the white seeded Yarloop strain. There are other white seeded strains of subterranean clover but Yarloop is the only one to be certified so far. The Mt. Barker strain frequently has a purplish coloured seed and Clare has a relatively large unusually flat type of seed, but in neither instance is the colour or structure sufficiently distinct to be used as a means of identification.

ACKNOWLEDGEMENTS
In the writing of this article acknowledgement is made of the many valuable constructive suggestions from Messrs H. G. Cariss of the Wheat and Sheep Division, and H. G. Elliott and F. E. Ryan of the Dairying Division.

SALT LAND SURVEY NEXT MONTH

Is there any salt on your property? Is it getting worse? If you have salt land, have you tried the methods recommended by the Department of Agriculture for managing salt land to make it pay its way?

These are among questions that will be asked farmers in a salt land survey to be held next month, with the co-operation of the Farmers’ Union and the Bureau of Census and Statistics. The questions on salt land will be enclosed with the Statistics form sent out next month. This survey follows a similar survey held in 1955, and aims to discover what trends are taking place in salt land, particularly whether or not it is getting worse, and whether farmers with salt land are following the advice given by the Department of Agriculture on how to manage salt land.

There are also a few questions on contouring. The Department would like to know not only how much land has been contourled, but how much of this was surveyed by Departmental officers and how much by farmers. Farmers will also be asked how much land not now contoured is intended for contouring within the next five years.

The 1955 survey was run in much the same way, and proved quite successful, with more than 80 per cent of farmers answering the questions.

It is hoped that this one will be even more successful. If all farmers give the questions careful thought and answer them as accurately as possible, some highly valuable information will be gained. This will, among other things, give soil conservation workers some idea of the effectiveness of their extension work, and help them to plan future programmes.

The fact that both the Farmers’ Union and the Bureau of Census and Statistics are giving full co-operation to this project shows how important it is considered to be.

GIVE SOME THOUGHT TO THESE QUESTIONS NOW, SO THAT YOU TOO WILL BE ABLE TO CO-OPERATE WHEN YOU GET THE FORM NEXT MONTH.
Flick's FLY CAKE is 2" wide, pink in colour.

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Lasts for months! Odourless!
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"After using ten cakes at the Nelson Bay Depot, which was infested with bush, domestic and several types of blowflies, for a period of seven days, it was difficult to find any flies at all."
"They have virtually performed the 'miracles' that your representative assured us we might expect."

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