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ESTABLISHING PASTURES UNDER WHEAT CROPS

M. L. POOLE, J. W. GARTRELL, D. A. N. NICHOLAS and Advisers, Wheat and Sheep Division

RECENT surveys indicate that in the medium and high rainfall cereal and sheep areas as much as half the new pasture sown is sown with a crop. In the drier wheatbelt areas the figure is 20 to 30 per cent.

In the early 1960s an estimated 80 per cent. of all pasture sown in the cereal and sheep areas was sown with a crop. However, there has since been a trend towards planting pure stands of pasture.

Undersowing as a means of pasture establishment has the great advantage of reducing operations during the busy seeding period. It is also commonly believed to have important economic advantages, but this may not always be so.

Effects on crop yield

When a farmer undersows, he hopes to get a good crop and at the same time establish a satisfactory pasture. However, the effect on the crop of undersowing pasture has been largely overlooked.

As far as the crop is concerned, clover growing beneath it is just another weed competing for moisture and nutrients. If the supply of moisture and nutrients was unlimited the crop would not suffer, but this is seldom the case in the Western Australian cereal growing areas.

The effect on crop yields is easily seen in the results of the 18 trials on undersowing summarised in the table. The trials have been carried out over the past 10 years by research officers of the Plant Research Division and district advisers of the Wheat and Sheep Division.

The reduction in crop yield caused by pastures sown under the crop ranged from nil to 7 bushels per acre, but generally the trials show that a decrease in wheat yield of 2 to 4 bushels per acre must be expected when pasture is sown with a crop.

Effects on seed set

When a pasture is sown beneath a crop, the crop is often termed a “companion” or “nurse” crop. These are misnomers, as although the crop may protect the pasture plants against windblast and cold in the six weeks after germination, from then on it competes with the pasture plants for moisture and nutrients.

Also, the crop begins to cut off the supply of light to the clovers, reducing their growth and making them less able to compete.

The results of the trials demonstrate this very well. Generally, the clover seed yield under a crop was only 20 to 50 per cent. of that obtained in a pure stand of the legume.

The cost of undersowing

The loss in wheat yield due to undersowing must be considered as part of the cost of undersowing. This cost may exceed the savings in time and operations.

The amount of legume seed set under the crop, although drastically reduced, may be sufficient for a satisfactory regeneration in the following year.

In the trials, successful establishment was generally achieved when the amount of seed set under the crop was more than 30 lb. per acre. However, such small quantities must be marginal for success when allowances are made for hard seed and summer losses through grazing, insects, false breaks and so on.

The stand density in the year after undersowing need only equal that of a first-year pure sowing of the legume to be equivalent but to be confident of success it is suggested that at least 50 lb. are needed.

Where not to undersow

Many trials conducted over many years would be necessary to give a clear-cut answer to this question. However, some unfavourable situations can be recognised—
On soils where it is difficult to establish pastures as pure stands.
This applies to much of the light land of the central, eastern and northern wheatbelt, particularly the poorer class wodgil country where failures due to poor seed set are common even in pure stand sowings. Undersowing will only aggravate this situation.

On soils where crops grow well and produce heavy canopies but where moisture is often severely limiting in spring.
This applies particularly to the heavy forest soils of the eastern wheatbelt. Medic pastures usually fail to establish under crops in these areas.

Under late sown crops.
The later legumes are sown, the less seed they produce. Crop yield may also be more severely reduced in late undersown crops because of the greater competition for moisture in spring.

Where crops are sprayed with herbicides.
Where stubble is burnt in the summer after undersowing.

Undersowing is usually successful in the medium and high rainfall cropping areas. Areas where success is most likely are:

- **Medium rainfall areas (16-20 in. annual rainfall).**
  In the western and southeastern wheatbelt satisfactory pastures have often been established under crops but the risk of pasture failure is much greater under a crop than as a pure stand. Undersowing is a marginal economic proposition in these areas because of the two to four bushel per acre wheat loss.

- **High rainfall areas (20-30 in. annual rainfall).**
  In these areas wheat crops are often poor due to diseases, but are grown in development programmes for regrowth control. Pasture establishment under such crops is usually successful and may offset crop failure. It is therefore popular in the Esperance region for new land development, and to a lesser extent in the West Midlands.

Even where undersown pasture has established however, stubble burns or cultivations for regrowth control may destroy pasture seed.

A GUIDE TO THE LIKELY RESULTS OF UNDERSOWING

ZONE A: Undersowing usually successful and is a widely accepted practice. Wheat crops often yield poorly in this zone.

ZONE B: Undersowing often successful in suitable situations. Risk of failure and loss of wheat yield make undersowing a doubtful economic proposition here.

ZONE C: Undersowing seldom successful, particularly on heavy soils and on poorer class light country where pasture establishment is always difficult.
### Wheat and Legume seed yields from 16 trials*

<table>
<thead>
<tr>
<th>Location and year</th>
<th>Pasture species sown under wheat</th>
<th>Wheat yields (bu./ac.)</th>
<th>Legume seed yields</th>
<th>Clover re-establishment in year following undersowing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Alone With legumes Yield reduction</td>
<td>Alone With wheat % of legumes alone</td>
<td></td>
</tr>
<tr>
<td><strong>Badgingarra, 1962</strong></td>
<td>Dwalganup sub. clover—0, 3, 6, 9, 12 lb./ac. ± 112 lb. sulphate of ammonia per acre</td>
<td>15.3 13.2 2.1</td>
<td>133 26 19.6</td>
<td>Success</td>
</tr>
<tr>
<td><strong>Lake Grace, 1964</strong></td>
<td>Geraldton sub. clover—4, 12 lb./ac. Snail medic—6, 18 lb./ac. Harbinger medic—3, 9 lb./ac. Commercial rose clover—1, 3 lb./ac. Beenong cherleri—1, 3 lb./ac.</td>
<td>14.3 10.7 3.6</td>
<td>169 100 59.2</td>
<td>Success</td>
</tr>
<tr>
<td><strong>Pingrup, 1964</strong></td>
<td>Geraldton, Blackwood sub. clover—4, 12 lb./ac. Snail medic—6, 18 lb./ac. Commercial rose clover—1, 3 lb./ac. Beenong cherleri—1, 3 lb./ac.</td>
<td>15.7 12.4 3.3</td>
<td>228 96 42.1</td>
<td>Success</td>
</tr>
<tr>
<td><strong>Tarin Rock, 1966</strong></td>
<td>Geraldton sub. c.over—4, 12 lb./ac. Cyprus barrel medic—3, 9 lb./ac. Kondinin rose clover—2, 6 lb./ac. Yamin cherleri—2, 6 lb./ac.</td>
<td>33.0 31.5 1.5</td>
<td>179 36 20.1</td>
<td>Success</td>
</tr>
<tr>
<td><strong>Forrestania, 1966</strong></td>
<td>Geraldton sub. clover—4, 12 lb./ac. Serint rose clover—2, 6 lb./ac. W.A. serradella—4 lb./ac.</td>
<td>19.3 18.1 1.2</td>
<td>44 10 22.7</td>
<td>Very sparse stand. Failure</td>
</tr>
<tr>
<td><strong>Lake Grace, 1967</strong></td>
<td>Geraldton sub. clover—4, 12 lb./ac. Cyprus barrel medic—3, 9 lb./ac. Hykon rose clover—2, 6 lb./ac. Yamin cherleri—2, 6 lb./ac.</td>
<td>13.2 11.1 2.1</td>
<td>111 47 42.3</td>
<td>Success</td>
</tr>
<tr>
<td><strong>Tarin Rock, 1967</strong></td>
<td>Geraldton sub. clover—4, 12 lb./ac. Kondinin rose clover—2, 6 lb./ac. Yamin cherleri—2, 6 lb./ac.</td>
<td>8.2 7.7 0.5</td>
<td>55 22 40.0</td>
<td>Success</td>
</tr>
<tr>
<td><strong>Kondinin, 1967</strong></td>
<td>Geraldton sub. clover—4, 12 lb./ac. Kondinin rose clover—2, 6 lb./ac. Yamin cherleri—2, 6 lb./ac.</td>
<td>30.6 25.4 5.2</td>
<td>204 64 31.4</td>
<td>Success</td>
</tr>
<tr>
<td><strong>Narembeen, 1959</strong></td>
<td>barrel medic—4, 8 lb./ac.</td>
<td>27.9 26.3 1.6</td>
<td>n.m. n.m.</td>
<td>Failure</td>
</tr>
<tr>
<td><strong>Tenindewa, 1964</strong></td>
<td>Harbinger medic—2, 5, 8 lb./ac.</td>
<td>16.8 9.2 7.6</td>
<td>n.m. n.m.</td>
<td>Success</td>
</tr>
<tr>
<td><strong>Salmon Gums, 1964</strong></td>
<td>barrel medic—6 lb./ac.</td>
<td>19.6 14.4 5.2</td>
<td>n.m. n.m.</td>
<td>Not recorded</td>
</tr>
<tr>
<td><strong>Kunjin, 1966...</strong></td>
<td>Geraldton sub. clover—4, 8, 12 lb./ac.</td>
<td>25.4 23.7 1.7</td>
<td>n.m. n.m.</td>
<td>Failure</td>
</tr>
<tr>
<td><strong>Tambellup, 1966</strong></td>
<td>Woogenellup sub. clover—4, 12 lb./ac.</td>
<td>9.8 5.2 4.6</td>
<td>n.m. n.m.</td>
<td>Success</td>
</tr>
<tr>
<td><strong>Kondinin, 1967</strong></td>
<td>Geraldton sub. clover—3, 6, 12, 24 lb./ac.</td>
<td>21.8 19.5 2.3</td>
<td>n.m. n.m.</td>
<td>Success</td>
</tr>
<tr>
<td><strong>Merredin, 1962</strong></td>
<td>Commercial barrel medic—6 lb./ac.</td>
<td>n.m. n.m.</td>
<td>334 0.4</td>
<td>0.1</td>
</tr>
<tr>
<td><strong>Wongan Hills, 1962</strong></td>
<td>Cyprus barrel medic—6 lb./ac.</td>
<td>493 4.9</td>
<td>40.0</td>
<td>0.9</td>
</tr>
<tr>
<td><strong>Lort River, 1966</strong></td>
<td>Geraldton sub. clover—30 lb./ac. Kondinin rose clover—15 lb./ac.</td>
<td>n.m. n.m.</td>
<td>174 96 55</td>
<td>Complicated by Dwalganup regeneration</td>
</tr>
<tr>
<td><strong>Condingup, 1967</strong></td>
<td>Woogenellup sub. clover—3, 10 lb./ac., plus urea—52 lb./ac. late sown</td>
<td>16.3 13.9 2.4</td>
<td>98 56 56</td>
<td>Success</td>
</tr>
<tr>
<td></td>
<td>Woogenellup sub. clover—3, 10 lb./ac., plus urea—80 lb./ac. early sown</td>
<td>11.6 10.7 0.9</td>
<td>10 2 20</td>
<td>Failure</td>
</tr>
</tbody>
</table>

* In most of these trials the differences between legume strains and legume seed rates in their effects on wheat yield were small.

n.m. Not measured.
Other causes of failure

The failure of undersown pastures is often attributed to undersowing itself, when in fact failure is due to other causes. In many cases, failure may be avoided by:

- **Paying greater attention to the depth of seeding.** Wheat is often sown as deep as 2 in., although the small clover seed is often unable to emerge from this depth. When undersowing, the wheat-clover mixture should never be sown deeper than 1½ in.

- **Taking the normal precautions necessary when sowing clover as a pure stand.** These include such things as inoculation, use of good seed, and application of trace elements where necessary.

Seeding rates for undersowing

The usual method of undersowing is to add a few pounds of clover seed to the wheat being drilled. Often, rates as low as 2 lb. to 4 lb. per acre of sub. clover seed or 1 lb. to 2 lb. per acre of cupped or rose clover seed are used.

The results of these trials suggest that higher seeding rates are worthwhile. Generally, increasing the seeding rate from 4 lb. to 12 lb. of sub. clover seed per acre depressed wheat yield by only an extra bushel per acre or less. At the same time the clover seed set under the crop was usually doubled or trebled, greatly increasing the chances of successful pasture establishment.

Wheat quotas, barley, oats and undersowing

The introduction of wheat quotas may cause many farmers to think differently about undersowing. The 2 to 4 bushels lost as a result of undersowing may not seem so important, whereas pasture production and soil fertility build-up may become relatively more desirable.

Also, as a consequence of wheat quotas, oats and barley are likely to be used more extensively for new land development, and for cropping generally. Similar yield losses to wheat are likely to apply if these cereals are undersown, but because of the lower returns per bushel from these crops the loss in terms of cash is less.

IN BRIEF

If contemplating undersowing realise that.—

- Wheat yield will be reduced by 2 to 4 bushels per acre when pasture plants are sown with the crop.

- Legume seed yields under a crop are usually only 20 to 50 per cent. of those obtained in a pure sowing of the same rate of legume seed.

- Although rates in the order of 2 to 4 lb. per acre of sub. clover, or 1 to 2 lb. per acre of rose or cherleri clover are commonly sown with crops, rates up to 12 lb. per acre of sub. clover and 6 lb. per acre of rose and cupped clovers greatly improve the chances of successful establishment for little extra loss in wheat yields.

- In a 20 in. or greater rainfall area, successful establishment under a crop can be anticipated;

- In a 16-20 in. rainfall area, undersowing is often successful, but failures and wheat yield losses may make undersowing more costly than sowing pure stands;

- In a less than 15 in. rainfall area, undersowing often fails, particularly on heavy soils and those light soils where pasture establishment is normally difficult.

Before undersowing ensure that.—

- Undersown crops are sown early—by mid-May each year.

- The seed is sown no deeper than 1½ inches.

- All requirements of the clover, such as inoculation and trace elements, are met.

After undersowing remember that.—

- Herbicides may kill clover under the crop.

- Stubble burning and deep ploughing of undersown crops may kill the clover seed.