Linseed growing in the Ord River valley

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Cover Page Footnote
The author wishes to express his gratitude to his colleagues at the Kimberley Research Station for their help and active interest in this work.
Experimental work with linseed at the Kimberley Research Station began in 1952 and has been intensified in the last four years. Fertiliser requirements and methods of land preparation, sowing, irrigation and weed control have been established. Suitable varieties have been selected. Farm-scale crops have been grown in the area and, although cotton is very much more remunerative as an establishment crop, it is expected that linseed will ultimately have a place in the Ord irrigation scheme.

EXPERIMENTS with irrigated linseed at the Kimberley Research Station began in 1952, but during the last four years work has been intensified. Results from these experiments have been promising.

Sown between late April and early June, the average experimental yield in the past four years of linseed crops not subject to severe pest damage is about 1,600 lb. per acre with yields up to 2,500 lb. per acre. Oil content of the seed varies from 44 to 48 per cent.

Linseed (*Linum usitatissimum* L.) is an annual reaching a height of 12 to 36 inches, depending on the variety. The varieties released for local planting have secondary branches as well as a primary stem, the number depending on the rate of seeding and the space between plants. These branches or tillers arise from a node near the ground surface.

The plant has a short tap root, but branch roots often penetrate as deep as 4 feet, depending upon the type and physical condition of the soil.

The foliage is comparatively sparse, and for this reason weeds are more troublesome than in crops which provide better coverage of the ground.

The flowers range in colour from white to blue, violet and pink. White flowers may be flat or crinkled with the edges curved inward (Punjab type), but blue flowers are always flat (disc or funnel types). At Kimberley, the flower opens shortly after sunrise and the petals usually are closed and drop off before noon. Linseed is usually self-pollinating, and very little natural crossing occurs.

The capsule or boll produced by the pollinated flowers has five compartments and should produce 10 seeds. The seeds are light to dark brown, bright yellow, greenish-yellow or smoky coloured. The outer covering of the seed contains a mucilaginous material which quickly becomes sticky when wet. Seed size varies considerably, depending on variety, growing conditions and latitude. For the same reasons, oil content may vary from 35 to 48 per cent. Oil quality, as measured by the iodine number, may vary for different varieties and conditions of growth from

*Division of Land Research and Regional Survey, CSIRO, Kimberley Research Station, Kununurra, Western Australia.
165 to 200, but the average at Kimberley is approximately 185.

**Land Preparation and Planting**

Seed bed preparation for linseed is similar to that used in wheat farming, but the soil should be worked down to a finer tilth and care must be taken to make it as weed-free as possible.

In early trials the border check system of irrigation was used, but this has now been replaced by the corrugation method* (Fig. 1), which saves time and money and reduces losses in yield from uneven watering.

Corrugations can be made in a number of ways. The best method is the use of a linkage drill modified to make the necessary furrows 42 to 48 inches apart. If a standard trailing drill is used, the seed can be sown as for a wheat crop and the irrigation furrows put in afterwards with furrowers mounted on a draw bar.

However, if the land has been laid down for irrigation on the contour—the system used for rice growing—linseed can be planted quite successfully on the flat with any type of drill as long as excess irrigation water can be drained off quickly.

Irrespective of the method used to grow the crop, careful land levelling is essential to prevent irregular watering. With sufficient experience and proper equipment, levelling can be done fairly rapidly.

The importance of early planting is shown in (Fig. 2), which shows the results of a time of planting experiment at Kimberley Research Station. Linseed should not be planted after the first week in June.

Rate of sowing is of considerable importance in crop establishment and final plant stand. High sowing rates lead to better seedling emergence, especially where soil crusting occurs. High plant density is also desirable because it enables the crop to compete better with weeds. High density also reduces the period of flowering. This reduces the susceptibility of the linseed crop to boll damage by insect pests and makes for even ripening of the seed.

Thinner stands have a longer flowering period and the oil content of seed from the later-maturing bolls is invariably lower, especially when flowering and seed development occur under rapidly rising temperatures.

A suitable plant population can be obtained with a sowing rate of 60 to 80 lb. per acre and a row spacing of 6 or 7 inches, the normal row width of a grain drill.

Shallow seeding, at about ½ to 1 inch deep, appears to be desirable to obtain good stands.

* See Western Australian Department of Agriculture Bulletin 3074. Irrigating dry season crops in the Ord River valley.
Fertiliser Requirements

Preliminary experiments on the fertiliser requirements of linseed when grown on the Kununurra clay have shown that unless the land has been under fallow during the preceding wet season heavy dressings of nitrogen are required (Table 1). However, if land has been under fallow, only 1 cwt. per acre of ammonium sulphate is needed, while on land previously "supered" 1½ cwt. per acre should be enough.

Application of potassium fertiliser has failed to produce any significant response in seed or oil yield.

<table>
<thead>
<tr>
<th>Ammonium sulphate cwt/acre</th>
<th>Clean fallowed</th>
<th>Unploughed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1,416</td>
<td>524</td>
</tr>
<tr>
<td>4</td>
<td>1,665</td>
<td>1,034</td>
</tr>
</tbody>
</table>

Irrigation

The crop is watered every seven or eight days until about three to four weeks before harvest. Water stress during any period of the crop's growth will cause a marked reduction in seed yield, especially stress after the beginning of flowering. The quantity of water required for the crop is similar to that for safflower—about 36 inches.

Plant Growth and Development

Time of planting has a substantial effect on the rate of growth of linseed. With late planting, the time for seedling emergence is longer, because of low temperatures. With early plantings seedlings emerge in seven to nine days.

The crop flowers about 45 days after seedling emergence. With a dense plant population flowering continues for about 14 to 18 days, but may extend up to six weeks if the stand is thin.

The time from sowing to harvest is about 140 days for a late April sowing and 110 days for an early June sowing. If sown in July the crop matures in about 90 days. This reduction in crop maturity time for later sown crops is brought about by high temperatures during the seed development period, and hence a lower yield is obtained.

Oil formation starts soon after pollination and, depending upon planting date, the maximum is reached three to four weeks after 10 per cent. flowering has occurred.

The iodine value of the oil—a measure of oil quality—also changes rapidly and reaches a maximum about a fortnight after oil content has reached it peak.

The increase in seed weight is a gradual process, showing a steady rise up to six weeks after the start of flowering. Linseed behaves in the same way as safflower in this respect.

Late planting not only reduces seed yield, but also oil content, iodine number and seed weight.

Harvesting

The crop is ready to harvest when the entire plant is dry, brittle and yellow-brown in colour, and the seeds rattle audibly in the bolls.

Wheat headers can be readily adapted for linseed harvesting. The drums should be adjusted in speed and clearance so that the bolls are broken completely without injuring the seed.

The correct setting of the riddles is also important, and the fan speed or air inlet should be regulated to sort the material effectively without blowing out seed. The knives must be in good condition and well adjusted to the ledger plates. If the knives tend to gum up, they should be washed with water.
Yield and Oil Content

The average yields from all experiments at Kimberley Research Station for the past four years, excluding obviously unsuitable treatments were:

<table>
<thead>
<tr>
<th>Year</th>
<th>Yield (lb./ac.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1959</td>
<td>1,543</td>
</tr>
<tr>
<td>1960</td>
<td>1,406</td>
</tr>
<tr>
<td>1961</td>
<td>1,823</td>
</tr>
<tr>
<td>1962</td>
<td>744</td>
</tr>
</tbody>
</table>

The low yield in 1962 was due to severe damage *Prodenia litura*. Yields of up to 2,500 lb. per acre have been recorded. Analysis of the data shows that early planting and good establishment are the key requirements for high yield.

The oil content of linseed depends largely on variety and time of planting. The standard variety RR204, planted in May, usually has an oil content of 44 to 48 per cent.

Varieties

Varieties tested early in linseed investigations at Kimberley Research Station, have very low yields with low oil content and iodine number. Most of these which were commercial strains grown in Queensland and southern Australia. Material imported from India in recent years has proved more suitable for Kimberley conditions.

As a result of variety trials, the variety RR204 has been used for a wide range of agronomic experiments and has been recommended for commercial cultivation. Newer varieties selected under local conditions are now being tested.

Pests, Weeds and Diseases

The damage caused to linseed by insect pests under Kimberley conditions can be considerable if the crop is not sprayed.

Larvae of *Prodenia litura* and *Heliothis armigera* are mainly responsible. The first species feeds on foliage, while *Heliothis* damages the fruiting points of the plants. DDT sprayed at critical periods has been effective in controlling *Heliothis* larvae, but difficulties are still being met in the control of *Prodenia*.

The main weeds in linseed in the Ord area are the grasses, *Chloris barbata* and *Echinochloa colonum*. They can be controlled by T.C.A. at 4 to 8 lb. per acre active ingredient applied as a pre-emergence or early post-emergence (4 to 5 leaf stage) spray.

No diseases of any importance have been noted on linseed at the Research Station.

Uses of The Crop

Linseed oil is the most important of all drying oils and is used in the production of paints and varnishes, linoleum, oil cloth polishes, printing ink, stock and some human medicines, as well as in foundaries and for other purposes of minor importance. When the manufacture of linseed oil began in Australia some 50 years ago, only raw and boiled linseed oil were produced. Now, more than 40 different types of refined linseed oils are manufactured. However, the main use of linseed oil has always been in the manufacture of paints and varnishes.

The linseed meal left after extraction of the oil contains about 34 per cent. protein and is sold primarily on this basis. About 5 to 6 per cent. oil remains after crushing. Linseed meal supplies about 77 lb. total digestable nutrients per 100 lb. and is of particularly high value for fattening cattle because it produces rapid weight gains and excellent finish. It is also excellent for young stock or breeding cattle. The availability of linseed meal could have a marked influence on the local cattle industry.

Acknowledgments

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