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LINSEED

A Useful Crop
for
South Australia

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# LINSEED—A Useful Crop

By **F. C. GROSS**,  
District Agricultural Adviser

## for South Australia

DIVERSIFICATION in farming is very necessary and very, very important. A variety of crops rotated with balanced pastures, supporting a diversity of livestock, means a balanced farm economy, full use of soil resources and more interest in the work of growing crops and livestock. During the past few years, another crop—linseed—has been added to the list of those which can be successfully included in the rotation on cereal growing farms in this State.

IT is only during the last few years that linseed production has become an economic farming proposition. This has been brought about by the availability of drought resistant and more prolific varieties, the effective control of disease and insect pests, and the more favourable relationship which the price of linseed now bears to that of wheat and other cereals. (World parity price for linseed as against "local" price for cereals). The rise of linseed growing in South Australia since 1947 is shown in the following table:—

| Year.          | Area of linseed<br>harvested<br>Acres. |
|----------------|----------------------------------------|
| 1947 . . . . . | 240                                    |
| 1948 . . . . . | 959                                    |
| 1949 . . . . . | 3,450                                  |
| 1950 . . . . . | 6,774                                  |

Pre-war Australia imported the whole of her linseed requirements from overseas, mainly from India and Argentina. Now, that it has been proved that linseed can be grown profitably here, we should do everything possible to expand the linseed growing industry so as to be as independent as possible of outside supplies. From the point of view of defence alone, this is vital. As yet, Australia is producing little more than 15 per cent of the linseed which she has use for. South Australia's share of this desirable production is little more than 2 per cent. Thus there is the need for a large increase in the area sown to linseed in South Australia. At the present profitable prices ruling for linseed there is no reason why the area could not be increased to 25,000 acres.

The main product from linseed is linseed oil, which is used in the manufacture of paints, varnishes, linoleum and other products. The residue which remains after the oil has been extracted from the crushed and partly cooked

seed is made into linseed meals and cake—a valuable stock food concentrate. Linseed straw has no commercial value at present, although in America it is used for its fibre in the manufacture of certain types of paper and other articles.

### MARKETING.

Linseed is grown under contract to the crushing firms. The price is fixed by world parity, which is based on overseas supplies. The price to the South Australian grower at the present time is world parity plus freight charges from overseas. During the past four years the price paid for clean standard linseed has ranged from £75 to £85 per ton or from 37s. to 42s. per bushel. The seed is bought on the basis of standard oil content and purity. The oil content standard is 40 per cent and purity of a commercial sample 95 per cent.

### RAINFALL AND SOIL REQUIREMENTS.

Enough experience has now been gained in the growing of linseed in South Australia to make it possible to determine just where the crop can or cannot be successfully grown. The districts which are suitable for linseed are those in which the average annual rainfall exceeds 17in. and in which the finishing conditions for cereal crops are generally prolonged and favourable. Such districts comprise the South-East from Bordertown southwards, the districts south of Adelaide, central Yorke Peninsula and the higher rainfall districts of the Lower North and the Mid North.

Linseed thrives on a wide range of soils, but an essential requirement is high fertility. The best soil types for the crop are loams well charged with organic matter, well drained and overlying a good clay subsoil. The linseed plant is as frost hardy as the cereals, although late frosts at flowering time can cause losses by killing the young flower buds. Linseed possesses

good drought resistance and stands up well to periods of dry weather. Finishing conditions, however, must be favourable for good yields to be obtained.

### PLACE IN THE ROTATION.

Linseed does not compete very well with weeds. It responds to soil fertility and therefore should be favourably placed in a rotation. In suitable cereal districts it can replace wheat in a rotation which normally includes at least one year of pasture. A good rotation is pasture, pasture, fallow, linseed. If land has been under pasture for a long term, the first crop when cultivation is resumed should be linseed. In pasture districts linseed can be used to advantage as the first crop in a session of cropping before the soil is put down to pasture

pared for seeding. Generally the same soil preparation is carried out for linseed as for a wheat crop. Soil preparation should be thorough, and the final cultivations should be designed to provide a firm, shallow, moist, weed-free seed bed to suit the crop. An extra cultivation before seeding, even if it means delaying seeding, is well worth while, particularly in controlling weeds like wild oats.

The erosion hazards associated with soil preparation and the early growth of linseed should never be lost sight of. This hazard is taken care of by properly protected and correctly farmed land.

### SEEDING.

Linseed should be sown as soon as possible after the opening of the growing season. The



A linseed crop in flower. In appearance the crop resembles flax, and botanically the two crops are the same, but linseed varieties have been developed for seed yield, whereas with flax varieties the objective is fibre production.

again. Under these conditions linseed is immediately followed by wheat or some other cereal crop for grain or fodder. Sometimes two linseed crops, or a flax and a linseed crop, are grown in succession, but this practice is only successful under really good conditions.

### SOIL PREPARATION.

Climate and soil conditions will determine whether the linseed crop is preceded by fallow or not. In the main cereal districts, where the soils are red and brown loams, fallow is an essential preparation for successful linseed crops. In the higher rainfall pasture districts fallowing is not necessary. Here, the land is broken up after a summer or early autumn rain and pre-

crop requires a long growing period, and best results are obtained from early seeding. May is the best time to sow linseed, although in later districts the sowing time can be extended into June. Linseed should not be sown too deep, particularly on heavy soils. One inch should be the average depth of sowing on to a firm seed bed. Seed should be sown at the rate of 30 lb. per acre. This can be increased to 40 lb. per acre if seeding time is delayed or if difficult conditions for germination and establishment are anticipated.

Seeding can be carried out with a combine or drill, as for wheat, the seed being sown through the "fine" side of the drill. In "setting" a drill to sow linseed it must be borne in mind

that linseed will sow about 10 per cent faster than wheat on the same drill setting. Care should be taken to see that there are no cracks or crevices in the grain box of the drill or combine to allow seed to escape.

### VARIETIES.

Only one variety of linseed is being grown in South Australia at the present time. This is the variety Walsh, which was developed in the United States of America and introduced into Australia in 1943. It is a medium early, fairly tall growing, drought resistant and rust resistant variety. Its rust resistance and ability to yield make it far superior to the Indian and Argentinian varieties which were tried previously. Walsh variety is one of the factors which have made commercial linseed growing possible in South Australia. It is the only suitable variety available to growers.

Seed is supplied to growers by the seed crushing firms. Selection and care of seed is needed to maintain purity and trueness to type.

Linseed and flax are the same botanically, but linseed has been developed for seed yield, whilst flax has been developed for fibre production. Care should be taken to keep these two crops distinctly separate, if both are being grown. Avoid mixing of seed and grow the two crops in widely separated fields to prevent natural crossing, if either crop is to be used for seed purposes.

### MANURING.

Superphosphate is, in the main, the only fertilizer necessary. It is applied at the same rate as is usual for a wheat crop, which is 1cwt. to 1½cwt. per acre. Zinc requirements of linseed are higher than the zinc requirements of cereals, and therefore it is necessary to apply zinc as a fertilizer on soils deficient in available zinc. This applies mainly to Bay of Biscay soils and deficient soils of the South-East, where zinc is applied as zinc sulphate at the rate of 7 to 14 lb. per acre.

### HARVESTING.

The crop is ready for harvesting when the plant has dried off and the seeds can be rattled in the bolls. Linseed is harvested in this State during late December and the early part of January. Harvesting should take place as soon after ripening as possible, although crops will stand without loss for some time after ripening under normal conditions. A grain header is used to harvest the crop.

Linseed presents no harvesting difficulties and is harvested in the same manner as a wheat crop with a few adjustments to the harvesting machine. A first essential is to see that cracks or openings in such places as the elevators, grain or riddle boxes are closed up to prevent leakage of seed from the machine. A minimum amount of straw should be taken into the machine when harvesting. The winding nature of the straw must also be taken into account and regular inspection given to parts of the machine where the straw is likely to accumulate.

The drum should be adjusted in speed and clearance so that the bolls are broken completely without injuring the seed. It is important to avoid over-threshing. Fan speed or air inlet should be regulated so as to sort the material effectively without blowing the seed out. The machine should be adjusted to prevent too much straw coming down on to the grain tray and riddles. Cutting knives must be sharp and well adjusted. Washing the knives is necessary if clogging occurs.

In the event of rain, both the machine and the harvested grain should be covered for protection, as it is impossible to recover the seed once it has been wet. Also, rain on the machine during harvesting makes seed remaining in the machine cloggy and sticky.

Riddle adjustment is necessary for linseed but special screens are not needed. As clean a sample as possible is made with the header, without loss of seed. The seed is then re-cleaned to market standard by the purchasing company.

### YIELDS.

A favourable yield of linseed is 10 to 12bush. per acre, whilst 8bush. per acre could be considered a satisfactory yield. In the three seasons that linseed has been grown in quantity in South Australia yields up to 24bush. per acre have been obtained, and in each of these seasons yields exceeding 20bush. per acre have been grown on some properties. The average yields of linseed for the past four years for South Australia are as follows:—

| Year.           | Average yield, linseed. Bushels per acre. | Average yield of wheat in counties in which linseed grown. Bushels per acre. |
|-----------------|-------------------------------------------|------------------------------------------------------------------------------|
| 1947* . . . . . | 6.75                                      | 17                                                                           |
| 1948 . . . . .  | 11.5                                      | 19                                                                           |
| 1949 . . . . .  | 9.7                                       | 20                                                                           |
| 1950* . . . . . | 7.2                                       | 21                                                                           |

\* In 1947 and 1950 linseed was grown in some districts which are marginal for linseed.

It can be generally assumed that linseed will yield about one-third to one-half as much as wheat under similar conditions. Cash returns per acre must be comparable with wheat to make linseed a worthwhile proposition. A bushel of linseed weighs 56 lb.

### IRRIGATION.

Linseed is a worthwhile irrigation crop when linseed prices are high. Irrigation is carried out prior to sowing to ensure adequate moisture for germination. Linseed requires rapid light waterings rather than prolonged soakings. Waterings should be given to maintain growth; usually one or two irrigations are sufficient, and rarely are more than four necessary. No water should be applied after the main flowering

The female moths lay from 1,000 to 3,000 eggs on the upper parts of the linseed plant. In warm spring weather the eggs hatch out in three to five days and the caterpillars attain their full size in 14 to 21 days. It is during this time that damage is done to the linseed crop. Upon attaining full size the caterpillars burrow into the soil and pupate at a depth of 4in. When the soil is moist and warm the moths may emerge from the pupae in a period as short as 14 days, but under dry or cool conditions emergence may be delayed several months. Overwintering of the cutworm is in the pupal stage. Moths emerge in the early spring when the soil is warm and sufficiently moist, as after a rain. The severity of cutworm infestation will vary according to seasonal conditions.



Aerial dusting of linseed with DDT to control the climbing cutworm. The successful destruction of these caterpillars with modern insecticides has been the final factor in making linseed a practicable crop for cereal farms.

ceases except where it is necessary to prevent soil from cracking badly between flowering and ripening.

### INSECT PESTS AND DISEASES.

The pest which causes most damage to linseed crops is the climbing cutworm. This worm or grub is the larvae of the moth *Heliothis armigera*. The climbing cutworm causes damage by boring into the immature seed bolls and eating out the seed. As much as 80 per cent of a crop has been destroyed when the cutworms have been present in large numbers. The cutworms are small caterpillars  $\frac{1}{2}$ in. to 1in. in length and greenish-grey in colour. They are the larvae of moths which are  $\frac{3}{4}$ in. long and measure about 1in. across the outstretched wings. The colour of the moth varies, but is generally buff or reddish brown with a black patch on the outer margin of the hind-wings, which are whitish in colour.

Before the advent of DDT insecticides there was no effective way of dealing with this pest. Successful destruction of the climbing cutworm with DDT sprays and dusts on linseed crops has been the final factor in making linseed growing a practical proposition.

The climbing cutworm can be controlled by spraying or dusting crops with DDT or Gammexane at the rate of 15 to 20 lb. per acre, as soon as the cutworm appears in the crop after flowering in the spring. Crops can be treated either by spraying or dusting from the air or by ground machines, but spraying has given better results than dusting. The cost of the operation is from 25s. to 30s. per acre. So far, in this State one application of insecticide is all that has been necessary to control cutworms, although in some seasons and in some districts two or even three sprayings or dustings might be necessary to destroy cutworms and eggs.

Red-legged earth mite (*Penthaleus major*) and lucerne flea (*Smynturus viridis*) can cause considerable damage to young linseed crops. These insects are most troublesome when linseed is sown on land which has previously been under pasture for a long term. Invasion of a crop also occurs from adjacent pasture fields. If red-legged earth mite is damaging a

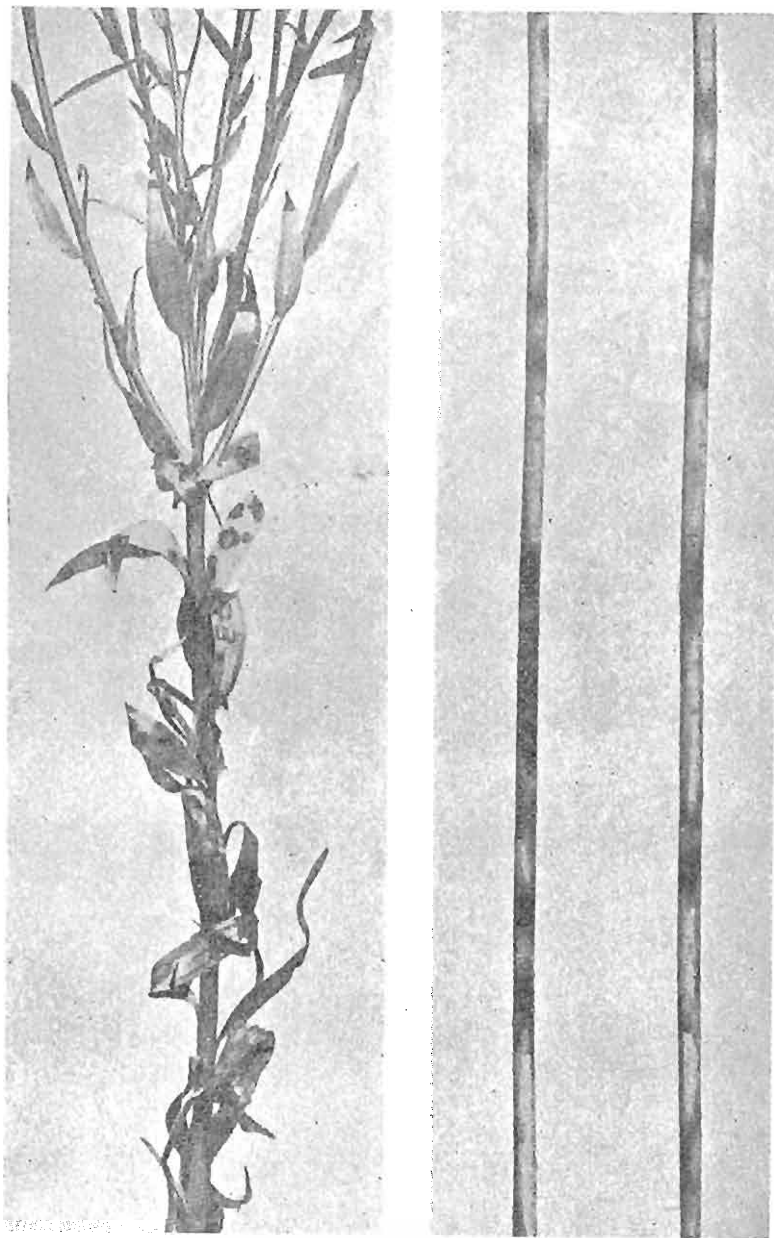
linseed crop it can be destroyed by spraying with DDT or Gammexane.

Lucerne flea is more difficult to destroy, but treatment with Gammexane No. 50 at the rate of 2 lb. per acre will be sufficiently effective to allow the affected linseed to grow away from lucerne flea attack. Gammexane is effective against red-legged earth mite and reasonably effective for the destruction of lucerne flea.

There are two fungus diseases which can cause damage to linseed crops in South Australia. The first is rust (*Melampsora lini*). This was the most serious disease of linseed in the past. The variety Walsh has proved completely resistant to rust in South Australia up to the present time, so that there now is no loss from this disease.

The second fungus disease which affects linseed is Pasmó (*Septoria linicola*, *Sphaerella linorum*). Pasmó has been widespread in linseed crops throughout the State since 1949. It is difficult to assess the amount of loss this disease has caused; crops infected with Pasmó have returned good yields, but yields would undoubtedly have been higher if the crops had been free of the disease. Pasmó was very prevalent in 1949, some crops being heavily infected, and yields were reduced as much as 20 per cent by the disease.

Pasmó is primarily a seed-borne disease, which is very infectious and will spread rapidly under favourable conditions of humidity and rainfall. The disease is found in all the flax and linseed growing areas of the world. Pasmó can attack the linseed crop at any time during its growth. Usually, however, it does not become evident until after flowering.



[From "Qld. Journal of Agriculture."]

Symptoms of Pasmó disease of linseed. Left: Spotting and destruction of leaves. Right: Stem markings.

The disease will develop rapidly under the influence of warmth and moisture in the spring. Prolonged wet weather at this time, particularly in the late spring, will favour a severe infestation of Pasmó. The disease affects the leaves and stem and even the bolls of the linseed plant and is characterized by brown or black patches on the stem and leaves. Pasmó appears in the crop in patches which extend as the infection progresses. Late infection would not materially affect yield. Pasmó disease can be carried on from year to year or place to place by infected seed; it can be carried over by infected straw; or it can be carried from crop to crop by air-borne spores. To control the disease then, seed from Pasmó-free crops only, should be sown; seed should be pickled with a mercurial compound at the rate of 3oz. per bushel; linseed crops should be widely spaced in the rotation.

The most practical way of dealing with Pasmó would be to use a resistant variety. Endeavours are being made in Queensland and New South Wales to develop a Pasmó resistant variety of linseed.

#### SUMMARY.

1. Linseed has a useful place in the rotation of crops on cereal growing farms.
2. Experience has shown that the crop can be grown successfully, and an excellent market exists for the product at profitable prices.
3. Linseed is suited to the better cereal growing country of the South, South-East, Lower North and Mid-North, wherever the annual rainfall exceeds 17in.
4. Linseed can be grown on a wide range of soils, but it demands high fertility and therefore should be favourably placed in the rotation, preferably as the first crop following a period of pasture.
5. Soil preparation for linseed is similar to that for a wheat crop.

6. Linseed should be sown early, preferably in May, and the depth of seeding should be approximately 1in., sowing at the rate of 30-40 lb. per acre with a combine, using the "fine" side of the drill.
7. Walsh, the only suitable variety available to growers, is a rust resistant type which is well suited to South Australian conditions.
8. Superphosphate, applied at the rate of 1-1½cwt. per acre, is the only fertilizer required, except in areas known to be zinc deficient, where zinc sulphate is added at the rate of 14 lb. per acre.
9. Linseed is harvested during late December or early January, using the ordinary grain header with a few adjustments to the mechanism.
10. An average crop of linseed will yield approximately 8bush. per acre, although good crops may return 20bush. or more.
11. When linseed prices are high, the crop may be grown under irrigation, using rapid, light waterings in preference to prolonged soakings.
12. The chief pest of linseed is the climbing cutworm, which may be controlled effectively by spraying or dusting with DDT or Gammexane at the rate of 15-20 lb. per acre.
13. Red-legged earth mite and lucerne flea also cause damage to young linseed crops. The former is controlled by spraying with DDT or Gammexane; while Gammexane No. 50 gives reasonable control of lucerne flea.
14. The seed-borne fungus disease Pasmó causes widespread reduction in yields from linseed crops. Measures aimed at reducing losses from the disease include sowing seed from Pasmó-free crops, pickling the seed with a mercurial preparation and keeping linseed crops widely spaced in the rotation.