Sesame seed

Mal Bennett

Introduction

Sesame, *Sesamum indicum* L., is an ancient oil crop supplying seeds for confectionery purposes, edible oil, paste (tahini), cake and flour. It is typically a crop of small farmers in the developing countries. In 1993, all but 1000 ha of the about 7 million ha of sesame grown were in developing countries (Table 1).

Sesame has important agricultural attributes: it is adapted to tropical and temperate conditions, grows well on stored soil moisture with minimal irrigation or rainfall, can produce good yields under high temperatures, and its grain has a high value ($Al000/t).

Sesame world production areas have remained generally stable over the years, but in some countries the crop is being marginalised. Competition from more remunerative crops and a shortage of labour have pushed sesame to the less fertile fields and to areas of higher risk. Left unchecked, sesame production may decrease in the foreseeable future. This provides an opportunity for Australia to produce larger quantities of high quality sesame seed to replace 'lost' world production.

However, before sesame can realise its potential, extensive research is needed to adapt the crop to mechanical agricultural systems. Furthermore, as Australia is becoming more involved with Asian regional activities, where much of the world's sesame is grown, Australia's own agricultural self-interest could be combined with its international extension and aid programs by taking the lead in a regional sesame research and development project.

Markets and marketing issues

In 1993, the world trade in sesame seed was 486,000 t. Japan was the largest importer taking 24% of the world imports. The second largest importer was the USA with 8% of world imports. It is forecast that the imports of sesame seed will grow at between 6 and 8% per annum until the year 2012.

Australia imported 6400 t of sesame seed in 1996 (worth $A12.7m), with China, Mexico and India the main suppliers. Australian sesame seed production is centred in the Northern Territory and Queensland, with New South Wales showing interest. Although production has fallen from 291 t in 1988–89 to 90 t in 1993–94, it is anticipated that improvements in cultivars and harvesting technology will increase production.

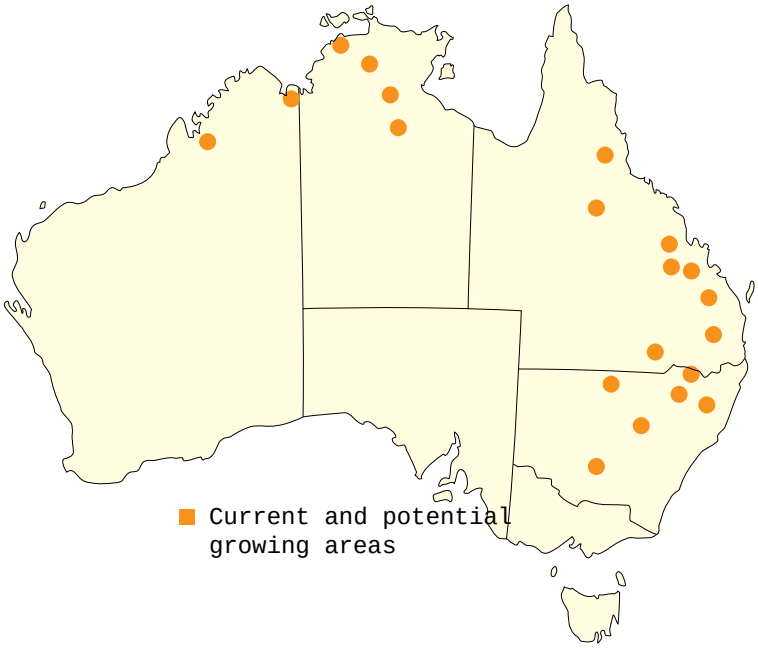

Table 1. Sesame areas, production and yields in 1993 by region.

There is an obvious potential to develop markets for Australian sesame seed, both here and overseas. Sesame seed is presently imported into Australia either as a whole seed and then dehulled or imported dehulled.

Oil industry. Australia imported 769 t of sesame oil and sesame products in 1996 (worth $A3.7m). Currently, there is one sesame oil processor in Australia producing small quantities of sesame oil from locally grown seed.

Confectionery and biscuit industry. The raw seeds currently used in Australia for confectionery and biscuit production are sourced from local and overseas suppliers.

Tahini industry. Tahini, a traditional Middle Eastern sesame paste, is made from hulled sesame seed. Market demand is currently met by local manufacturers and imports from Mexico, the Middle East and some Mediterranean countries.

Dip and spread manufacturers. Dip manufacturers add ingredients, such as chickpeas and egg plant, to tahini and call the products Hommus and Baba Gannouj. These manufacturers purchase their tahini from local suppliers and some also use imports.

Bakery industry. The bakery industry prefers dehulled seeds, which are purchased from local and overseas suppliers.

Halva industry. Halva is a popular sweet made by mixing approximately 50% tahini with boiled/whipped sugar and several other ingredients to a manufacturer's recipe. At present all halva sold in Australia is fully imported from Greece, Turkey and Israel.

Attention to two aspects—natural antioxidants and organic sesame—could improve marketing of Australian sesame seed.

About the author

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Sesame seed contains antioxidants which inhibit the development of rancidity in the oil. In the food industry, where synthetic antioxidants are used extensively, there is an increasing demand for more natural products.

With the growing demand for organically grown food there is a market for sesame products produced under organic conditions.

Crop potential. During the 1970–80s Australian agronomists targeted chickpea and canola in

their search for new commercial crops. Now, almost two decades later, chickpeas and canola are grown extensively, with domestic and international sales. Sesame has the potential to follow their development pattern with adequate research and persistence by scientists and farmers.

Production requirements

Sesame grows best on well-drained soils of moderate fertility. The optimum pH for growth ranges from 5.4 to 6.7. Good drainage is crucial, as sesame is very susceptible to short periods of waterlogging. Sesame is intolerant of very acidic or saline soils.

The response of sesame to both temperature and daylength indicates that it is well adapted to wet season production in the tropics, or summer production in the warmer temperate areas. While there is some variation between cultivars, the base temperature for germination is about 16°C. In temperate areas, soil temperatures determine the earliest date of sowing. The optimum temperature for growth varies with cultivar in the range 27–35°C. Periods of high temperature above 40°C during flowering reduce capsule and seed development.

Key messages

- Suitable to sorghum growing regions.
- High value oilseed crop.
- Extensive local and overseas markets.

Because sesame is short day plant, with flowering initiated as daylength declines to a critical level, cultivars are developed for particular latitudes.

The total amount of water required to grow a sesame crop ranges from 600 to 1000 mm, depending on the cultivar and the climatic conditions. The water requirement can be met from available soil moisture at sowing, rainfall during the growing season and irrigation.

Desiccation is a prerequisite to successful harvesting of sesame.

Hail and frost cause severe damage to sesame crops. Strong winds as the crop matures will greatly increase the likelihood of lodging and pre-harvest seed losses.

Cultivars

Four sesame cultivars are recommended for use in a Australia. They are 'Yori 77' and 'Edith' for the NT and northern WA, and 'Aussie Gold' and 'Beech's Choice' for Queensland. The characteristics of these four cultivars are given in Table 2. There are no cultivars recommended for growing in NSW and it is advised that prospective growers seek advice from Selected Seeds Pty Ltd, Qld.

Agronomy

There are various advantages in including sesame in a crop rotation system. If sown after a leguminous crop, sesame can utilise the residual nitrogen. If the leguminous crop made good growth, then the residual nitrogen should meet about one-third to one-half of the sesame crop needs.

Where sesame is rotated with a cereal, there can be mutual benefits in weed control. Broadleaf weeds can be readily controlled in the cereal crop using selective herbicides, such as atrazine or 2–4 D, greatly reducing the risk of broadleaf weeds in the subsequent sesame crop. Similarly, grass weeds which are difficult to control in the cereal crop can be fairly

easily controlled in a conventionally tilled sesame crop using pre-emergent herbicides such as Treflan®, Dual® and Stomp®. Eptam® can be used as a pre-emergent herbicide for the control of some broadleaf weeds.

Paddocks to be sown should have an even grade and be well drained. As control of broadleaf weeds is a problem in sesame, paddocks with a low content of broadleaf weed seeds should be chosen.

The optimum sowing date for sesame in NSW is the first half of December, in Queensland the 2nd and 3rd weeks of December while in the NT the 2nd and 3rd weeks of January are recommended.

Seed should be sown in rows 30–50 cm apart to give 30–35 plants/m^2. Generally a sowing rate of 3.3 kg/ha of seed is required. If sesame is sown on 1 m row spacing to fit with equipment configuration or irrigation bed arrangement, then the seeding rate should be reduced by half. Sowing in cool conditions in NSW will require higher sowing rates.

As sesame seed is small, sowing depth should be no greater than 2.5 cm and the seed should be sown into moist soil.

The fertiliser requirements for sesame will depend on the fertility of the soil, which will, in turn, vary with soil type and previous land use. The following is a guide on the type and rate of fertiliser to be applied.

An application rate of 60 kg/ha of nitrogen is likely to be adequate. The nitrogen should all be applied at sowing as there appears to be no advantage in a split application.

Table 2. Characteristics of Australian sesame cultivars.

Most sandy loam soils can be expected to be deficient in P, K, S, Cu, Zn and B. Unless the area has received prior applications of fertiliser, an application of at least 100 kg/ha of both single superphosphate plus trace elements and muriate of potash is warranted.

The clay soils tend to be more fertile. They do not require K, but applications of P, S, Cu, Zn and B will be needed.

The number and timing of irrigations will depend on soil type, location and seasonal conditions. Generally, the crop requirements for water can be expected to be about half of that for cotton or maize. The preferred method for establishment is an initial watering before sowing. The soil needs to be kept moist until the beginning of flowering, to help early growth and to maintain herbicide activity. The most critical time for moisture is between first flower and completion of flowering. The final irrigation should be applied when the lower capsules turn yellow.

Pest and disease control

Sesame grows slowly during the early stages of growth and is not strongly competitive with weeds. Poor weed control early in the life of the crop can result in greatly reduced crop yields.

In the NT, zero-tillage techniques are recommended to assist establishment. Zero tillage involves sowing the crop into a mulch which reduces weed growth and has other benefits. These include reducing soil temperatures and soil surface evaporation, and protecting the soil from erosion. No post-emergence herbicides for grass control can be used.

In NSW, where row spacing is wide, inter-row cultivation and spot spraying with glyphosate is possible. The pre-emergent herbicides trifluralin, metolachlor, and pendimethalin can be used for control of grassy weeds. Sesame is extremely sensitive to low concentrations of the residual herbicides in the sulfonylurea family which arc widely used in wheat and barley.

Key statistics

Areas and production of sesame in Australia

These include Glean®, Logran® and various products containing metsulfuron such as Ally®. Growers should observe the plant-back periods listed on the label. The control of broadleaf weeds poses a major problem at the present time as no effective post-emergent herbicides have been identified.

While a wide range of insect pests attacks sesame around the world only the sesame leaf webber *(Antigastra catalaunalis)*, Heliothis caterpillars, *Helicoverpa punctigera* and *H. armigera* and green vegetable bug *(Nezara viridula)* have caused serious problems in Australia. To date, sesame leaf webber has not been recorded in NSW. Mirids can also infest sesame crops. The yellow mirid is a beneficial and should not be sprayed, while the green mirid may require control.

Heliothis caterpillars are highly mobile and can rapidly damage sesame capsules. Control is made difficult by the high levels of pesticide resistance found in Heliothis. Regular monitoring and the application of integrated pest management strategies are essential to minimise their impact. Similar pest management strategies to those used for cotton are recommended. The threshold level for spraying is one small to medium sized caterpillar per 10 plants. To date two applications of insecticide have provided satisfactory control.

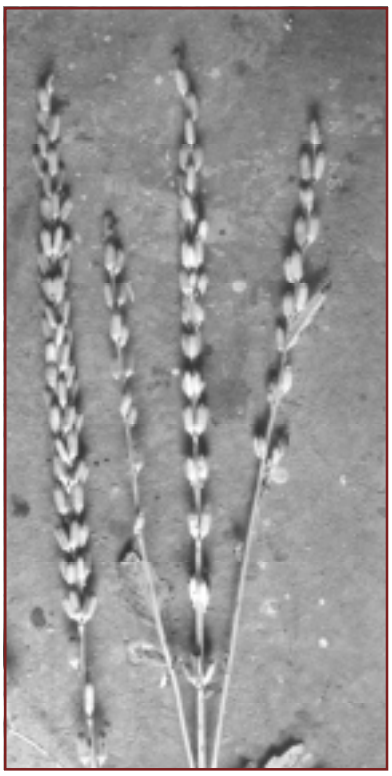
Sesame is prone to root and stem diseases associated with waterlogging, while damping-off diseases can also occur if humidity is high. Seven diseases affecting sesame have been identified but only two of them, *Corynespora cassilcola* (target spot) and *Pseudocercospora sesami* (large cercospora leaf spot), can severely affect grain yields.

Large cercospora leaf spot causes large, irregularly shaped, dull brown spots on the foliage. The spots often coalesce, killing portions or entire leaves on susceptible cultivars during humid conditions.

Target spot first appears as dark (often purplish) spots on leaves, stems and pods. As spots enlarge they develop lighter coloured centres.

Harvesting, storage and handling

The indeterminate growth habit of sesame with its subsequent uneven ripening of the capsules creates difficulties for mechanical harvesting. However, techniques have now been developed that reduce seed losses during harvesting to less than 10%. It is important that the crop be completely dry before harvesting, as sap from green material passing through the header can discolour and taint the seed, creating off-flavours in subsequent processed products.



Commercial sesame cultivars grown in north-western Australia include 'Edith' (right) and 'Yori 77' (left).

The recommended procedure for harvesting sesame is to spray the crop with a desiccant when at least 70% of the capsules have changed colour from dark green to light green or yellow. In northern Australia, an aerial application of Reglone® at 1 L/ha has proven effective. In NSW and southern Queensland the rate of Reglone should be increased to 2–3 L/ha. In southern NSW where temperatures are much cooler, desiccants have proven unreliable and it is recommended that the crop be harvested and windrowed to dry.

The crop is harvested when 95% of the capsules have turned brown, which should be about 7–9 days after desiccation. At this stage, the grain moisture content will be about 6–7% in northern Australia. In temperate areas the moisture content is likely to be higher and the grain will require a longer time to dry before harvesting.

Harvesting is most efficient at a ground speed of 4–6 km/hour using a harvester fitted with a Harvestair® air reel and an extended table which gives a knife-to-auger distance as large as possible.

Sesame seed is easily threshed and relatively delicate, so drum speed should be reduced to about half of that required for cereals, and the concave clearance made as wide as possible. Seed damage during harvesting affects both the viability of the seed, storage and the quality of the oil.

For safe long-term storage, sesame seed should be clean, have a moisture content no more than 6% and be stored at a relative humidity of approximately 50% and at a temperature less than 18°C.

Economics of sesame production

The economics of sesame production will vary with location, while the attractiveness of the crop to a potential grower will depend on the expected returns from alternative crops that can be grown. The area sown to sesame is dependent on the area that can be harvested in 3 days by one harvester. Currently 90–100 ha is the recommended 'unit' area. A smaller area should be sown if the crop is being sown for the first time.

Gross margin budget for sesame production in the Northern Territory, Queensland and New South Wales

Plant breeding is developing higher yielding cultivars for the sesame growing regions of Australia.

Acknowledgments

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