



NORTHERN

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GRAINS RESEARCH
& DEVELOPMENT
CORPORATION

SAFFLOWER

SECTION 2

PRE-PLANTING

SAFFLOWER VARIETIES | PLANTING SEED QUALITY

Pre-planting

2.1 Safflower varieties

The first commercial oilseed safflower variety in Australia was Gila, introduced from Arizona in the 1950s. In the 1970s and 1980s, Gila suffered severe losses from *Alternaria* disease (caused by *Alternaria carthami*), leading the CSIRO to develop and release the varieties Sironaria and Sirothora in 1987. Sironaria is resistant to *A. carthami* and moderately resistant to *Phytophthora* spp., whereas Sirothora is susceptible to *A. carthami* but resistant to *Phytophthora* spp. and recommended for irrigation. A few other varieties were introduced from the United States, including the oleic oil variety Saffola 517 and the linoleic oil variety Saffola 555. Sironaria is still widely grown, but as a dual-purpose birdseed and linoleic oil type; its oil content is lower than newer safflower varieties from other parts of the world. Australia's safflower-breeding program ceased in 1987 and, with the exception of recent introductions by private companies, little work on variety development has since been conducted in Australia.

Varietal selection of safflower should be based on growing location, disease resistance, maturity, yield potential (both seed and oil content), and suitability for the target market. Growers should be aware of the risk of cross-pollination between varieties. Oleic and linoleic varieties should not be grown in close proximity because of the potential for cross-pollination, which can alter fatty acid composition, decrease oil purity and reduce the value of seed. They should be separated by at least 400 m.¹

Some newer introductions are becoming available to growers, but many are only obtainable on a closed-loop selling arrangement. This means that seed is provided by a company and the grower agrees to grow the crop and sell it back to the same company or its agent. Other new varieties have been going through testing and seed multiplication. The characteristics of safflower varieties currently commercially available in Australia are provided in Table 1.

Safflower hybrids have been developed overseas, but none are commercially available in Australia. Growers should check with local agronomists and seed companies to determine the most appropriate variety for their situation. Markets should also be considered, because different varieties are better suited to different markets.²

¹ R Byrne (2009) Safflower. In Summer crop production guide 2009. (Eds L Serafin, L Jenkins, R Byrne) NSW Department of Primary Industries.

² N Wachsmann, T Potter, R Byrne, S Knights (2010) Raising the bar with better safflower agronomy. Agronomic information and safflower case studies. GRDC, <http://www.grdc.com.au/BetterSafflowerAgronomy>

Table 1: Summary of safflower varieties in Australia.

Variety	Maturity	Morphology	Oil content	Alternaria resistance	Phytophthora root rot resistance
Oleic oil types					
CW88-OL	–	Tall, yellow–orange	–	–	–
CW99-OL	–	Medium, yellow–yellow	–	–	–
S317	Late	Tall, yellow–orange	42%	MS	–
S517	Medium	Medium, yellow–orange	42%	–	MS
Linoleic acid types					
CW1221	Medium	Medium, yellow–yellow			
CW2889	Very early	Short, yellow–yellow			
Gila	Early	Medium	35%	S	S
Sironaria	Medium	Tall, yellow–orange	34%	MR	MS
Sirothora	Early	Short,	33%	MS	MR
S501	Early	Short, yellow–orange	42%	–	–
S555	Medium	Medium, yellow–yellow	42%	–	–

MS, Moderately susceptible; MR, moderately resistant; S, susceptible

2.1.1 High-oleic safflower

The development of unique safflower varieties with unprecedented levels of industrially useful oleic oil has the potential to usher in a new oilseeds industry. The safflower variety and its ‘super-high oleic safflower oil’ (dubbed SHOSO) is the culmination of 11 years of investment and research within the GRDC and CSIRO Crop Biofactories Initiative (CBI). The development is now taking the first steps towards commercialisation with the appointment of an industry partner, GO Resources.³

Key points

- Safflower engineered by CSIRO produces levels of oleic acid that can replace some petrochemicals in the manufacture of plastics, paints, resins and many other industrial oils.
- Commercialisation of the new safflower oil is underway by Australian company GO Resources, the licensee of the technology.
- Final testing of crop performance under field conditions and deregulation activities (associated with the Office of the Gene Technology Regulator) are in progress.
- The ability to use plants as ‘biofactories’ is a cornerstone of the bioeconomy, a ‘green’ production system essential to future environmental stability and economic growth.⁴

³ G Braidotti (2015) Development may herald new oilseeds industry. Ground Cover Issue 119, Nov–Dec 2015, <https://grdc.com.au/Media-Centre/Ground-Cover/Ground-Cover-Issue-119-Nov-Dec-2015>

⁴ G Braidotti (2015) Grain could drive new Australian oil trade. Ground Cover Issue 119, Nov–Dec 2015, <https://grdc.com.au/Media-Centre/Ground-Cover/Ground-Cover-Issue-119-Nov-Dec-2015/Grain-could-drive-new-Australian-oil-trade>

FAQ

2.2 Planting seed quality

Safflower seeds (Figure 1) are contained in a thick hull, which, in botanical terms, is actually a type of fruit known as an achene. However, as with sunflower, most people refer to the whole unit as a seed, and that convention will be used here. Depending on variety, hulls may be smooth or ridged, pure white or white with a grey or brown tinge, and/or may possess purple, grey or black stripes. Hulls generally lack a pappus, and where present, pappus hairs are usually short.



Figure 1: Safflower seed.

Photo: Nick Wachsmann

As for all crops, planting seed should be genetically pure, free from seed-borne diseases, have a high germination percentage (>80%), and be free from weeds and other crop seeds. Many suppliers can provide a copy of the quality certificate on request; otherwise, samples can be sent to an accredited laboratory for testing.

The longevity of oilseeds under normal silo conditions is limited, so fresh seed should be used where possible. Planting seed from crops that have experienced an extended period of warm, wet weather prior to harvest should be avoided. These conditions favour the development of *Alternaria carthami*, which can infect seed and transmit Alternaria disease to the next crop, causing newly planted seed to rot in the soil, or the damping off of seedlings.

The germination percentage of seed can also be markedly reduced by rain on mature crops, which causes sprouting in the head.⁵

2.2.1 Seed size

The size of safflower seeds varies between varieties and with growing conditions, but they are shaped like small sunflower seeds. Typically, seeds average 6–7 mm in length and weigh about 4 g/100 seeds, making 25,000 seeds/kg. The recognised test weight is 52.5 kg/hL, which is similar to oats.⁶

2.2.2 Seed germination and vigour

A germination percentage of 80% is assumed for safflower, with a germination percentage as high as >90%; however, growers should always check the bag and conduct germination tests.

i MORE INFORMATION

Breeding improvements in safflower
(*Carthamus tinctorius* L.)

⁵ N Wachsmann, T Potter, R Byrne, S Knights (2010) Raising the bar with better safflower agronomy. Agronomic information and safflower case studies. GRDC, <http://www.grdc.com.au/BetterSafflowerAgronomy>

⁶ N Wachsmann, T Potter, R Byrne, S Knights (2010) Raising the bar with better safflower agronomy. Agronomic information and safflower case studies. GRDC, <http://www.grdc.com.au/BetterSafflowerAgronomy>

2.2.3 Seed storage

When storing safflower seed, grain moisture should be <8% to prevent mould production and deterioration due to heat.

2.2.4 Safe rates of fertiliser sown with the seed

Safflower has nutritional requirements similar to wheat with respect to nitrogen, phosphorus and sulfur. However, surface-applied fertilisers have variable response in safflower because the plants obtain moisture and nutrients down to 3 m in the soil profile, with their extensive taproot system. Hence, fertilisers should either be drilled in prior to sowing or topdressed before bud formation in damp soil conditions, to allow the nutrients to move down the soil profile.

In order to avoid toxicity, which will reduce crop establishment, no more than 20 kg/ha of nitrogen should be drilled with seed.⁷

Fertiliser should preferentially be sown in a band 2.5 cm below and beside the seed, particularly when fertiliser rates of nitrogen are high. It is assumed that the relative seed size of safflower means that it should be treated as per sunflower, rather than canola, in terms of seed safe requirements. Consult your nutritional advisor or fertiliser supplier for more specific information.

⁷ R Byrne (2009) Safflower. In Summer crop production guide 2009. (Eds L Serafin, L Jenkins, R Byrne) NSW Department of Primary Industries.