

Safflower (*Carthamus tinctorius* L.)

French: Carthame, safran batard; Spanish: Cartamo, alazor; Italian: Cartamo; German: Saflor

Crop data

Annual. Seeds are harvested for oil (30 to 45 %) used in human food (low cholesterol) or for industrial uses; meal for livestock protein supplement (24 % protein) which is high in fibre.

Planted in April/May (early spring) in areas which have at least 120 days of frost free periods, and hot summers. The crop is frost-tolerant in the seedling stage, withstanding temperatures of -7 °C. Typically grown at less than 1100 m altitude.

Sowing rates: 17 - 28 kg/ha for dryland and 28 - 39 kg/ha for irrigated conditions (pure live seed), at depths of 2.5-4 cm, after soil temperature has reached 4 °C. Row spacing: up to 35 cm. Soil crusting can be a problem in establishment.

Safflower is a deep-rooted, long-season crop that withstands periods of drought longer than other annuals. Optimum growing condition occur on deep, fertile, well-drained soils with a neutral pH. Plant height varies from 38 to 102 cm depending upon environmental conditions. It is particularly suited to dryland conditions where an annual crop is needed to use surplus water from recharge areas that otherwise would contribute to saline seeps*. The crop is very sensitive to excessive water. Safflower is a good rotation crop with small grains or on fallow in that it helps to break weed and disease cycles. It should not be grown in two consecutive seasons due to the lack of available water and the potential for serious damage from diseases.

* Saline seeps are areas with intermittent or continuous saline water discharge under dryland conditions, at or near the soil surface downslope from recharge areas (from which water percolating below the root zone flows laterally and so continues to the saline seepage).

Nutrient demand/uptake/removal

Nutrient demand/uptake/removal - Macronutrients				
Yield kg/ha	Source	kg/ha		
		N	P2O5	K2O
1610 (grain + straw)	Halvorson & Black, 1985	68	-	-
1800 kg/ha	Thorup, 1984	91	23	68
2200 kg/ha	Singh & Singh, 1980	77	40	63

Plant analysis data

No information available.

Fertilizer recommendations

Fertilizer application should be based on residual nutrient levels as indicated by a preplant soil test, available soil water, soil type, level of management and availability of irrigation. On coarse-textured soils all fertilizer can be applied before sowing. On heavy-textured soils about half the N can be applied before sowing, the other half at early budding. Approximately 18 kg N/ha is needed for each kg/ha of seed. Excessive N applications can result in excessive foliage which depletes available water during seed development, thus decreasing seed yield and quality.

Nitrate N soil tests should be taken to a depth of 61 cm, while P and K tests should be taken to a depth of 15 cm. Deeper nitrate-N soil tests may give better guidance. Recently published fertilizer recommendations for North Dakota/USA based on target yield, residual nitrate-N, sodium bicarbonate extractable P and ammonium acetate extractable K, are shown below.

USA - North Dakota Recommendations for Broadcast Application - Macronutrients									
Target yield kg/ha	Soil N plus fertilizer N needed* kg/ha N	P Soil Test Level(kg/ha)				K Soil Test Level(kg/ha)			
		VL 0-10	L 10-20	M 20-30	H over 30	VL 0-110	L 110-223	M 223-335	H over 335
		kg P ₂ O ₅ /ha				kg K ₂ O/ha			
672	34	17	11	0	0	22	17	0	0
896	45	22	11	0	0	34	22	0	0
1120	56	22	17	0	0	39	22	11	0
1344	67	28	17	0	0	50	28	11	0
1568	78	34	22	0	0	56	34	11	0
1792	90	39	22	11	0	67	39	11	0
2016	101	45	28	11	0	73	45	17	0
2240	112	50	28	11	0	84	50	17	0
2464	123	56	34	11	0	90	56	17	0
2688	134	62	34	11	0	101	62	22	0

* Subtract residual nitrate N (61 cm depth) from figures in this column.

Preferred nutrient forms

Nutrients should be applied in readily available forms, consequently all standard N, P and K fertilizers are suitable sources. The best methods of application are dependent upon the fertilizer source, the equipment available and soil chemistry. For example, anhydrous ammonia should be applied 10-15 cm below the soil surface, while other ammonium N sources (urea, ammonium nitrate, solutions) should be broadcast and incorporated before sowing, particularly on high pH, calcareous soils.

Preliminary research indicates a distinct advantage to band placement of P over broadcasting, particularly on low testing soils.

Most soils of Western USA are high in K, but specific areas may be marginal or deficient and require fertilizer application for optimum production.

S deficiencies are not common, but may occur on sandy soils early in the growing season. Safflower has not responded to micronutrient applications in Montana, USA.

Present fertilizer practices

For Montana, USA, average dryland fertilizer recommendations would be 56 kg/ha 11-55-0 with the seed, followed by N topdressing of 34-68 kg/ha N; average irrigated fertilizer recommendations would be 78 kg/ha 11-55-0 with the seed and 68-90 kg/ha N topdressed.

Further reading

BERGMAN, J.W. et al.: Safflower production guidelines. CIS8. ; Montana Agricultural Experiment Station, Montana State University, Bozeman, MT., USA (1979)

DAHNIKE, W.C. et al.: Fertilizing safflower. SF-727. North Dakota State University, Fargo, ND, USA(1990)

HALVORSON, A.D.; BLACK. A.L.: Safflower helps recover residual nitrogen fertilizer. Montana Ag Research (Winter). Montana State University, Bozeman, MT, USA (1985)

SINGH, U.B.; Singh, R.M.: Effect of graded levels of moisture regimes, N and P fertilization on seed yield, oil content and NPK uptake by safflower. Indian Journal Agronomy. 25 (1):9-17 (1980)

Author: J.S. Jacobsen, Department of Plant and Soil Science, Montana State University, Bozeman, USA