

AGRONOMIC STUDIES WITH SUNFLOWERS  
IN MINNESOTA

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This report will be confined to three aspects of the agronomic research on sunflowers.

1. Oilseed crop comparisons.

Sunflower seed production for edible oil started in 1947 in Minnesota. Trials were conducted at various locations during the next eight years on soils varying from sand to clay. Sunflowers when free of serious disease and insect damage produced more oil per acre than any of the oilseed crops - flax, soybeans, mustard, rape, safflower - now grown in the state. Some exceptions occur. Flax on peat and some heavy soils, rape on heavy soils in extreme northern Minnesota, and soybeans in some areas in southern Minnesota may outproduce sunflowers; but, statewide, sunflowers are the potential "oil king." Comparative trials with soybeans are shown in Table 1.

Table 1. Comparative average seed yields, oil contents, and oil yields of sunflowers and soybeans grown at Crookston 1948-52, Morris 1948-50, southwestern Minnesota 1948-52, Anoka 1953-55.

Location <sup>a</sup>	Seed yield		Oil Content		Oil yield	
	sun- flower	soybean	sun- flower	soybean	sun- flower	soybean
	pounds per acre		percent		pounds per acre	
Crookston	1100	912	30.3	17.9	333	163
Morris	1252	878	31.0	18.8	400	164
Southwestern Minn.	1302	1485	31.1	18.6	405	276
Anoka	1028	1041	31.2	19.0	314	194

<sup>a</sup>Soil types were clay at Crookston, silt loam at Morris, loam to clay loams in southwestern Minnesota, and sand in Anoka County.

These data appear favorable to sunflowers but do not show the risk differential between the two crops. Sunflowers are "risky" - insects or disease may destroy the crop. Soybeans are a "sure" crop.

2. Crop sequence and rotation.

Insect and disease problems might be expected to increase when sunflowers become a commonly-grown crop in an area. In addition, sunflowers have the reputation of being "hard on the soil" and, thus, detrimental to following crops. The cost of controlling weed (volunteer) sunflowers in the following crop is another disadvantage.

In general, soil from sunflower plots was slightly lower in potassium and pH than soil from continuous soybean plots. The University of Minnesota Soil Testing Service interprets all of these potassium contents and the potassium contents below 21 to be in the medium range. Phosphorus contents above 20 are in the high range. The lack of decline in soil pH may be attributed to dust from a nearby road "graveled" with limestone.

Insect problems did not increase from continuous cropping. In fact, the only serious insect damage was sunflower moth in 1957 - the first year of the study. Sunflower trials have been conducted in neighboring fields for ten years so plenty of host plants are present. Perhaps weather is more important than crop rotation and presence of host plants in determining severity of insect attacks.

Rust was present each year, but no economic damage occurred even though sunflowers of various maturities and susceptibilities were grown in an adjacent field. Neither downy mildew nor *Sclerotinia* occurred on continuous sunflower plots although downy mildew-infected plants were in adjacent fields. *Verticillium* became extremely damaging in 1961 and practically destroyed the 1962 crop. *Verticillium* symptoms occurred later and damage was less in the alternately cropped than in the continuous sunflower plots.

Insects were no problem in soybeans, and the only disease of importance was bacterial blight. Soybeans in rotation with sunflowers were consistently better than continuous soybeans due to some unknown factor(s) making rotation desirable.

### 3. Weed control and planting methods.

Sunflowers are a weedy crop. They compete well with weeds but do not develop ground cover quickly enough to prevent weeds from establishing. In the rotation study, weeds were mostly eliminated by spraying with CDAA and cultivation. However, sunflowers were more weedy than soybeans. Smartweed and ragweed, resistant to CDAA, were the main weeds. Oats planted on the rotation in 1963 were excellent on all plots - 84 to 86 bushels per acre was the range of treatment yields. Nevertheless there were more smartweed plants on plots previously in sunflowers.

Herbicidal control of weeds in sunflowers may be expected to give some increase in yield and prevent an increase in the soil weed-seed population.

Sunflowers are a species remarkably resistant to a wide range of pre-emergence herbicides and decidedly susceptible to many postemergence herbicides. Data of three effective pre-emergence herbicides are shown in Table 4.

Table 4. Weed control and yields of cultivated sunflowers sprayed with pre-emergence herbicides at Rosemount, Minnesota.

Treatment and rate per acre, pounds	Weed control <sup>a</sup>	Seed per acre, pounds
Untreated	6.5	1322
CDAA, 4	9.0	1606
Amiben, 3	8.0	1555
EPTC, 3, preplanting incorporated	9.5	1548

<sup>a</sup> 0 complete weed cover, 10 weed free.

None of these herbicides are registered for sunflowers by the Pesticides Regulation Division, U. S. Department of Agriculture.

CDAAs have been used for years in trial plots. For late May planting, it is a reliable control for foxtails, barnyard grass, and to some extent - lambsquarters. However, earlier planting in combination with herbicides may become common in Minnesota. CDAAs do not appear to be a good herbicide in early-planted sunflowers. Its residual effect in the soil is too short if applied in late April or early May to kill the later germinating weeds.

Amiben is promising but we do not have enough tests to be certain of its safety on sunflowers.

EPTC is very promising and sunflowers are a most resistant species to this herbicide.

The high cost of pre-emergence herbicides might be offset by elimination of cultivation if narrow grain drill rows were used. Trials indicated that rate of seeding should not exceed two times the normal planting rate in wide rows to avoid severe lodging. More herbicide work is needed on narrow rows at planting rates in the range of one to one and a half times normal.

Work on biological control of weeds in drilled sunflowers has to date been unsuccessful. Winter wheat and winter rye have been the weed control crops sown with sunflowers. For the principles behind this method of biological weed control, see "Companion crops for weed control in soybeans," Agronomy Journal 46(6):278-281. 1954.

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