# Sunflower Seed, Oil, or Silage: New Crops for Central Oregon

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# SUNFLOWER SEED, OIL, OR SILAGE:

# NEW CROPS FOR CENTRAL OREGON

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## INTRODUCTION

Central Oregon's short growing season with its late spring and summer frosts limits the kinds of crops that can be grown. A wider choice of adapted crops is needed to vary crop rotations and to allow production changes as market values change. Also, since the climate prevents field corn production, corn and other grains must be bought from outside the area to provide energy supplements for livestock. A crop that could substitute for corn in silage and be grown under local conditions would result in large savings of feed costs.

Second only to soybeans, sunflower oilseed varieties are one of the most important sources of high-quality vegetable oil in the world. Sunflower seeds are high in energy and protein. Nonoil varieties are used for human and bird food. Sunflowers have substituted for corn in silage in other areas where corn production is uncertain because of drought or short growing season.

Since sunflowers mature rapidly and tolerate cold and drought, they should be adapted to local conditions. Their use would increase flexibility in choice of crops and fill the need for a silage crop.

This report discusses aspects of sunflower production and presents results of studies conducted at the Central Oregon Experiment Station to determine if sunflowers could be grown successfully in Central Oregon and if seed, oil, and forage yields would be high enough to warrant their use.

## PRODUCTION ASPECTS

### Varietal Options

Two kinds of sunflowers are available for commercial use. Oilseed varieties usually have black seeds with thin hulls that stick to the kernel. Oilseeds contain about 40 percent oil and 20 percent protein. Nonoil varieties have striped seeds with thick hulls that are detached from the kernel. Nonoil seeds are larger than oilseeds and have lower oil and protein contents.

Both oil and nonoil varieties have been tested at the Central Oregon Experiment Station and both have produced seed yields in excess of 2,000 pounds per acre. Dry forage yields have averaged 5.2 tons per acre for oil varieties and 4.2 tons per acre for nonoil varieties.

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## Open-pollinated Varieties

Seed for planting open-pollinated varieties is cheaper than seed for hybrids; this low seed cost is the main advantage of using open-pollinated varieties. Open-pollinated oilseed varieties that have been tested in Central Oregon originated in Russia. They are Issanka, Krasnodarets, Peredovik, and Sputnik. All resist rust and Verticillium wilt, but are susceptible to downy mildew and Sclerotinia white mold. None of these diseases appeared to cause problems in the local tests.

Open-pollinated nonoil varieties that have been tested locally include Arrowhead, Mingren, Dahlgren 694, and Sundak. All except Sundak are susceptible to rust; none are resistant to downy mildew, Verticillium wilt, or Sclerotinia stalk rot. None of these diseases appeared to cause problems in local tests(Tables 2,3,4).

## Hybrids

Hybrids have the potential for higher yields than open-pollinated varieties. They result in more uniform stands and have greater disease resistance. They also have a higher degree of self-compatibility, which reduces dependency on large bee populations for good seed set. Hybrids 201, 894,896,903, Sunbred 212, Sunbred 223, Sunbred 254, and Experimental 1 have been grown locally (Tables 1,2,3,4,5).

## Soil Conditions

## Soil Testing

Soil fertility levels and fertilizer and lime needs should be determined by soil tests well in advance of planting. Soil test recommendations should be followed to maintain high soil fertility levels for optimum production.

## Fertilizers

Sunflowers have extensive root systems which enable them to use low levels of residual soil nutrients; they may also be specially adapted for nutrient uptake. For these reasons, they appear to need less fertilizer than cereals. Sunflowers remove similar amounts of nutrients from soils as other field crops do, however, and the nutrients must be replaced sometime during the rotation. The best policy is to maintain nutrients at optimum levels for all crops in the rotation.

## Variety, Nitrogen Fertilizer, and Planting Rate Effects On Seed Yield and Forage Yield and Quality

Since nothing was known about the nitrogen requirements of sunflowers under Central Oregon conditions, an experiment was done to study the effects of variety, nitrogen fertilizer rate, and planting rate on seed and forage yields and forage quality. Hybrids 894 and 903 were planted at rates of 7.5 or 15 pounds of seed per acre (29,000 or 58,000 plants per acre) and were fertilized with either 80 or 160 pounds of nitrogen per acre. The hybrids were planted May 13, 1977 on Deschutes sandy loam soil and were irrigated with 1.5 inches of water every 5 to 7 days during the season. They were harvested on August 22.

Hybrid 903 produced more seed than Hybrid 894 (Table 1). Variety, nitrogen, and planting rates were closely related in terms of seed yield. The low nitrogen rate combined with the high planting rate of Hybrid 903 resulted in higher seed yields than from the high nitrogen, low planting rate combination. Both combinations produced higher seed yields than low nitrogen, low planting rate or high nitrogen, high planting rate. Seed yields from Hybrid 894 were highest from the low planting rate combined with either nitrogen rate.

Dry forage yields ranged from 4.8 to 6.5 tons per acre. The high nitrogen rate increased forage yield of both hybrids seeded at the low planting rate. Forage yield also was higher at the 15 pound seeding rate with either level of nitrogen. The best combination for optimum forage yields appeared to be 80 pounds of nitrogen per acre applied to sunflowers planted at 15 pounds of seed per acre.

Table 1. Effects of variety, nitrogen fertilizer rate (N), and planting rate (PR) on dry forage and seed yields and forage nutritive values of sunflowers grown under irrigation at Redmond in 1977.

| Treatment | Yield: Dry forage | Yield: Seed | Forage: Crude protein | Forage: Crude fiber | Forage: Lignin |
|---|---|---|---|---|---|
| | tons/acre | lb/acre | % | % | % |
| Hybrid 894, $N_{80}$, $PR_{7.5}$* | 4.8 | 906 | 12.2 | 44.3 | 7.0 |
| Hybrid 894, $N_{160}$, $PR_{7.5}$ | 5.6 | 823 | 10.2 | 40.6 | 12.2 |
| Hybrid 894, $N_{80}$, $PR_{15}$ | 5.7 | 565 | 8.7 | 39.6 | 8.3 |
| Hybrid 894, $N_{160}$, $PR_{15}$ | 6.2 | 693 | 7.8 | 40.7 | 12.7 |
| Hybrid 903, $N_{80}$, $PR_{7.5}$ | 6.0 | 1,291 | 9.1 | 32.3 | 10.4 |
| Hybrid 903, $N_{160}$, $PR_{7.5}$ | 6.4 | 1,404 | 9.4 | 41.2 | 8.2 |
| Hybrid 903, $N_{80}$, $PR_{15}$ | 6.5 | 1,592 | 10.7 | 33.0 | 8.9 |
| Hybrid 903, $N_{160}$, $PR_{15}$ | 6.4 | 1,208 | 8.5 | 38.4 | 7.0 |
| Avg | 6.0 | 1,060 | 9.6 | 38.8 | 9.3 |
| LSD 0.05 | ns | 214 | | | |

*$N_{80}$ = 80 pounds of nitrogen per acre; $N_{160}$ = 160 pounds of nitrogen per acre. $PR_{7.5}$ = 7.5 pounds of seed per acre; $PR_{15}$ = 15 pounds of seed per acre.

Forage nutritive value was affected by variety, nitrogen, and planting rates. Crude protein content of Hybrid 894 was higher at the low planting rate with either rate of nitrogen than at the high planting rate. Crude fiber content of Hybrid 894 was unaffected by either nitrogen or planting rate. The low nitorgen rate at either planting rate resulted in lower lignin content in Hybrid 894. Crude protein levels in Hybrid 903 were highest for the low nitrogen, high planting rate treatment and were lowest for the high nitrogen, high planting rate combination. The low nitrogen rate resulted in lower crude fiber content, but the high nitrogen rate resulted in lower lignin content.

From this study it was clear that the planting and nitrogen fertilizer rates used would depend on whether the sunflowers were being grown for seed or forage.

## Planting Date

Although sunflowers can be planted and will grow at anytime during the spring, Central Oregon's short growing season with late spring frosts determines when they should be planted for maximum yields. An experiment was done during two years at the Central Oregon Experiment Station to study the effects of different planting dates on seed, oil, and forage yields of sunflowers.

Ten varieties (11 varieties in 1976) were planted on April 11-14, April 28-29, May 12-13, and May 26-28 on Deschutes sandy loam soil at Redmond in 1975 and 1976, and on Deschutes loamy sand at Alfalfa in 1975. Varieties were Peredovik, Sputnik, Krasnodarets, Issanka, Hybrid 201, Hybrid 894, and Hybrid 896 oilseed varieties; Arrowhead birdfeed variety; Dahlgren 694, Mingren, and Sundak human food varieties.

Oilseed varieties were seeded at 7.5 pounds per acre to give a plant population of 29,000 plants per acre. Birdfeed and human food varieties were seeded at 5.5 pounds per acre to give a plant population of 19,400 plants per acre. All varieties were fertilized with 700 pounds per acre of 16-20 before planting, and were irrigated with 1.5 inches of water every 5 to 7 days during the season.

All varieties were harvested on September 15-17, 1975 and September 8, 1976. Whole plants from May 12 plantings were analyzed for crude protein, crude fiber, and lignin contents. Whole plants of six varieties from the May 12, 1976 planting were analyzed for *in vitro* digestible dry matter content. Seed and forage yields were determined for all planting dates in 1975 and for the May 12 planting in 1976. Seed oil concentrations were determined for all planting dates in 1975.

### Planting Date Effects On Seed Yield

Planting date affected seed yields in both years (Table 2). In 1975 seed yields ranged from an average of 1,511 pounds per acre for the April 11 planting, to 1,858 pounds per acre for the May 12 date. Yields compared favorably with those reported from other areas. Yields of 850 to 2,630 pounds per acre have been reported from Georgia, Minnesota, North Dakota, and Texas.

The 1976 season severely tested the varieties and dates of planting. A late frost in June killed plants seeded on all dates except May 12. Plants seeded on May 12 were at stages of growth more tolerant of cold when the frost occurred than plants seeded on the other dates. Although all varieties planted on May 12 survived the frost, seed yields were reduced to an average of 368 pounds per acre.

Table 2. Effects of planting date and variety on seed yields of sunflowers grown under irrigation at Redmond in 1975 and 1976.

| | Planting dates | | | | | |
|---|---|---|---|---|---|---|
| | 1975 | | | | | 1976 |
| Varieties | 4/11 | 4/28 | 5/12 | 5/26 | Avg | 5/12 |
| | lb/acre | | | | | |
| Peredovik | 1,482 | 1,691 | 1,535 | 1,558 | 1,566 | 279 |
| Sputnik | 1,803 | 1,784 | 2,052 | 1,894 | 1,883 | 256 |
| Krasnodarets | 1,332 | 1,977 | 1,685 | 1,346 | 1,585 | 409 |
| Issanka | 1,842 | 2,022 | 1,968 | 1,960 | 1,947 | 475 |
| Hybrid 896 | 1,569 | 1,683 | 1,899 | 1,446 | 1,648 | 310 |
| Hybrid 201 | 1,288 | 2,012 | 2,123 | 1,519 | 1,736 | 333 |
| Hybrid 894 | | | | | | 401 |
| Arrowhead | 1,674 | 1,826 | 2,141 | 1,962 | 1,901 | 375 |
| Mingren | 1,221 | 1,417 | 1,648 | 1,279 | 1,392 | 401 |
| Dahlgren 694 | 1,512 | 1,747 | 1,888 | 997 | 1,536 | 402 |
| Sundak | 1,388 | 1,767 | 1,638 | 1,611 | 1,600 | 406 |
| Avg# | 1,511 | 1,793 | 1,858 | 1,557 | | 368 |
| LSD 0.05 lb/acre | ns | ns | ns | 500 | 247 | ns |

#LSD 0.05 for date means is 156 lb/acre.

## Planting Date Effects on Seed Oil Content and Yield

Because of severe frost damage in 1976, oil contents were only determined in 1975. Planting date affected oil concentrations, which ranged from 36.4 percent for Hybrid 201 planted May 26, to 43.4 percent for Sputnik planted April 28 (Table 3). Earlier planting dates generally resulted in higher oil contents than the May 26 date. This agreed with reports from Georgia and Minnesota where highest oil contents also resulted from earlier planting dates. Oil yields ranged from an average of 636 pounds per acre for the April 11 planting date, to 778 pounds per acre for the April 28 planting date. Oil contents and yields compared favorably with those reported from other areas.

Table 3. Effects of planting date and variety on seed oil contents and yields from sunflowers grown under irrigation at Redmond, in 1975.

| Varieties | Planting dates: April 11 | | April 28 | | May 12 | | May 26 | | Avg | |
|---|---|---|---|---|---|---|---|---|---|---|
| | % | lb/acre | % | lb/acre | % | lb/acre | % | lb/acre | % | lb/acre |
| Peredovik | 40.1 | 594 | 40.2 | 680 | 40.5 | 622 | 37.3 | 581 | 39.5 | 624 |
| Sputnik | 42.4 | 765 | 43.4 | 774 | 43.2 | 887 | 41.4 | 784 | 42.6 | 803 |
| Krasnodarets | 40.4 | 538 | 40.7 | 805 | 39.3 | 662 | 36.7 | 484 | 39.3 | 628 |
| Issanka | 41.3 | 761 | 42.0 | 849 | 39.3 | 773 | 38.1 | 747 | 40.2 | 783 |
| Hybrid 896 | 41.6 | 653 | 42.6 | 717 | 41.6 | 790 | 41.2 | 596 | 41.8 | 689 |
| Hybrid 201 | 39.2 | 505 | 41.9 | 843 | 39.2 | 832 | 36.4 | 553 | 39.2 | 683 |
| Avg# | 40.8 | 636 | 41.8 | 778 | 40.5 | 761 | 38.5 | 626 | | |
| LSD 0.05, % | ns | | ns | | ns | | ns | | 1.8 | |
| LSD 0.05, lb/acre | | ns | | ns | | 142 | | ns | | 106 |

LSD 0.05 for date means are 1.4% and 87 lb/acre.

## Planting Date Effects on Forage Yield

Only May 12 and May 26 plantings were harvested for forage in 1975 at Redmond because the April plantings were damaged by frost and matured more rapidly than was expected. Dry forage yields from the May 12 planting ranged from 3.2 to 5.4 tons per acre (Table 4). Dry forage yields from the May 26 planting ranged from 4.1 to 6.5 tons per acre. Plants seeded May 26 grew taller (average height = 71 inches) than plants seeded May 12 (average height = 65 inches). The height differences accounted for the higher forage yields of the May 26 planting.

Only varieties planted on May 12 were harvested in 1976 because of the late spring frost that killed varieties planted on other dates. Dry forage yields ranged from 2.8 to 4.7 tons per acre. Plants were harvested one week earlier in 1976 than in 1975. Consequently, plants were less mature and contained more moisture when harvested in 1976 than in 1975. Yields from both years compared favorably with sunflower forage yields obtained in other areas.

Just before the plants were harvested at Alfalfa in 1975, blackbirds ate all of the seeds and ruined the experiment. Until then, the May 13 planting date appeared to result in greater forage production, with a larger production of heads to stalks, than the other planting dates. Birds probably would not be a problem with large acreages of sunflowers grown for silage and harvested at immature stages. Although no yield or nutritive values were obtained, the study showed that sunflowers would grow well at Alfalfa, in spite of frosts and high winds.

Table 4. Effects of planting date and variety on forage yields of sunflowers grown under irrigation at Redmond, Oregon in 1975 and 1976.

| | Forage yield and percentage dry matter (DM) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1975 | | | | | | 1976 | | | | | |
| | May 12 | | | May 26 | | | May 12 | | | Avg | | |
| Varieties | green | dry | DM | green | dry | DM | green | dry | DM | green | dry | DM |
| | -tons/acre- | | % | -tons/acre- | | % | -tons/acre- | | % | -tons/acre- | | % |
| Peredovik | 13.2 | 4.7 | 35.7 | 17.8 | 5.4 | 30.2 | 14.5 | 3.4 | 23.1 | 15.2 | 4.5 | 29.6 |
| Sputnik | 15.0 | 5.2 | 35.0 | 19.5 | 6.5 | 33.1 | 16.8 | 4.5 | 26.9 | 17.1 | 5.4 | 31.6 |
| Krasnodarets | 8.8 | 3.2 | 36.4 | 12.4 | 4.8 | 38.3 | 9.7 | 2.9 | 30.0 | 10.3 | 3.6 | 35.3 |
| Issanka | 14.1 | 5.1 | 36.1 | 13.8 | 4.5 | 32.9 | 14.3 | 2.9 | 20.3 | 14.1 | 4.2 | 29.6 |
| Hybrid 896 | 13.4 | 4.9 | 36.8 | 12.0 | 4.3 | 36.3 | 17.1 | 4.7 | 27.5 | 14.2 | 4.6 | 32.6 |
| Hybrid 201 | 15.9 | 5.3 | 33.1 | 18.8 | 5.8 | 30.8 | 18.7 | 4.5 | 24.1 | 17.8 | 5.2 | 29.2 |
| Hybrid 894 | | | | | | | 20.9 | 4.2 | 20.0 | 20.9 | 4.2 | 20.0 |
| Arrowhead | 15.5 | 4.9 | 31.9 | 15.3 | 4.1 | 26.5 | 14.8 | 2.8 | 18.9 | 15.2 | 3.9 | 25.9 |
| Mingren | 11.5 | 4.2 | 36.3 | 13.9 | 4.2 | 29.8 | 15.2 | 4.0 | 26.0 | 13.5 | 4.1 | 30.6 |
| Dahlgren 694 | 17.6 | 5.4 | 31.0 | 14.5 | 3.5 | 23.8 | 19.3 | 4.3 | 22.4 | 17.1 | 4.4 | 25.7 |
| Sundak | 11.9 | 4.2 | 35.2 | 15.9 | 4.9 | 30.5 | 17.8 | 3.6 | 20.1 | 15.2 | 4.2 | 27.9 |
| Avg | 13.7 | 4.7 | 34.8 | 15.4 | 4.8 | 31.2 | 16.3 | 3.8 | 23.6 | | | |
| LSD 0.05, tons/acre | | 2.8 | | | 2.1 | | | 1.5 | | | 1.2 | |

#LSD 0.05 for dry forage date means is 0.6 tons/acre.

## Conclusion

This study showed that sunflowers should be planted in mid-May in Central Oregon to obtain optimum yields of seed, oil, or forage with the least danger of frost damage.

## Seedbed Preparation

Seedbeds should be well compacted to maintain soil moisture for seedling roots. Sandy soils especially should be firm because they lose moisture rapidly if they are loose. Irrigating before seeding helps to firm seedbeds and increases seed germination rates.

## Planting Depth

Seeds must be placed where soil moisture will be adequate for germination and emergence, but should never be deeper than 3 inches. Planting 2 inches deep in sandy soils and 1.5 inches deep in heavier soils should result in uniform stands.

## Row Width and Plant Population

Row width varies with the equipment used for planting. Performance in other areas has been best using 20- to 30-inch rows, but rows as wide as 40 inches and as narrow as 14 inches have resulted in high yields. Yield differences due to row width would not justify investing in new equipment. In all of the studies done at the Central Oregon Experiment Station, 36-inch rows have been used.

Sunflowers adjust to plant population differences by growing thick stalks with large heads and seeds at low populations and thin stalks with small heads and seeds at high populations. Seed size is very important in nonoil varieties grown for human food, but unimportant in oilseed varieties grown for oil. Plant populations for nonoil varieties may range from 12,000 to 20,000 plants per acre. Plant populations for oilseed varieties may range from 15,000 to 60,000 plants per acre. The plant population that is used may depend on soil fertility, moisture availability, and the crop for which the sunflowers are being grown.

Since yield potential can be influenced by population distribution and number of plants per acre, proper adjustment and operation of planting equipemnt is very important. Usually planters distribute seed well if correct plates for the seed size and sunflower seed kickers are used. Commercial seed companies supply correctly sized plates for the seed they sell.

## Irrigation

Sunflowers are drought tolerant and may produce well on less water than is needed for other crops grown in Central Oregon. This aspect has not been studied yet to determine how much less water is needed before yields are affected. In experiments done so far, plants have been irrigated with 1.5 inches of water every 5 to 7 days during the season.

Sunflowers reach a height of about 5 feet at maturity; this makes changing hand lines with high risers very difficult and prevents use of low wheel lines. Sunflowers are well adapted to flood irrigation, but care should be taken so that they are not over-watered, since wet conditions damage them more than dry conditions.

## Weed Control

Weeds in sunflowers can be controlled by either cultivation or herbicide application or a combination of both methods. Although sunflowers compete well with weeds, this competitive advantage is realized only after they are well established. Since the first 4 weeks after emergence are most critical from the standpoint of weed competition damage, early weed control is essential for maximum seed and forage yields.

### Cultural Control

Weeds can be controlled in sunflowers by cultural methods if the entire program is followed diligently. Weeds must be controlled in other crops in the rotation. During the year when sunflowers are grown, preplant, pre-emergence, and postemergence cultural control practices must be followed. If any one tillage operation is misused or poorly timed, the entire cultural control program may be ruined.

Weeds beginning to grow in early spring can be removed by discing or roto-tilling before planting. Sunflowers should be planted as soon as possible after the last tilling to give them an equal start with germinating weed seeds. Weeds may emerge before sunflowers during cool weather; these can be removed by harrowing. After the sunflowers emerge, weeds can be controlled with a row cultivator, taking care not to cover the sunflowers during the first cultivation. Depending on the amount of weeds in the field, more than one cultivation may be necessary. Sunflower roots are shallow and may be damaged by cultivating too closely to the plants; cultivation should not be any closer to the row center than the plant leaf spread.

### Chemical Control

In very weedy soils it may be necessary to use a combination of cultural practices and herbicides to control weeds. The following herbicides have been licensed for use on sunflowers. All should be used according to container label instructions.

EPTC (Eptam). Apply at rates of 2 pounds per acre on light sandy soils and 3 pounds per acre on heavier soils.

Although BARBAN (Carbyne), CHLORAMBEN (Amiben), and TRIFLURALIN (Treflan) are licensed for use on sunflowers, they have not been tested on sunflowers in Central Oregon.

## Harvesting

Sunflowers planted in mid-May in Central Oregon are usually ready to harvest for forage by late August or early September, and for seed by mid to late September.

### Seeds

Sunflower seeds are harvested by direct combining of standing plants. All combines used to harvest small grains will thresh sunflowers. Combines must be equipped with a front attachment designed to harvest sunflower heads with a minumum of stalks. The attachments are available from equipment manufacturers or can be made in local machine shops.

### Forage

Sunflower forage is harvested with the same equipment used to harvest corn for silage. Sunflower forage can be ensiled without additives; it contains everything necessary to form silage.

## Silage Quality

Palatability, nutrient composition, and digestibilty of silages may vary greatly depending on the maturity of the crop when ensiled, water content of the crop, and proportion of ears or heads to stalks. The palatability of sunflower silage has been found to be especially sensitive to maturity of the crop at time of ensiling. If ensiled at early maturity, when about 20 percent of the plants are in bloom, palatability of sunflower silage has been closer to that of good corn silage. Palatability differences may be due to different amounts of crude fiber, which increases with plant maturity. The lower palatability of sunflower silage as compared to good corn silage may reflect crude fiber contents of about 30 to 40 percent in sunflower silage and about 20 percent in good corn silage.

Crude protein content of plants also decreases as plants mature. If sunflowers are ensiled at early maturity the resulting silage has been found to have a crude protein content of about 10 percent, which is about equal to that of good corn silage.

Digestibility of sunflower silage also has been found to be highest when plants are ensiled at early maturity. Good corn silage contains about 13 to 18 percent total digestable nutrients, as compared to sunflowers silage which contains about 10 to 12 percent total digestible nutrients.

Nutrient compositions, and *in vitro* digestible dry matter of sunflower forage from varieties grown at Redmond are presented in Table 5. Because plants seeded on May 12 had a larger proportion of heads to stalks than plants seeded on May 26, only the May 12 planting was analyzed for nutritive values in 1975. Since May 12 was the only planting that survived a late spring frost, it was the only one analyzed in 1976.

Crude protein concentrations ranged from 9.14 to 11.42 percent in 1975, and from 8.06 to 14.34 percent in 1976. Crude fiber levels ranged from 31.48 to 42.75 percent in 1975, and from 25.38 to 39.00 percent in 1976. Lignin concentrations ranged from 5.77 to 8.98 percent in 1975, and from 3.62 to 6.77 percent in 1976. Protein levels were higher and fiber and lignin levels were lower in 1976 than in 1975 because plants were less mature when harvested in 1976.

Digestible dry matter was estimated on selected varieties in 1976. Percentages of in vitro digestible dry matter ranged from 52.2 to 59.1.

These analyses were done on plants in the early dough stages. The values are satisfactory and indicate that, from the standpoint of nutrient composition and digestibility, sunflowers grown in Central Oregon could be ensiled at that growth stage with good results. Because palatability of sunflower silage decreases as plants mature, sunflowers should be ensiled no later than the early dough stage.

Table 5. Nutrient composition* and in vitro digestible dry matter of sunflower forage from varieties grown at Redmond in 1975 and 1976.

| | 1975 | | | 1976 | | | |
|---|---|---|---|---|---|---|---|
| Variety | Crude protein | Crude fiber | Lignin | Crude protein | Crude fiber | Lignin | In vitro digestible dry matter |
| | % | | | | | | |
| Peredovik | 10.6 | 32.4 | 6.0 | 8.1 | 27.4 | 4.7 | 52.2 |
| Sputnik | 9.4 | 31.5 | 5.9 | 8.9 | 34.0 | 6.4 | |
| Krasnodarets | 10.1 | 36.7 | 7.1 | 13.1 | 27.6 | 4.7 | 58.4 |
| Issanka | 11.4 | 36.5 | 6.7 | 11.2 | 31.5 | 6.2 | |
| Hybrid 896 | 10.9 | 36.6 | 7.0 | 11.2 | 31.7 | 6.0 | |
| Hybrid 201 | 9.1 | 37.1 | 5.8 | 11.4 | 26.4 | 4.2 | 57.0 |
| Hybrid 894 | | | | 11.2 | 33.3 | 6.2 | 54.6 |
| Arrowhead | 9.9 | 42.8 | 9.0 | 14.3 | 32.6 | 5.4 | 59.1 |
| Mingren | 11.4 | 38.0 | 6.9 | 13.7 | 32.4 | 5.4 | |
| Dahlgren 694 | 10.3 | 33.3 | 6.5 | 9.6 | 25.4 | 3.6 | |
| Sundak | 10.7 | 39.6 | 7.2 | 12.9 | 39.0 | 6.8 | 58.0 |
| Avg | 10.4 | 36.4 | 6.8 | 11.4 | 36.6 | 5.4 | 56.6 |

*Dry matter basis.

An experiment done at the University of Minnesota in 1977 showed that sunflower silage was palatable and produced acceptable weight gains and growth of steers. The feeding value of sunflower silage plus ground barley ration (8 pounds/head/day) was compared to that of alfalfa haylage plus ground barley ration (8 pounds/head/day) in a trial with Holstein steers. Nutrient analyses of the feed used in the trial are presented in Table 6. Steers gained an average of 2.14 pounds per day on the sunflower silage-barley ration, as compared to 2.32 pounds per day for steers on the alfalfa haylage-barley ration (Table 7).

Table 6. Nutrient analyses of sunflower silage, alfalfa haylage, and barley used in a feeding trial at the University of Minnesota, 1977.

| Analysis | Sunflower silage | Alfalfa haylage | Barley |
|---|---|---|---|
| Dry Matter | 32.5 | 46.5 | 88.6 |
| Crude protein | 11.1 | 18.3 | 14.7 |
| Digestible protein | 6.8 | 11.9 | 12.4 |
| Crude fat | 7.1 | 2.4 | 2.1 |
| Crude fiber | 33.5 | 30.9 | 5.3 |
| Nitrogen free extract | 38.8 | 39.0 | 74.6 |
| Ash | 9.5 | 9.4 | 3.3 |
| Calcium | 0.8 | 1.5 | 0.3 |
| Phosphorus | 0.3 | 0.3 | 0.5 |

Table 7. Animal comparisons, feed consumption, and weight gain of dairy steers in a feeding trial at the University of Minnesota, 1977.

| | Sunflower silage | Alfalfa haylage |
|---|---|---|
| Animals, number | 19 | 19 |
| Days fed, number | 63 | 63 |
| Initial weight, lbs. | 748.88 | 749.50 |
| Final weight, lbs. | 882.99 | 895.63 |
| Forage/animal/day, lb as fed | 46.33 | 34.93 |
| Forage/animal/day, lb DM* | 15.06 | 16.23 |
| Grain/animal/day, lb as fed | 8.03 | 8.03 |
| Grain/animal/day, lb DM | 7.12 | 7.12 |
| Total feed/lb gain, lb DM | 10.42 | 10.08 |
| Total gain/animal, lb | 134.11 | 146.13 |
| Gain/animal/day, lb | 2.14 | 2.32 |

*DM = dry matter.

Adapted from: Marx, G. 1977. Sunflower silage A-OK. In Nutritional information on sunflower meal, sunflower hulls, sun-silage: the new forage crop. Mimeo from Ravenhorst, Bellows & Associates, Inc., Olivia, MN 56277.

## Seed Sources

Although local seed dealers do not maintain sunflower seed stocks on hand, if given sufficient notice, they can obtain seed of most open-pollinated varieties and some hybrids. Proprietary hybrids and open-pollinated varieties are available from the following partial list of companies:

AgPro Associates, P. O. Box 329, Lind, WA 99341
Cargill, Inc., 110 S. 7th Street, Minneapolis, MN 55402
Interstate Seed & Grain, 417 Main Ave., Fargo, ND 58102
Northrup King Co., 1500 Jackson Street N.E., Minneapolis, MN 55413
Pacific Oilseeds, Inc., P. O. Box 1008, Woodland, CA 95696.
Sigco Sun Products, Box 150, Breckenridge, MN 56520

## Sunflower Markets

Sale of sunflower seeds currently is more difficult than selling other grain crops in the Pacific Northwest. Because an oil extracting facility does not yet exist in the region, there are no local markets for seed. An oil extraction facility that would serve the region and that could process sunflower oil seeds, may be constructed within the next 3 to 5 years in Oregon or Washington. Construction of the facility appears to depend on whether sufficient acreage of oil crops (soybeans, rapeseed, sunflower, meadowfoam, crambe) would be seeded to supply adequate amounts of raw materials to maintain the facility in operation. This creates a problem because growers are understandably reluctant to plant oil crops unless the product can be sold. International markets do exist, however, and can absorb oilseed production until a regional oil extracting facility is built. The major problem in selling to international markets is accumulating cargo amounts of seed for shipment. Anyone who would like to produce sunflower oilseed for international markets should contact AgPro Associates, P. O. Box 329, Lind, WA 99341 before planting.

Sunflower confectionary seeds have a very limited market. Consequently, it is not feasible at this time to attempt producing them in Central Oregon in competition with other areas where confectionary seed production and processing are well established.

Sunflower forage can be marketed locally by feeding it as silage to livestock; this would appear to be the best present use of sunflowers in Central Oregon.

## SUMMARY

Central Oregon's cool climate and short growing season limit the kinds of crops that can be grown. A wider choice of crops is needed for crop rotations and production changes. A substitiute for corn silage to supplement livestock energy requirements is also needed. The sunflower is a short season plant potentially useful for seed, oil, and forage crops. Sunflower forage has substituted for corn in silage in other areas.

This report discusses aspects of sunflower production and presents results of studies on sunflowers done at the Central Oregon Experiment Station. The studies showed that sunflowers are adapted to Central Oregon conditions and that seed, oil, and forage yields would be high enough to justify their use. Mid-May was found to be the best time to plant for highest yields and least risk of frost damage. Depending on the variety used, a nitrogen fertilizer rate of 80 pounds per acre and seeding rate of 7.5 to 15 pounds per acre resulted in optimum oilseed and forage yields. Nutrient composition and digestibility of sunflower forage from varieties grown in Central Oregon compared favorably with values reported in other areas. Sunflower forage ensiled no later than the early dough stage should result in silage with a satisfactory feeding value. Due to present difficulties in marketing sunflower seeds in the Pacific Northwest, growing sunflowers for silage appears to be their best current use in Central Oregon.

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