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Sunflower Date of Planting Study in Western North Dakota, 2000

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Summary

An early-season NuSun sunflower (*Helianthus annuus* L. c.v. Mycogen 8242NS) cultivar was planted on four different dates at each of two different locations in southwest North Dakota. Soil crusting at the Hettinger Research Extension Center site reduced plant populations below acceptable levels and this site was abandoned. Cold soil temperatures, hail, and downy mildew reduced plant stands for the first two planting dates at the Bowman, ND site. Seed yield, oil yield, and oleic content of the oil produced tended to be greater for the May 24 planting date than dates preceding or following. Seed test weight and oil content were significantly higher for May 10 and May 23 planting dates compared to the planting dates prior to or following. Delaying seeding 14 days past May 24 in 2000 resulted in a reduction in gross revenue of $7.23 per acre.

Introduction

Sunflower is considered a late season crop in much of North Dakota with planting occurring as late as the last half of June. Late June plantings often result in lower yields and oil content. When harvest is delayed by weather, as seen in the fall of 1998, mechanical drying of seed is required thus adding to production expenses.

There has been minimal date of planting research in southwest North Dakota. Southwest North Dakota tends to have less snow cover, thus soils tend to warm and dry out earlier than in other parts of the state. Mandan Indians were known to plant sunflower in April in the Bismarck-Mandan area (Anonymous, 1989). Sunflower has been planted successfully in late April in parts of Minnesota and South Dakota (Robinson, 1970). Yields and quality of early-planted sunflower has generally been above average. Seeding date and the effect of plant density has been studied in Canada (Gubbels, 1989, and Dedio, 1985) and at Minot, ND (Zarnstorff, 1998).

No-till producers in southwest North Dakota promote the need for early closure of the crop canopy (Manitoba-North Dakota Zero Tillage Farmers Assoc., 1997). Early canopy closure produces a more favorable microclimate of humidity and cooler soils resulting in a more efficient use of available moisture for plant development. Early canopy closure also provides more competition to late germinating weeds when compared to late seeded crops that shade the ground later in the season. In date of seeding trials conducted at Mandan, ND and at

Akron, CO when sunflower was seeded prior to peak weed emergence, the crop provided increased competition to the weeds (Tanaka and Anderson, 1998, 1997).

If sunflowers are seeded early in narrow rows and weeds are controlled early with pre-plant and post plant herbicide products, early canopy closure should control late germinating weeds, eliminating the need for herbicides or cultivation later in the season. Also early planting will provide producers the opportunity to harvest high quality seed earlier with less cost required for post harvest handling.

Increased yield and quality of sunflower planted at the proper date and cultural practices will improve producers' net returns. Sunflower planted in narrow row spacing may help producers in southwest North Dakota succeed in growing sunflower since sunflower may be more competitive than weeds when grown in narrow rows. Limited water would be used by the crop to increase marketable grain rather than by unwanted weed biomass. Soil moisture is usually the limiting factor for crop yields when grown in diverse rotations in southwest North Dakota. Early planted sunflower may be more effective in utilizing available moisture and precipitation than sunflower that is planted at the current recommended dates for the state. Early seeding should mean early harvest thus providing a greater chance for soils to be recharged with moisture prior to seeding the next crop in the rotation sequence.

The objective of this project is to determine and demonstrate the optimum planting date of sunflower for southwestern North Dakota.

Materials and Methods

Two sites were selected in southwestern North Dakota. These sites were at Bowman and the Hettinger Research Extension Center. A randomized complete block design with four replications for each seeding date was used at each site. Size of the plot area at each location varied according to the equipment utilized. Plot size at Bowman was 40 feet by 2680 feet and at the Hettinger Research Extension Center 10 feet by 20 feet. Each site was soil tested and fertilized according to soil test results for a 1500 to 2000 pound per acre yield. Anhydrous ammonia was used as the source of nitrogen at the Bowman site while urea was used at the Hettinger site. Additional nitrogen, phosphorous, potassium, and a micronutrient mix was applied through the drill at the Bowman site. Additional nitrogen and phosphorous was deep banded prior to planting at the Hettinger site.

Stored soil moisture was estimated at the first planting date using the Brown soil moisture probe. Stored soil moisture at the Bowman site was estimated to be 4.4 inches in the upper 3.5 feet of soil in 2000 using the Brown soil moisture probe (Brown, 1958). Precipitation (Figure 1) was measured with an automated self-tipping bucket in 2000 at the Bowman site. Heat units (Figure 2) were calculated from the North Dakota Agricultural Weather Network site near Bowman, ND.

Sonalan 10 G (ethalfuralin) at the rate of ten pounds per acre was pre-plant incorporated and Poast (sethoxydim) was applied post-emergence at the rate of one pint per acre for weed control at both sites. In addition to the herbicides used plots were hand weeded to control kochia and Russian thistle at Bowman and Hettinger.

The NuSun sunflower cultivar 8242NS was planted at both locations. A 40-foot Concord air drill with low disturbance points was used at

Bowman and a cone plot drill was used at Hettinger. The seeding rate was adjusted for a final harvest population of 23,000 plants per acre at Bowman. At Hettinger, plots were over-seeded and hand thinned to the desired plant stand.

Fields were scouted on a regular basis for stage of crop development (Figure 3 and Figure 4), pests and beneficial insects. Sunflower beetle (Zygogramma exclamationis) adults and larva population levels as well as sunflower moth (Homoeosoma electellum) adult populations were low throughout the season and did not require treatment. Black sunflower stem weevil (Apion occidentale) was noted at all locations but populations were low.

The Hettinger site was abandoned after crusting problems occurred on the second, third, and fourth planting dates in 2000. In 2000, cold, and wet soil conditions along with downy mildew (Figure 5) appear to have reduced final harvest stands at Bowman. Plots were scouted for wireworm but neither insects nor feeding symptoms were found. A hailstorm on June 3, 2000 at the Bowman site further reduced the plant stand for the April 26 and May 10 seeding dates.

The center 30 feet of each plot at Bowman was harvested using producer equipment and seed weight taken for each plot using a digital weigh scale at the farmstead. In 2000, the April 26 planting date was harvested on September 25 and the remaining planting dates were harvested on September 28. Final plant stands were taken at harvest. Seed was weighed from each plot and sampled for moisture and dockage. Moisture and dockage adjustments were made and the results reported. Dr. Jerry Miller, ARS, NDSU, Fargo, ND analyzed seed for oil content using Nuclear Magnetic Resonance (NMR) and fatty acid profile using gas chromatography.

Results and Discussion

The harvest plant populations (Table 1) for the 26 April and 10 May planting dates were significantly less than harvest plant populations for the 24 May and the 7 June planting dates. A hailstorm on 3 June injured emerged plants of the first two planting dates but not the last two planting dates. Downy mildew was found in all planting dates but no differences in incidence of the disease were observed. Soil and air temperatures after planting but prior to emergence may have affected stand establishment of the first two seeding dates (Blamey et. al. 1997).

Grain yield of the 24 May planting date was significantly greater than the first planting date but not compared to the planting date immediately preceding or following. Test weight and seed oil content was greatest for the 10 May and 24 May planting dates in comparison to the first and last date of seeding. Oil produced per acre, which is the grain yield per acre multiplied by seed oil content, is significantly greater for the 23 May planting date in comparison to the first planting date.

Oleic content of oil was greater than 50 percent for all planting dates in 2000. In 1999 the first and last planting dates at this site produced seed with oleic acid content less than the minimum required by processors (Ashley et. al. 1999). Blamey et. al. (1997) suggested that planting date can influence oil quality especially the percent of linoleic and oleic in sunflower oil.

Implications

In a year when limited water stressed the crop and warmer than normal temperatures occurred during the latter half of the growing season, yield was reduced by 5.2 pounds per acre for each day that planting was delayed past 24 May until 7 June. If sunflower is valued at $0.10 per pound then the total cost of delaying planting from 24 May to 7 June was $7.23 per acre.

This study will be conducted a third year (2001) at the Miles Hansen Farm near Bowman.

Cooperating Producers and Organizations

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Table 1. Harvest plant population, grain yield, test weight, oil content, and pounds of oil produced per acre in the Sunflower Date of Seeding Study on the Miles Hansen Farm, Bowman, ND, 2000.

						----------Fatty acids----------			
Date	Plant population	Grain yield[1]	Test weight[1]	Seed oil content[1]	Oil produced	Palmitic	Stearic	Oleic	Linoleic
	no./acre	lb/acre	lb/bu	%	lb/acre	----------%----------			
26-Apr	11598	1159.3	26.1	40.0	463.3	5.1	4.8	55.8	32.5
10-May	14066	1310.2	27.1	42.5	557.2	4.8	4.6	57.9	30.9
24-May	20074	1434.5	27.0	42.7	612.2	5.2	4.7	62.4	25.4
7-Jun	18440	1362.2	25.9	41.1	560.0	4.9	4.4	58.5	30.5

Mean	16044	1316.5	26.5	41.6	548.2	5.0	4.6	58.6	29.8
CV%	16.1	11.3	1.9	1.7	11.5	--	--	--	--
$LSD_{.05}$	4122	238.0	0.8	1.1	101.1	--	--	--	--

[1] Adjusted to 10% moisture basis

Figure 1. Fifteen year average and 2000 precipitation for May through September at the Miles Hansen Farm, Bowman, ND.

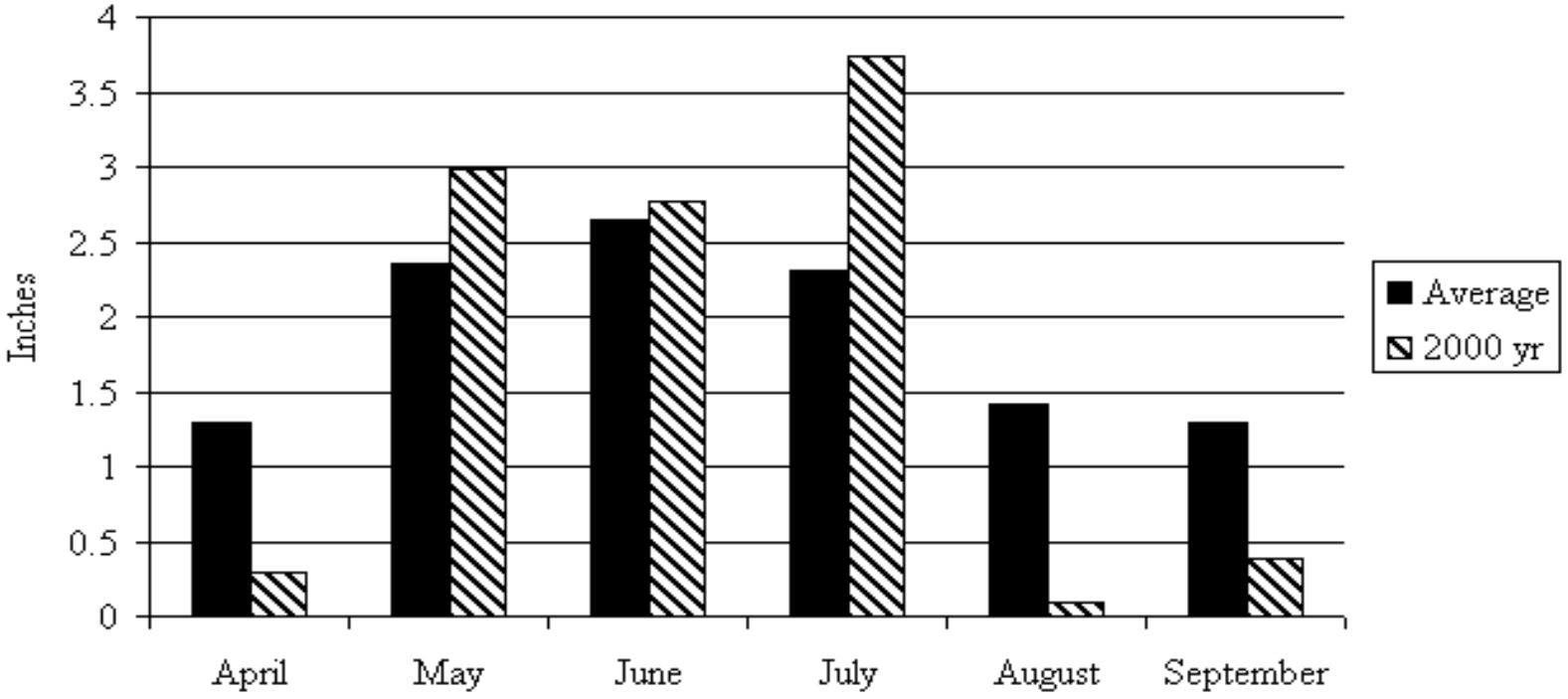

Figure 2. Seven year mean and 2000 cumulative growing degree days May through September for North Dakota Agricultural Weather Network station at Bowman, ND.

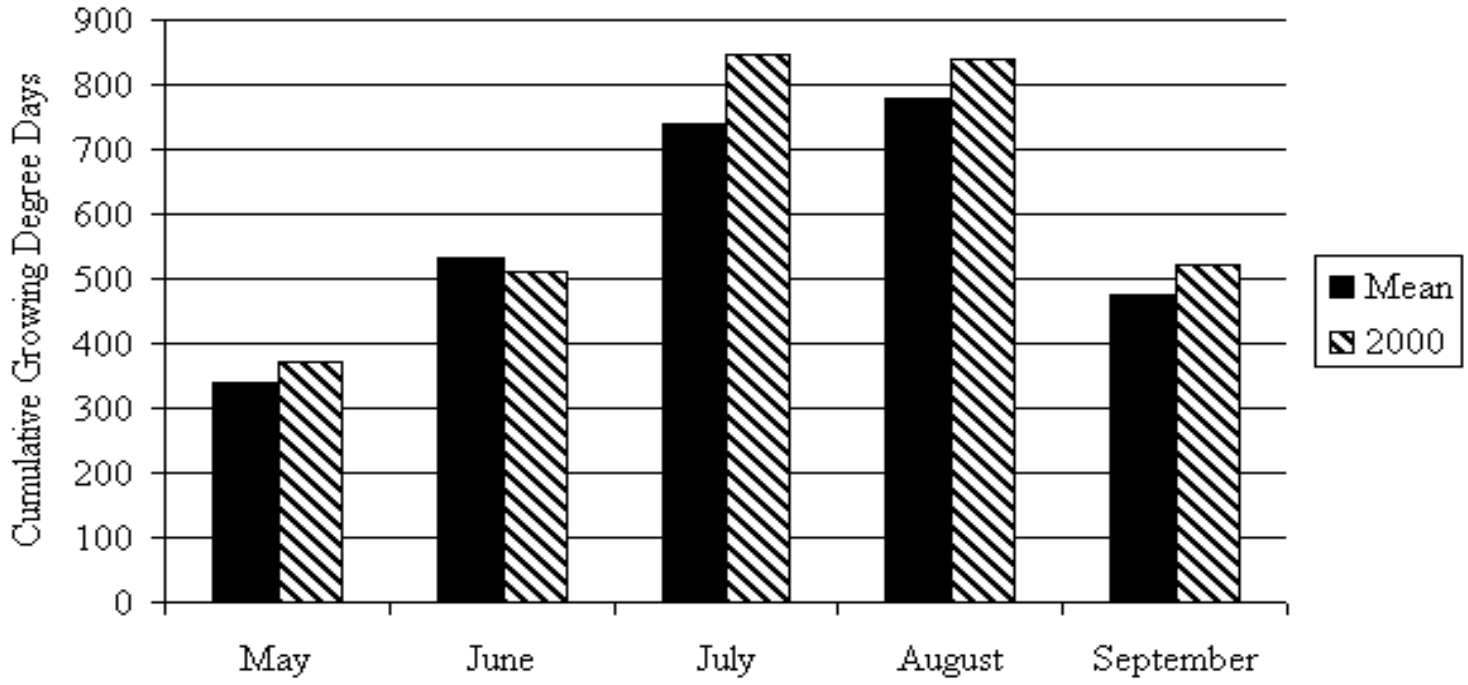

Figure 3. Plant counts for four planting dates on the Miles Hansen Farm near Bowman, ND on July 6, 2000.

April 26 Plainting Date - 12,000/acre

May 10 Planting Date - 16,000/acre

May 23 Planting Date - 24,000/acre

June 7 Planting Date - 22,500/acre

Figure 4. Stage of development for the four planting dates on August 10, 2000 on the Miles Hansen Farm, Bowman, ND.

April 26 Plainting Date - R7

May 10 Planting Date - R6

May 23 Planting Date - R5.8

June 7 Planting Date - R4

Figure 5. Downy mildew in sunflower field, Miles Hansen Farm, Bowman, ND, 2000.

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