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PROJECT TITLE: Dryland Evaluation of Standard and Specialty Oil Safflower Varieties.

PROJECT LEADER: Gregg R. Carlson, Agronomist - Havre

PROJECT PERSONNEL: Jerald W. Bergman, Safflower Breeder - Sidney
Thomas L. Allen, Research Specialist - Havre

OBJECTIVES:

Safflower serves as an excellent crop component in many areas of northern Montana in flexible dryland rotations with small cereal grains. A significant portion of the north central cropping area has climatic conditions suitable for production of standard oil safflower; and certain smaller, yet significant areas further have specific climatic conditions required for production of specialty safflower lines of the high-oleic oil type. It is the objective of this study to evaluate existing commercial entries along with promising experimental lines being developed at Sidney to determine varietal appropriateness, and subsequent release and recommendation information specific to environmental conditions in northern areas. The MAPS program is utilized to refine the definition of areas appropriate for the production of quality safflower.

RESULTS:

All entries in the 1997 safflower variety trial performed rather poorly when compared with long-term safflower performance at Havre. Although planting date (18 days and 13 days before last 1997 freeze and long-term average last freeze, respectively), was reasonably early; seedling development and early vegetative growth was sluggish. Stand and biomass development was below that expected under 1997 growing conditons. Flowering date was about as late as can be considered comfortable at Havre in terms of achieving an adequate stage of maturity before first frost.

July mean temperature was 69.2 degrees F, and Total Growing Degree Day (GDD) values (base 50) were 108 percent of normal. Mean yields were less than half of normal, and both test weight and percent oil values were below normal for Havre.

Stand percent, flower date, plant height, yield, test weight, and oil data for the 1997 trial are presented in Table 1. Long-term (1988-1997) yield and percent oil summaries on selected entries are presented in Table 2.

SUMMARY:

Single trials were established annually on-station at Havre using standard plot techniques in a randomized complete block design. Entries were planted in 4 or 6-row plots, 20 feet in length on a 12-inch spacing utilizing a `Rem' self-propelled cone seeder equipped with `Acra-plant' hoe openers. Plots were trimmed to 16 feet and harvested with a plot combine. Other variables specific to the trials are listed in the data table. Data is summarized for selected entries having been tested 3 years or more during the reporting period 1988-1997. No data were available for 1992 due to severe hail injury, nor the 1993 crop due

to a short, cool, and wet growing season.

FUTURE PLANS:

It is planned that these investigations be continued on an annual basis in on-going support of the Montana safflower breeding and variety development project.

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TABLE 1. DRYLAND FALLOW MONTANA UNIFORM SAFFLOWER VARIETY EVALUATION NURSERY. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1997.

VAR/SELN	DESCRIPTION	STAND %	FLOWER DATE 1/	PLNT HT Inches	YIELD Lbs/Ac	TEST WT Lbs/Bu	OIL % @0%Moist.	---- OIL ---- % @8%Moist.	Lbs/Ac
CENTENNL	MT Cert. #901-1925	98.93	208.33	23.36	673.50	38.83	42.02	38.66	260.17
95B 6701	96 DOl3 #125	90.37	209.33	17.87	653.83	38.07	41.10	37.81	251.90
94B 6109	96 DOl1 #229/126	93.77	205.67	18.74	643.40	37.70	41.68	38.35	246.83
95B 6644	96 WOl7 #89 120	92.70	204.33	18.18	637.30	37.30	40.24	37.02	235.73
94B 6678	96 DOl2 #111	90.33	208.00	18.28	614.10	38.77	41.95	38.59	237.13
95B 7181	96 DOl5 #115	85.90	206.67	19.93	597.17	40.27	38.73	35.63	213.87
95B 7348	96 DOl5 #310/130	96.87	206.00	19.17	574.73	38.10	41.05	37.77	217.90
91B 2166	95 DLO4 #303/106	95.83	206.33	20.01	567.63	35.87	37.04	34.08	193.07
91B 6342	94 DOl3 #325/111	95.07	205.00	18.20	562.17	37.67	40.43	37.19	209.90
S-518	SeedTec Int'l	98.43	206.33	19.23	560.77	37.40	42.70	39.29	221.13
95B 7174	96 DOl5 #114	97.70	205.33	20.35	540.17	38.00	41.19	37.89	204.93
95B 6704	96 DOl3 #126	94.80	207.67	19.15	519.50	39.07	39.82	36.63	190.20
91B 6668	94 MTDSVT #302/117	90.10	206.67	18.92	517.43	36.07	39.34	36.19	187.47
91B 3842	96 DLi2 #113	96.63	205.33	21.59	484.20	36.70	44.02	40.50	197.67
FINCH	FSF #95/21 Williston	94.80	206.33	22.09	469.97	39.10	36.19	33.29	156.43
MORLIN	MT Cert. #921-1631	96.10	209.33	20.18	466.57	37.33	37.85	34.82	162.43
95B 6713	96 WOl6 #88 122	87.50	206.33	19.92	460.97	28.90	42.97	39.53	184.87
MONT2000	MT Cert. #911-906	97.40	206.67	18.23	452.30	35.80	39.82	36.64	165.67
ERLIN	MT Cert. #951-900	95.60	204.33	19.00	421.17	37.73	37.44	34.45	144.80
MONT2001	MT Cert. #941-1780	68.23	210.67	19.30	315.87	33.90	37.35	34.36	108.70
EXPERIMENTAL MEANS		92.85	206.73	19.59	536.64	37.13	40.15	36.93	199.54
C.V. 2: (S OF MEAN/MEAN)*100		2.05	.37	2.42	10.87	1.75	1.47	1.47	12.29
LSD (0.05)		5.46	2.20	1.36	167.01	1.86	1.69	1.56	70.22

1/ No. of Days from January 1 (207 = July 26)

CLIMATIC and NURSERY MANAGEMENT DATA

Exp #: 97-7702-SA Field: An-4-5 Design: __N/A__ # Ents: 20 # Reps: 3 Plot-Obsrv: 108sqft. Hvst-Obsrv: 64 sqft.
Qtr: ___SWNW___ Section: 33 Twnshp: 32 N Range: 15 E Latitude: 48.48 N Longitude: 109.78 W Elevation: 2689 ft.

Seeding Date: 05/02/97 Sd'g Depth: 1.75 in. Depth to Moisture @ Sd'g: 1.50 in. Moist Soil Depth @ Sd'g: 55.0+ in.
Soil Temp @ Sd'g: __._F @ 1 in. 72.0F @ 2 in. 58.0F @ 4 in. Soil Texture: CL Soil Series: __Joplin/Hillon CL___
Cropping System: ___ Fallow ____ Recrop ____ Full-Till _X_ Reduced-Till ____ No-Till # Tillages: 5 # Chem Apps: 1
Cropping System Details: 1x Chem Flw 9/95, 1x Sweep Till 5/96, 2x Sweeps/Rods 7&9/96, 1x Sweeps/Rods + 1x TrplK 4/97
Cropping History: 1 Yr Ago = 96 = ____Fallow____ 2 Yrs Ago = 95 = ___Safflower__ 3 Yrs Ago = 94 = ____Fallow____
Fertilizer: 70#N,40#P2O5,25#K2O/ac via gran. blend bd'cst & till-incrop. 9/96_ Herbicide: "Sonalan" PPI @2.0 Pts/ac
Harvest Date: 10/01/97 Root Penetration Depth: 38 in. Comments: __Pre-Plant Soil Analysis was Pre-Fertilization___

Depth	PRE-PLANT SOIL ANAL 09/10/96 (Max Depth=48")									04/01/97	POST-HVST SOIL ANAL 10/06/97 (Max Depth=48")								
	in. PAW	pH	% OM	Lb/a NO3	ppm P	ppm K	ppm S	Soil Text	CEC Txt	in. PAW	in. PAW	pH	% OM	Lb/a NO3	ppm P	ppm K	ppm S	Soil Text	CEC Txt
0 -6"	.81	8.0	1.4	30	16	337	11	CL	21.8	.92	.47	8.1	1.7	8	19	301	13	CL	21.8
6-24"	3.18			54			20	CL		3.07	1.15			30			29	CL	
24-36"	.94			64				SCL-		1.70	.76			28				CL	
36-48"	1.16			100				SCL-		1.56	1.20			68				CL	
TOTAL:	6.09			248						7.25	3.58			134					

Precipitation & Stored Soil Water Summary: 04/01/97 to Sd'g: 0.58 in. (0.42 in events =>.1 in.) Calc'd Initial Soil Water @ Sd'g: 6.67 in.
Sd'g to 10/06/97: 7.16 in. (6.55 in events =>.1 in.) Meas'd Resid Soil Water 10/06/97: 3.58 in.
Growing Season (05/02/97 to 14 days prior to Harvest Maturity: 7.13 in.) (6.55 in events =>.1 in.)
Post-Grwg Seas (14 days prior to Harvest Maturity to 10/06/97: 0.03 in.) (0.00 in events =>.1 in.)
Adj'd Summary: Init GS H2O Inv + 'Init GS Inv to Hvst' Prec - Hvst Resid H2O - 'PostGS' Prec (Calc'd ET: 10.81 in.)

TABLE 2. TEN-YEAR YIELD AND PERCENT OIL SUMMARY ON SELECTED ENTRIES FROM A FALLOW SAFFLOWER VARIETY PERFORMANCE NURSERY. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1988-1997.

VARIETY OR SELECTION	NO. OF YEARS TESTED 1/	YIELD (POUNDS PER ACRE) 1993 2/	1994	1995	1996	1997	AVERAGE FOR YEARS TESTED	10-YR. COMPAR. AVERAGE YIELD 3/	PERCENT OF CHECK YIELD 4/	OIL (Percent by Weight) @ 8% MOISTURE 1993 2/	1994	1995	1996	1997	AVERAGE FOR YEARS TESTED	10-YR. COMPAR. AVERAGE OIL % 3/	PERCENT OF CHECK OIL % 4/
STIRLING	3	-	1185.1	2240.7	1126.5	-	1517.4	1333.9	134.0	-	35.3	32.5	33.1	-	33.6	35.2	84.3
FINCH	8	-	1072.1	1727.0	1048.8	470.0	1134.9	1134.9	114.0	-	37.2	34.7	34.7	33.3	36.9	36.9	88.5
MORLIN	5	-	813.8	1898.6	942.0	466.6	1185.1	1110.8	111.6	-	41.0	37.1	35.1	34.8	37.0	38.5	92.4
SAFFIRE	5	-	1173.2	-	-	-	1026.1	1092.7	109.8	-	34.7	-	-	-	33.8	32.5	77.9
S-208	6	-	966.8	1795.6	-	-	1157.2	1088.0	109.3	-	40.6	35.2	-	-	40.0	39.1	93.7
90B 6011	3	-	873.8	1763.9	1024.6	-	1220.8	1073.2	107.8	-	41.8	35.6	38.1	-	38.5	41.4	99.3
85B1837	3	-	-	-	-	-	850.6	1055.4	106.0	-	-	-	-	-	40.5	38.0	91.2
MONT 2000	6	-	952.1	1997.6	972.1	452.3	1066.2	1017.5	102.2	-	43.0	39.0	40.2	36.6	40.4	41.8	100.2
S-541	7	-	907.3	1821.7	918.4	-	1046.3	1000.0	100.4	-	42.9	40.1	40.6	-	42.9	42.4	101.7
CENTENIAL	8	-	780.6	1679.5	937.7	673.5	995.7	995.7	100.0	-	42.1	38.6	39.0	38.7	41.7	41.7	100.0
91B 6668	4	-	888.6	1741.1	870.4	517.4	1004.4	982.5	98.7	-	42.0	37.9	37.3	36.2	38.3	40.4	96.8
87B1298	3	-	-	-	-	-	961.7	981.1	98.5	-	-	-	-	-	39.6	38.6	92.6
ERLIN	4	-	873.2	1784.9	925.0	421.2	1001.1	979.3	98.4	-	40.6	37.3	35.9	34.5	37.1	39.0	93.6
82B3555	3	-	-	-	-	-	850.7	957.4	96.2	-	-	-	-	-	43.2	40.5	97.2
87B1650	3	-	-	-	-	-	907.3	921.9	92.6	-	-	-	-	-	39.7	42.7	102.3
88B 3006	3	-	813.8	1628.6	-	-	1137.7	918.5	92.2	-	41.0	37.3	-	-	39.7	40.5	97.1
85B4431	4	-	-	-	-	-	876.9	896.9	90.1	-	-	-	-	-	39.0	37.1	89.1
GIRARD	6	-	830.0	1618.0	-	-	930.2	874.6	87.8	-	40.5	35.9	-	-	40.0	39.1	93.8
S-317	4	-	975.3	-	956.5	-	1021.0	837.4	84.1	-	41.9	-	38.8	-	40.3	40.8	97.8
MT 3697	4	-	761.8	-	-	-	771.6	824.8	82.8	-	43.1	-	-	-	43.6	41.4	99.4
5/ OKER	5	-	692.6	-	-	-	749.4	798.1	80.2	-	39.0	-	-	-	40.4	38.7	92.9
83B1954	3	-	-	-	-	-	677.0	761.9	76.5	-	-	-	-	-	43.1	40.4	97.0
MONT 2001	4	-	822.9	1533.7	922.7	315.9	898.8	688.9	69.2	-	42.3	37.8	38.7	34.4	38.3	40.3	96.7
85B3918	3	-	-	-	-	-	492.7	554.5	55.7	-	-	-	-	-	45.6	42.8	102.6
MEAN (ENTRIES LISTED)		-	904.9	1787.0	967.7	473.8	-	953.3	-	-	40.5	36.9	37.4	35.5	-	39.6	-
6/ Grwg Ssn Ppt. (in.)		-	6.32	14.12	6.28	7.14	8.27										
Sl PAW in. to SD at Plt		-	7.91	7.25	8.88	7.25	8.24										
Tot Plt Avl Water (in.)		-	14.23	21.37	15.16	14.39	16.51										
Soil NO3(lbs) to SD@Plt		-	250.0	210.0	88.0	248.0											
SD (Smplng Dpth inches)		-	48.0	48.0	48.0	48.0											
Fertilizer App. (# N)		-	70.0	70.0	70.0	70.0											
(# P2O5)		-	40.0	40.0	40.0	40.0											
(# K2O)		-	0.0	25.0	25.0	25.0											

Check variety is Centennial.

1/ Only the five most recent years are shown, but the summary calculations include all the years noted.
In 1991 stands were variable due to soil crusting following a 1.8" cloudburst 10 days after seeding. Affected most were Finch, 85B 3829, Oker, and Saffire.
The 1992 nursery was destroyed by hail in July and frost in August.

2/ The 1993 nursery was destroyed by frost and snow in August.

3/ 10-yr. CA = (x/y) * where x = average yield or oil content of the entry for years tested, y = average yield or oil content of Centennial for the same years, and z = 10-yr. average yield and oil content for the check variety Centennial.

4/ Percent of Centennial yield or oil content for the same data years.

5/ 80B 2793 in 1982, 80B 2793-2 in 1983.

6/ Seeding to 14 days prior to harvest maturity.