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

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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 possess 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 1995 safflower variety trial performed exceptionally well, particularly in view of the cooler temperatures and shortened frost-free period. Although sown reasonably early (May 1), flowering date was a week later than that considered comfortable in terms of achieving an adequate stage of maturity before first frost. Early growth was slow, but abundant moisture throughout the season afforded luxuriant growth - possibly the best ever seen at the Havre station.

July mean temperature was only 66.3 degrees F, and Growing Degree Day (GDD) values (base 50) were 90 percent of normal, but July-September GDD was 97 percent of the 1951-1995 average for Havre. Mean yields, at over 1,750 lbs/ac, were coupled with test weights averaging 39.8 lbs/bu, 8%-moisture oils achieving a mean of 37.0 percent, and subsequent oil production averaging 650 lbs/ac.

Stand percent, flower date, plant height, yield, test weight, and oil data for the 1995 trial are presented in Table 1. Long-term (1986-1995) yield and percent oil summaries on selected entries are presented in Table 2.

`Finch', Montana developed, currently yields very well among released, standard cultivars on a `Ten-year Comparable Average' basis at Havre. Finch, a white-hulled line, features higher test weight; and serves as a more disease-resistant replacement for `S-208' in the birdseed market. However, the average oil content of S-208 is 2 percent higher than that of Finch.

`S-317' (oleic), S-208 and `S-541' continue to perform very well under dryland conditions in the Havre area as alternaria and/or pseudomonas disease organisms have generally not become factors limiting production. `Saffire' has yielded well, but its' oil content is 17 and 23 percent lower than S-208 and S-541, respectively. Other named varieties among those yielding slightly less, but

within 10 percent of the check are `Montola 2000' (high oleic) and `Centennial.' Their 10-Yr Comparable Average oil production is 107 and 100 percent of S-208 and S-541, respectively.

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 `Hege 125C' 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 1986-1995. 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.

NARC will continue to cooperate with a portion of NWARC's current investigations regarding the potential for use of safflower as a livestock forage. It is unlikely that under Havre area dryland conditions growers would plant safflower with intentions of haying it as is being done in western Montana, but the potential for salvaging as forage a crop which is not expected to produce mature seed is gaining interest. Such flexibility may, at least for diversified operators, provide greater incentive to grow safflower for the rotational benefits it offers in a small grain program.

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TABLE 1. DRYLAND FALLOW MONTANA UNIFORM SAFFLOWER VARIETY EVALUATION NURSERY. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1995.

1/ VAR/SELN	DESCRIPTION	STAND %	FLOWER DATE 2/	PLNT HT Inches	YIELD Lbs/Ac	TEST WT Lbs/Bu	OIL % @0%Moist.	---- OIL ---- % @8%Moist.	Lbs/Ac
STIRLING	94MTDSVT #213/112,EARC	98.43	217.33	27.91	2240.67	42.03	35.30	32.48	728.20
MONT2000	MT Cert.#911-906	99.47	219.33	27.30	1997.60	37.93	42.43	39.04	783.40
91B 1130	94DLI3 #108,EARC	100.00	218.00	32.41	1905.93	39.47	40.50	37.26	714.93
MORLIN	MT 911-880	99.23	219.33	30.64	1898.63	38.10	40.37	37.14	707.07
S-541	SeedTec Lot# 02061	100.00	220.00	31.76	1821.73	40.27	43.63	40.14	731.50
S-208	SeedTec 83WW045-8	100.00	219.00	32.09	1795.60	39.93	38.30	35.23	634.20
90B 2763	94MTDSVT #214/116,EARC	99.47	216.33	29.70	1784.87	39.83	40.57	37.32	668.50
90B 6011	94MTDSVT #115,EARC	99.47	218.67	32.61	1763.90	39.23	38.70	35.60	631.07
91B 6668	94MTDSVT #117,EARC	100.00	218.33	29.53	1741.07	40.13	41.17	37.87	661.93
FINCH	ND Lot# FS 2003&2004	98.97	219.00	30.84	1727.03	43.07	37.73	34.72	600.37
91B 1712	94DLI4 #315/109,EARC	100.00	218.67	28.67	1684.93	39.47	41.80	38.45	652.07
CENTENNL	HV Cert.#901-1925	100.00	219.00	32.02	1679.53	40.80	41.93	38.58	650.87
91B 1126	94DLI3 #327/107,EARC	99.47	218.67	31.76	1633.13	42.07	39.13	36.00	590.37
88B 3006	94MTDSVT #114,EARC	100.00	220.00	31.89	1628.57	39.53	40.50	37.26	607.00
GIRARD	ND Lot# GS 2006	99.47	219.33	34.06	1618.03	39.87	39.07	35.94	582.50
MONT2001	Cert.# 941-1780,SARC	98.43	218.67	29.33	1533.70	37.10	41.03	37.75	579.37
91B 2676	94DLI2 #327/107,EARC	100.00	219.00	32.74	1386.37	38.10	41.57	38.24	533.23
EXPERIMENTAL MEANS		99.55	218.75	30.90	1755.37	39.82	40.22	37.00	650.39
C.V. 2: (S OF MEAN/MEAN)*100		.59	.26	3.23	5.13	1.04	1.51	1.51	5.41
LSD (0.05)		1.70	1.63	2.87	259.20	1.19	1.75	1.61	101.45

1/ Entry 'Oker' was deleted from ANOVA due to poor stand arising from defective seed.
2/ No. of Days from January 1 (219 = August 7)

CLIMATIC and NURSERY MANAGEMENT DATA

Exp #: 95-7702-SA Field: An-4-5 Design: __RCB__ # Ents: 18 # 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: 05/01/95 Sd'g Depth: 1.50 in. Depth to Moisture @ Sd'g: 0.50 in. Moist Soil Depth @ Sd'g: 55.0+ in.
Soil Temp @ Sd'g: 62.0F @ 1 in. 62.0F @ 2 in. 56.0F @ 4 in. Soil Texture: CL Soil Series: Kevin-Joplin-Hillon CLs
Cropping System: _X_ Fallow ___ Recrop ___ Full-Till _X_ Reduced-Till ___ No-Till # Tillages: 4 # Chem Apps: 1
Cropping System Details: 1x Chem Flw 9/93, 1x Sweep Till 5/94, 2x Sweeps/Rods 7&9/94, 1x Triple K 4/95 (seed'g prep)
Cropping History: 1 Yr Ago = 1994 = ___Fallow___ 2 Yrs Ago = 1993 = _Cer.Museum_ 3 Yrs Ago = 1992 = ___Fallow___
Fertilizer: 70#N,40#P2O5,25#K2O/ac via gran. blend brd'cst & till-incorp. 4/95 Herbicide: 'Treflan'@ 1.5 pts/ac PPI
Harvest Date: 10/11/95 Root Penetration Depth: __ in. Comments: __Pre-Plant Soil Analysis was Pre-Fertilization___

Depth	PRE-PLANT SOIL ANAL 04/13/95 Max Depth=48"								__/__/__	POST-HVST SOIL ANAL __/__/__ (Max Depth=__")								
	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"	.94	8.2	1.2	10	12	222	15	CL	21.8	_____	____	___	___	___	___	___	___	____	____
6-24"	2.68			60			23	CL		_____	____			___			___	____	
24-36"	1.53			80				CL		_____	____			___			___	____	
36-48"	1.38			60				CL		_____	____			___				____	
										_____	Inadvertently, No Post-Hvst Sample was Taken								
TOTAL:	6.53			210						_____	____			___					

Precipitation & Stored Soil Water Summary: 04/13/95 to Sd'g: 0.72 in. (0.48 in events =>.1 in.) Calc'd Initial Soil Water @ Sd'g: 7.25 in.
Sd'g to 10/11/95: 14.97 in. (14.01 in events =>.1 in.) Meas'd Resid Soil Water __/__/__: N/A in.
Growing Season (05/01/95 to 14 days prior to Harvest Maturity: 14.12 in.) (13.34 in events =>.1 in.)
Post-Grwg Seas (14 days prior to Harvest Maturity to 10/11/95: 0.85 in.) (0.67 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: N/A 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. 1986-1995.

VARIETY OR SELECTION	NO. OF YEARS TESTED 1/	YIELD (POUNDS PER ACRE) 1991 2/	1992 3/	1993 3/	1994	1995	AVERAGE FOR YEARS TESTED	10-YR. COMPAR. AVERAGE YIELD 4/	PERCENT OF S-208 YIELD 5/	OIL (Percent by Weight) @ 8% MOISTURE 1991 2/	1992 3/	1993 3/	1994	1995	AVERAGE FOR YEARS TESTED	10-YR. COMPAR. AVERAGE OIL % 4/	PERCENT OF S-208 OIL % 5/
FINCH	8	2049.0	-	-	1072.1	1727.0	1381.8	1379.6	108.4	37.7	-	-	37.2	34.7	38.6	38.6	94.3
MORLIN	3	1804.5	-	-	813.8	1898.6	1505.7	1353.8	106.4	37.0	-	-	41.0	37.1	38.4	40.9	100.1
S-317	5	1264.8	-	-	975.3	-	1345.0	1317.5	103.5	41.4	-	-	41.9	-	43.0	42.9	105.0
82B3555	4	-	-	-	-	-	1176.2	1310.3	103.0	-	-	-	-	-	43.5	42.2	103.3
S-208	8	1483.0	-	-	966.8	1795.6	1272.4	1272.4	100.0	39.1	-	-	40.6	35.2	40.9	40.9	100.0
SAFFIRE	6	1732.5	-	-	1173.2	-	1166.5	1268.9	99.7	33.0	-	-	34.7	-	34.3	33.9	82.9
MONT 2000	4	1139.3	-	-	952.1	1997.6	1243.3	1252.0	98.4	41.6	-	-	43.0	39.0	41.4	44.3	108.4
S-541	8	1269.1	-	-	907.3	1821.7	1211.4	1211.4	95.2	41.7	-	-	42.9	40.1	44.0	44.0	107.6
87B1298	3	1172.3	-	-	-	-	961.7	1205.6	94.7	38.7	-	-	-	-	39.6	40.5	99.2
85B1837	3	-	-	-	-	-	850.6	1203.5	94.6	-	-	-	-	-	40.5	39.8	97.4
CENTENIAL	6	1239.8	-	-	780.6	1679.5	1059.0	1164.4	91.5	41.9	-	-	42.1	38.6	42.6	43.6	106.7
82B1277	3	-	-	-	-	-	1018.4	1140.7	89.6	-	-	-	-	-	43.2	42.1	103.1
87B1650	3	1191.2	-	-	-	-	907.3	1137.2	89.4	38.8	-	-	-	-	39.7	40.7	99.5
85B4431	4	1176.4	-	-	-	-	876.9	1067.5	83.9	37.3	-	-	-	-	39.0	38.9	95.2
83B1954	5	-	-	-	-	-	985.1	1056.1	83.0	-	-	-	-	-	43.5	42.0	102.7
GIRARD	8	1156.0	-	-	830.0	1618.0	1052.0	1052.0	82.7	39.7	-	-	40.5	35.9	40.7	40.7	99.6
88B 3006	3	970.7	-	-	813.8	1628.6	1137.7	1023.0	80.4	40.8	-	-	41.0	37.3	39.7	42.3	103.5
6/ OKER	7	1549.9	-	-	692.6	-	870.7	925.0	72.7	39.5	-	-	39.0	-	41.3	41.7	102.0
MT 3697	4	725.7	-	-	761.8	-	771.6	905.1	71.1	41.8	-	-	43.1	-	43.6	42.8	104.7
85B3918	3	-	-	-	-	-	492.7	697.1	54.8	-	-	-	-	-	45.6	44.8	109.6
MEAN (ENTRIES LISTED)		1328.3	-	-	894.9	1770.8	-	1147.2	-	39.3	-		40.6	37.3	-	41.4	-
7/ Grwg Ssn Ppt. (in.)		10.27	10.19	-	6.32	14.12	8.39										
8/ Sl PAW in. to SD@Plt		10.02	7.59	-	7.91	7.25	8.78										
Tot Plt Avl Water (in.)		20.29	17.78	-	14.23	21.37	17.17										
Soil NO3(lbs) to SD@Plt		204.0	252.0	-	250.0	210.0											
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	0.0	-	0.0	25.0											

Check variety is S-208.
1/ Only the five most recent years are shown, but the summary calculations include all the years noted.
2/ Stands were variable due to soil crusting following a 1.8" cloudburst 10 days after planting. Affected most were Finch, 85B 3829, Oker, and Saffire.
3/ The 1992 nursery was destroyed by hail in July and frost in August.
The 1993 nursery was destroyed by frost and snow in August.
4/ 10-yr. CA = (x/y) * z where x = average yield or oil content of the entry for years tested, y = average yield or oil content of S-208 for the same years, and z = 10-yr. average yield and oil content for the check variety S-208.
5/ Percent of S-208 yield or oil content for the same data years.
6/ 80B 2793 in 1982, 80B 2793-2 in 1983.
7/ Seeding to 14 days prior to harvest maturity.
8/ Depth of moist soil (ft.) * 2.00 in. PAW/ft except starting in 1986 where soil PAW values are actual gravimetric measurements.