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PROJECT TITLE: SMALL GRAIN SEEDING RATE STUDIES UNDER NO-TILL CONDITIONS

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PROJECT PERSONNEL: D. Spicher, Cooperating Landowner
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OBJECTIVES: To evaluate appropriate seeding rates compatible with small grain cropping systems under no-till conditions in northern Montana.

RESULTS:

Eight trials evaluated seeding rates for winter wheat, spring wheat, barley, and safflower using two trials per crop in Hill County. Seeding rates tested were 15, 20, 25, and 30 seeds/ft² for the three small grain crops and 10, 15, 20, 25, 30, 35, 40, and 45 lb/ac (2-13 seeds/ft²) for safflower. One winter wheat trial was planted on the Howard Sterrett farm west of Havre and seven established on two soils approximately 2 miles apart at the Daryl Spicher farm southwest of Hingham. These locations are similar to those used for no-till recrop trials conducted since the mid 1980s at NARC. The winter wheat trial on Phillips soil near Hingham was abandoned because of technical problems with the cone attachments during seeding. Antelope grazed safflower trials during much of the growing season and intense pressure on the Phillips soil at Hingham also forced it to be abandoned. Preliminary statistical analyses were conducted with MPEP for each of the six trials analyzed.

Soil, climatic, and management information, summarized in Table 1, indicate that approximately 9 and 12 to 13 inches of moisture were available for production of winter and spring crops, respectively. Half of this (5-6 inches) was stored in the soil profile with the remainder accounted for as growing season precipitation. Winter wheat had low to moderate levels of available P and less NO₃-N in the profile than the spring crops at Hingham. Available moisture status in the winter wheat may be underestimated because growing season precipitation in Table 1 does not reflect winter precipitation (October to March) and soil moisture was not specifically monitored there in the spring.

Seeding rates tested were important for safflower yield of S-208 but had minimal influence on production of Lew, Lewis, and Norstar small grain varieties (Tables 2 to 7). Safflower yield was particularly sensitive to seeding rates that exceeded 40 lb/ac. Rates up to 35 lb/ac were acceptable for safflower production at this site. Recommended dryland rates for conventionally tilled safflower are 20 to 25 lb/ac or less. Limited results from this trial imply that rates may need to be extended to 30 or 35 lb/ac for optimal safflower production with no-till systems.

Average plant heights ranged from 19 to 28 inches tall with barley being the shortest and spring wheat the tallest. Winter wheat produced more tillers than the spring-planted small grains (41 vs. 30 tillers/ft²). Grain yields

averaged 21 (winter wheat), 31 (spring wheat), 50 (barley) bu/ac and 1195 lb/ac (31 bu/ac) for safflower. Total small grain biomass was nearly 2 ton/ac with approximately 40, 50, and 70% straw for Lewis, Lew, and Norstar, respectively. Test weights were light for winter wheat, typical for spring wheat, and heavy for barley and safflower. Small grain protein levels were 13 to 14% for winter wheat and barley and 15 to 16% for spring wheat. Safflower grain contained 42 to 44% oil on a dry-weight basis (38-41% standardized to 8% moisture).

SUMMARY:

The small grain varieties Lew, Lewis, and Norstar were not dramatically influenced by seeding rates of 15 to 30 seeds/ft² in Hill County during 1990, however, rates of 40 lb/ac or greater dramatically reduced safflower grain yield. Preliminary results using S-208 suggest that extending seeding rates to 30 or 35 lb/ac may be needed for optimal safflower production with no-till systems. Using moderate seeding rates to help crops reduce competition from weeds throughout the growing season is an important management component for effective crop production under no-till conditions.

FUTURE PLANS:

Continue summarizing seeding rate investigations for small grains under no-till cropping systems in northern Montana.

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TABLE 1. SOIL, CLIMATIC, AND MANAGEMENT INFORMATION FOR NO-TILL RECROP SEEDING RATE TRIALS. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MT. 1990.

DESCRIPTION	HAVRE PHILLIPS WW	HINGHAM		
		PHILLIPS		TELSTAD
		SW	/ SB	SW / SB / SAF
SEEDING DATE	SEP 16	MAY 5		MAY 5 / 5 / 10
BUNDLE HARVEST DATE	JUL 30	AUG 24-27/ 13		AUG 22 / 13 / ND
GRAIN HARVEST DATE	JUL 30	AUG 30 / 27		AUG 22 /27 /OCT 1
SOIL ANALYSIS (0-6" EXCEPT SOIL NO ₃ -N & WATER ALSO @ 6-12", 12-24", & 24-36")				
PH	7.40	7.15		7.63
ORGANIC MATTER (%)	1.3	1.3		1.4
NO ₃ -N (LB/AC)	58	193		126
AVAIL. P (PPM)	12	43		30
AVAIL. K (PPM)	341	383		283
SO ₄ -S (PPM)	7.5	3.5		8.0
NA (MEQ/100 G)	0.15	0.69		0.09
EC (MMHOS/CM)	0.91	0.06		0.67
ZN (PPM)	ND	0.4		0.3
WATER STORED IN SOIL PROFILE TO 3 FT.				
AT PLANTING (INCH)	5.0	6.0 / 6.0		6.0 / 6.0 / 6.4
AT HARVEST (INCH)	4.2	3.7 / 3.1		2.2 / 2.4 / 2.2
GROWING SEASON PRECIPITATION (INCH)	4.4	6.4 / 6.4		5.9 / 6.4 / 6.6
04-01-90 TO SOIL SAMPLE	ND	0.2 / 0.2		0.2 / 0.2 / 0.2
SOIL SAMPLE TO BUNDLE HARVEST	4.4	5.7 / 5.6		5.7 / 5.6 / ND
BUNDLE TO GRAIN HARVEST	0.0	0.5 / 0.6		0.0 / 0.6 / 6.2
GRAIN HARVEST TO SOIL SAMPLE	0.0	0.0 / 0.0		0.0 / 0.0 / 0.2

WW=WINTER WHEAT, SW=SPRING WHEAT, SB=SPRING BARLEY, SAF=SAFFLOWER,
ND=NOT DETERMINED

PREVIOUS CROP: SPRING WHEAT

SEEDING DEPTHS (INCHES): 1.00 SW AND WW; 0.75 SB; 1.25 SAF

GRAIN YIELD (BU/AC) STANDARDIZED TO 60 (WW,SW), 48 (SB), OR 38 (SAF)
LB/BU TEST WEIGHT

DRILL: USDA III YIELDER WITH PAIRED ROW SPACING

FERTILIZER: 74 LB N/AC AS 46-0-0 DEEP BANDED AND 6 LB N/AC + 30 LB P₂₀₅/AC
AS 11-52-0 BANDED WITH SEED AT PLANTING.

WEED CONTROL: PREPLANT - GLYPHOSATE + 2,4-D (LANDMASTER) AT 54 OZ/AC;

POSTEMERGE - HINGHAM: (SW AND SB) METSULFURON (ALLY) AT 0.1 OZ/AC + 2,4-D
AT 6 OZ/AC (SAF - WEEDED BY HAND)

- HAVRE: (WW) = 2,4-D AT 1 PT/AC

SOIL TAXONOMY: PHILLIPS = BOROLLIC PALEARGID (WW AND SECTION 21 AT HINGHAM)
TELSTAD = ARIDIC ARGIBOROLL (SECTION 28 AT HINGHAM)

TABLE 2. NO-TILL RECROP SEEDING RATE TRIAL WITH LEW SPRING WHEAT. DARYL SPICHER FARM (SEC. 21, T32N, R10E) AT HINGHAM, HILL COUNTY. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MT. 1990.

SEEDING RATE	PLANT HEIGHT	TILLER	GRAIN YIELD	TEST WEIGHT	STRAW WEIGHT	TOTAL YIELD	PROTEIN
SEEDS/SQ FT	INCH	NO/FT2	BU/AC	LB/BU	CWT/AC	CWT/AC	%
15	28.45	29.75	30.55	61.43	28.03	46.38	15.98
20	24.89	27.68	30.00	61.33	22.78	40.78	16.18
25	26.43	33.10	29.85	61.85	30.40	48.30	16.35
30	27.75	31.03	31.10	61.88	25.62	44.28	16.23
EXPERIMENTAL MEANS	26.88	30.39	30.38	61.62	26.71	44.93	16.18
F TEST FOR RATE	1.28NS	0.69NS	0.08NS	1.91NS	0.33NS	0.31NS	0.32NS
C.V. 2: (S OF MEAN/MEAN)*100	5.16	8.98	6.77	0.33	21.27	12.96	1.70
LSD(0.05)	4.44	8.73	6.58	0.66	18.17	18.64	0.88

NS = Not significant at P < 0.05 probability level.

TABLE 3. NO-TILL RECROP SEEDING RATE TRIAL WITH LEW SPRING WHEAT. DARYL SPICHER FARM (SEC. 28, T32N, R10E) AT HINGHAM, HILL COUNTY. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MT. 1990.

SEEDING RATE	PLANT HEIGHT	TILLER	GRAIN YIELD	TEST WEIGHT	STRAW WEIGHT	TOTAL YIELD	PROTEIN
SEEDS/SQ FT	HTIN	NO/FT2	BU/AC	LB/BU	CWT/AC	CWT/AC	%
15	28.82	24.97	31.93	58.65	14.95	34.10	15.15
20	27.55	24.30	31.65	58.60	14.60	33.60	15.38
25	28.10	28.70	31.90	58.78	17.82	36.95	14.80
30	29.08	34.85	33.13	58.55	23.20	43.08	14.92
EXPERIMENTAL MEANS	28.39	28.21	32.15	58.64	17.64	36.93	15.06
F TEST FOR RATE	0.71NS	2.94NS	0.28NS	0.09NS	1.54NS	1.78NS	1.93NS
C.V. 2: (S OF MEAN/MEAN)*100	2.92	10.00	3.87	0.54	18.19	8.83	1.21
LSD (0.05)	2.65	9.02	3.99	1.02	10.27	10.43	0.58

NS = Not significant at P < 0.05 probability level.

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TABLE 4. NO-TILL RECROP SEEDING RATE TRIAL WITH LEWIS SPRING BARLEY. DARYL SPICHER FARM (SEC.21, T32N, R10E) AT HINGHAM, HILL COUNTY, NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MT. 1990

SEEDING RATE	PLANT HEIGHT	TILLER NO/FT2	GRAIN YIELD BU/AC	TEST WEIGHT LB/BU	STRAW WEIGHT CWT/AC	TOTAL YIELD CWT/AC	PROTEIN %	PLUMP %	THINS %
15	19.12	30.65	45.50	49.10	15.48	37.30	13.77	56.35	19.47
20	18.73	37.83	50.15	49.38	19.50	43.60	12.95	58.78	18.25
25	19.66	24.52	52.65	49.20	14.95	40.23	12.68	61.85	17.52
30	19.09	32.20	44.40	48.88	15.38	36.68	13.60	54.93	21.08
EXPERIMENT MEANS	19.15	31.30	48.18	49.14	16.32	39.45	13.25	57.98	19.08
F TEST FOR RATE	0.07NS	7.44*	0.73NS	0.18NS	0.50NS	0.83NS	0.73NS	0.41NS	0.27NS
C.V. 2:	7.54	6.41	9.47	1.01	18.41	8.82	4.62	8.17	15.60
LSD (0.05)	4.62	6.41	14.60	1.59	9.61	11.13	1.96	15.15	9.52

* Significant at 0.05 probability level (NS = not significant)

TABLE 5. NO-TILL RECROP SEEDING RATE TRIAL WITH LEWIS SPRING BARLEY. DARYL SPICHER FARM (SEC. 28, T32N, R10E) AT HINGHAM, HILL COUNTY, NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MT. 1990.

SEEDING RATE	PLANT HEIGHT	TILLER NO/FT2	GRAIN YIELD BU/AC	TEST WEIGHT LB/BU	STRAW WEIGHT CWT/AC	TOTAL YIELD CWT/AC	PROTEIN %	PLUMP %	THINS %
15	21.93	28.93	52.25	51.08	11.55	36.65	13.75	78.45	6.93
20	23.24	27.15	52.85	51.53	18.90	44.25	13.17	77.10	8.28
25	20.95	28.13	49.00	51.15	10.85	34.35	14.25	78.98	7.50
30	21.82	33.03	49.83	51.05	16.20	40.13	13.25	74.33	9.55
EXPERIMENT MEANS	21.99	29.31	50.98	51.20	14.38	38.84	13.61	77.21	8.06
F TEST FOR RATE	1.70NS	0.89NS	0.69NS	0.20NS	0.51NS	0.84NS	1.02NS	0.30NS	0.39NS
C.V. 2:	3.28	9.36	4.38	0.95	37.37	12.09	3.64	4.96	22.62
LSD (0.05)	2.31	8.78	7.15	1.56	17.19	15.02	1.58	12.24	5.84

NS = Not significant at P < 0.05 probability level.

TABLE 6. NO-TILL RECROP SEEDING RATE TRIAL WITH NORSTAR WINTER WHEAT. HOWARD STERRETT FARM (SEC. 17, T32N, R15E) AT HAVRE, HILL COUNTY. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MT. 1990.

SEEDING RATES	PLANT		GRAIN	TEST	STRAW	TOTAL	
	HEIGHT	TILLERS	YIELD	WEIGHT	WEIGHT	YIELD	PROTEIN
SEEDS/FT2	INCH	NO/FT2	BU/AC	LB/BU	CWT/AC	CWT/AC	%
15	26.13	40.13	23.08	54.88	33.80	47.63	13.77
20	25.11	37.18	20.20	54.88	28.28	40.40	14.37
25	25.28	40.18	23.18	55.73	28.50	42.40	13.83
30	24.29	46.45	19.47	55.45	35.28	46.97	14.02
EXPERIMENTAL MEANS	25.20	40.98	21.48	55.23	31.46	44.35	14.00
F TEST FOR RATE	0.61NS	1.16NS	1.62NS	0.93NS	1.60NS	1.30NS	0.47NS
C.V. 2: (S OF MEAN/MEAN)*100	3.84	8.85	7.03	0.80	9.05	6.94	2.85
LSD (0.05)	3.09	11.60	4.83	1.41	9.11	9.85	1.28

NS = Not significant at P < 0.05 probability level.

TABLE 7. NO-TILL RECROP SEEDING RATE TRIAL WITH S-208 SAFFLOWER. DARYL SPICHER FARM, (SEC.23, T32N, R10E) AT HINGHAM, HILL COUNTY. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MT. 1990.

SEEDING RATE		PLANT	GRAIN	TEST	OIL CONTENT	
		HEIGHT	YIELD	WEIGHT	DRY	8% HOH
SEEDS/FT2 (LB/BU)		INCH	CWT/AC	LB/BU	%	%
2	(10)	22.93	14.70	41.23	44.35	40.80
3	(15)	22.29	13.42	40.98	43.63	40.13
5	(20)	23.52	13.88	41.20	44.50	40.95
6	(25)	22.64	10.08	40.83	44.10	40.58
8	(30)	22.93	13.05	41.20	43.88	40.35
9	(35)	22.83	14.83	40.78	44.43	40.88
11	(40)	22.15	7.58	40.15	41.65	38.33
13	(45)	20.18	8.10	40.48	43.83	40.33
EXPERIMENTAL MEANS		22.43	11.95	40.85	43.79	40.29
F TEST FOR VAR.		2.02NS	3.22*	0.88NS	1.77NS	1.74NS
C.V. 2: (S OF MEAN/MEAN)*100		3.15	13.70	1.00	1.58	1.59
LSD (0.05)		2.08	4.82	1.21	2.03	1.88

* Significant at P < 0.05 probability level (NS = not significant)