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PROJECT TITLE: Effects of seeding date and rate on performance of three, 2-rowed spring barley cultivars under dryland fallow cropping conditions.

PERSONNEL:

Cooperating Investigators: G.F. Stallknecht, Coordinator - Huntley
G.R. Carlson, Agronomist - Havre
K.M. Gilbertson, Res Assoc - Huntley
G.D. Jackson, Soil Scientist - Conrad
D.M. Wichman, Agronomist - Moccasin

Cooperator: Thomas L. Allen, Technician - Havre

OBJECTIVES:

It was our objective to re-evaluate the effects of planting date and rate on yield and quality performance of barley using selected modern cultivars and cropping techniques.

SUMMARY:

Previous research has shown that earlier planting dates normally enhance dryland barley performance in Montana, but such work was conducted nearly two decades ago with cultivars and cropping systems differing from those in common use today.

In cooperation with Huntley and Moccasin, trials were initiated in 1989 using the cultivars 'Bowman', 'Clark', and 'Gallatin' planted on four dates approximately ten days apart - at four rates (8, 13, 18, and 23 seeds per Sq.Ft.). Studies were established using standard research techniques with plots consisting of three, 20-foot rows per cultivar/date/rate in a randomized complete block design with four replications grouped by planting date. Identical trials were established for each of the three years 1989, 1990, and 1991. The first planting each year was made as early after April 1 as was possible in view of weather and field conditions. Subsequent planting dates, weather permitting, were at ten-day intervals with the fourth planting being approximately thirty days after the first.

RESULTS:

Partial results (head date, plant height, yield, and test weight data) available at this time for the 1991 trials at Havre are summarized in Table 1. As was the case with both previous years, date of seeding remains critically important to both yield and quality of dryland barley in Northern Montana.

FUTURE PLANS:

The 1991 crop marks the end of this three-year study. When remaining data (% plump, % thin, 1,000-kernel wt, and % protein) becomes available, the 1991 data will be finalized and coupled with the two previous years for 'Year x Cultivar x Date x Rate' analyses. Then, the data from all three locations will be combined for final analyses and publication of overall results.

TABLE 1. EFFECTS OF SEEDING DATE AND RATE ON PERFORMANCE OF THREE, 2-ROWED SPRING BARLEY CULTIVARS UNDER DRYLAND FALLOW CROPPING CONDITIONS. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1991.

TMT ID	CULTIVAR	DATE 1/	RATE Seeds/SqFt	2/HEAD DATE	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	WT KER g/1000	PLUMP %	THIN %	PROTEIN %
12	GALLATIN	1	23	169.50	33.71	110.10	53.60	.	.	.	.
4	BOWMAN	1	23	168.50	31.62	105.75	53.03	.	.	.	.
3	BOWMAN	1	18	168.50	32.46	103.60	53.30	.	.	.	.
11	GALLATIN	1	18	170.25	32.86	103.45	53.58	.	.	.	.
10	GALLATIN	1	13	172.00	34.56	102.65	53.62	P	P	P	P
2	BOWMAN	1	13	168.25	32.09	99.95	53.30	.	.	.	.
16	BOWMAN	2	23	174.25	32.17	98.68	52.65	E	E	E	E
15	BOWMAN	2	18	174.25	33.26	95.95	51.63	.	.	.	.
1	BOWMAN	1	8	168.75	34.64	95.20	52.97	N	N	N	N
24	GALLATIN	2	23	176.25	33.84	92.20	50.55	.	.	.	.
23	GALLATIN	2	18	176.50	35.44	92.03	51.10	D	D	D	D
9	GALLATIN	1	8	173.00	36.45	91.00	53.38	.	.	.	.
14	BOWMAN	2	13	174.25	33.56	88.35	52.67	I	I	I	I
8	CLARK	1	23	174.50	37.17	87.78	52.30	.	.	.	.
22	GALLATIN	2	13	176.25	35.49	87.58	51.38	N	N	N	N
7	CLARK	1	18	174.50	35.98	87.45	51.35	.	.	.	.
28	BOWMAN	3	23	180.00	33.75	82.10	50.10	G	G	G	G
6	CLARK	1	13	174.75	34.68	82.08	51.30	.	.	.	.
39	BOWMAN	4	18	185.00	31.28	80.93	48.05	.	.	.	.
20	CLARK	2	23	178.25	34.65	79.65	48.70	.	.	.	.
5	CLARK	1	8	175.50	34.88	77.58	51.08	.	.	.	.
27	BOWMAN	3	18	179.25	34.96	77.03	48.80	.	.	.	.
40	BOWMAN	4	23	185.25	30.83	76.08	47.88	.	.	.	.
26	BOWMAN	3	13	180.00	34.19	75.43	49.85	.	.	.	.
21	GALLATIN	2	8	177.00	35.66	73.43	50.43	.	.	.	.
36	GALLATIN	3	23	180.00	34.36	73.37	47.33	.	.	.	.
13	BOWMAN	2	8	175.50	35.13	72.53	52.40	.	.	.	.
35	GALLATIN	3	18	180.75	34.01	72.50	47.73	.	.	.	.
25	BOWMAN	3	8	181.25	34.10	72.48	50.20	.	.	.	.
19	CLARK	2	18	178.50	35.36	70.68	47.23	.	.	.	.
38	BOWMAN	4	13	186.50	30.15	69.28	47.95	.	.	.	.
34	GALLATIN	3	13	182.50	33.47	69.00	47.35	.	.	.	.
33	GALLATIN	3	8	184.50	33.23	66.93	47.95	.	.	.	.
18	CLARK	2	13	180.50	36.16	62.23	47.83	.	.	.	.
37	BOWMAN	4	8	186.25	30.98	61.88	47.45	.	.	.	.
47	GALLATIN	4	18	187.00	31.04	60.95	44.93	.	.	.	.
48	GALLATIN	4	23	187.25	30.06	60.55	45.35	.	.	.	.
17	CLARK	2	8	182.25	35.77	59.10	47.63	.	.	.	.
46	GALLATIN	4	13	189.25	28.07	58.00	44.30	.	.	.	.
45	GALLATIN	4	8	188.75	30.09	52.45	44.13	.	.	.	.
32	CLARK	3	23	187.50	31.59	51.70	44.00	.	.	.	.
30	CLARK	3	13	188.00	32.34	50.02	43.95	.	.	.	.

TABLE 1. EFFECTS OF SEEDING DATE AND RATE ON PERFORMANCE OF THREE, 2-ROWED SPRING BARLEY CULTIVARS UNDER DRYLAND FALLOW CROPPING CONDITIONS. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1991. (Continued).

TMT ID	CULTIVAR	DATE 1/	RATE Seeds/SqFt	2/HEAD DATE	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	WT g/1000	KER WT	PLUMP %	THIN %	PROTEIN %
41	CLARK	4	8	193.50	29.26	46.03	42.60					
42	CLARK	4	13	192.00	27.98	44.80	42.85					
31	CLARK	3	18	187.75	32.85	44.70	44.50					
29	CLARK	3	8	191.75	30.55	42.88	42.83					
44	CLARK	4	23	192.25	28.76	42.55	41.95					
43	CLARK	4	18	192.50	29.44	40.68	42.28					

STATISTICAL SUMMARY	2/HEAD DATE	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	WT g/1000	KER WT	PLUMP %	THIN %	PROTEIN %
EXPERIMENTAL MEANS	180.22	33.02	74.82	48.78	.	.	.	.	.
TOTAL OBSERVATIONS	192.00	192.00	192.00	192.00	192.00	48.00	48.00	48.00	48.00
NO. OF REPLICATIONS	4.00	4.00	4.00	4.00	4.00	1.00	1.00	1.00	1.00
NO. OF TREATMENTS	48.00	48.00	48.00	48.00	48.00	48.00	48.00	48.00	48.00
REP. MEAN SQUARE	3.23	7.11	396.21	9.06		-	-	-	-
TMT. MEAN SQUARE	213.67	21.98	1475.01	52.53		-	-	-	-
ERROR MEAN SQUARE	.91	2.55	60.69	1.52		-	-	-	-
ERROR DEGREES OF FREEDOM	141.00	141.00	141.00	141.00		-	-	-	-
F TEST FOR REPS.	3.53*	2.79*	6.53**	5.97**		-	-	-	-
F TEST FOR TMTS.	233.88**	8.62**	24.30**	34.65**		-	-	-	-
STANDARD ERROR	.96	1.60	7.79	1.23		-	-	-	-
STANDARD ERROR OF THE MEAN	.48	.80	3.90	.62		-	-	-	-
C.V. 1: (S/MEAN)*100	.53	4.84	10.41	2.52		-	-	-	-
C.V. 2: (S OF MEAN/MEAN)*100	.27	2.42	5.21	1.26		-	-	-	-
LSD (0.05)	1.34	2.23	10.89	1.72		-	-	-	-

1/ 1 = 4/16, 2 = 4/25, 3 = 5/9, 4 = 5/17

2/ Head Date = No. of Days from January 1 (180 = June 29)

** Denotes Statistical Significance at $P \leq .01$

* Denotes Statistical Significance at $P \leq .05$

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FACTOR ANALYSIS - FACTOR 1 = CULTIVAR										
ID	CULTIVAR	2/HEAD DATE	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	KER WT g/1000	PLUMP %	THIN %	PROTEIN %	
1	BOWMAN	177.20	32.82	84.70	50.76	.	.	.	.
3	GALLATIN	179.40	33.27	79.14	49.17	.	.	.	.
2	CLARK	184.00	32.96	60.62	46.40	.	.	.	.
		**	ns	**	**					
	F =	835.05	1.32	167.64	206.16					
	P =	.000	.271	.000	.000					
	LSD (.05)	.33	.56	2.72	.43					
FACTOR ANALYSIS - FACTOR 2 = PLANTING DATE										
ID	PLANTING DATE	2/HEAD DATE	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	KER WT g/1000	PLUMP %	THIN %	PROTEIN %	
1	APRIL 16	171.50	34.26	95.55	52.73	.	.	.	.
2	APRIL 25	177.00	34.71	81.03	50.35	.	.	.	.
3	MAY 9	183.60	33.28	64.84	47.05	.	.	.	.
4	MAY 17	188.80	29.83	57.85	44.98	.	.	.	.
		**	**	**	**					
	F =	3003.11	91.83	225.65	375.41					
	P =	.000	.000	.000	.000					
	LSD (.05)	.39	.64	3.14	.50					
FACTOR ANALYSIS - FACTOR 3 = PLANTING RATE										
ID	PLANTING RATE	2/HEAD DATE	PLNT HT Inches	YIELD Bu/Ac	TEST WT Lbs/Bu	KER WT g/1000	PLUMP %	THIN %	PROTEIN %	
4	23 SEEDS / SQ.FT.	179.50	32.71	80.04	48.95	.	.	.	.
3	18 SEEDS / SQ.FT.	179.60	33.25	77.49	48.70	.	.	.	.
2	13 SEEDS / SQ.FT.	180.40	32.73	74.11	48.86	.	.	.	.
1	8 SEEDS / SQ.FT.	181.50	33.39	67.92	48.59	.	.	.	.
		**	ns	**	ns					
	F =	46.74	2.34	22.87	.84					
	P =	.000	.076	.000	.472					
	LSD (.05)	.39	.64	3.14	.50					

** Denotes Statistical Significance at $P \leq .01$

ns Denotes No Statistical Significance at $P \leq .05$

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CLIMATIC and NURSERY MANAGEMENT DATA - SEEDING DATE #1

Seeding Date:	04/16/91	Soil Temp @ Sdg:	46F @ 2in., 44F @ 4in.
Harvest Date:	08/05/91	Root Penetration Depth:	N/A in.
Seeding Depth:	1.00 in.	Depth to Moisture at Sdg:	0.00 in.
Soil Series:	Telstad-Joplin Cl L	Probed Moist.Depth @ Sdg:	55.0 in.+
Previous Crop:	Fallow	Herbicide:	'Bronate' @ 1.5 pts/ac
Measured Soil Water on 04/02/91:	8.09 in.		(sampling depth = 48 in.)
Precipitation 04/02/91 to Seeding:	1.08 in		(1.08 in events > .1 in.)
Initial Stored Soil Water at Seeding:	9.17 in.		(sampling depth = 48 in.)
Measured Soil Water at Harvest:	4.42 in.		(sampling depth = 48 in.)
Growing Season Precipitation (Sdg.to 14 days prior to harvest maturity 'HM'):			
Total - all measurable events:	9.71 in.		
Total - all events >.1 inches:	8.91 in.		
Post Growing Season Precipitation (within 14 days of harvest maturity):			
Total - all measurable events:	0.28 in.		
Total - all events >.1 inches:	0.19 in.		
Adj'd Residual Soil Water @ (HM-14d):	4.14 in.		(sampling depth = 48 in.)
Soil Analysis on 4/02/91: (NO3,P,K at 0-6 in.; NO3 at 6-24, 24-36 & 36-48 in.):			
NO3(lbs/ac)= 150 , P(ppm olsen)= 33 , K(ppm)= 293 , pH= 7.1, O.M.(%) = 0.9			
Fertilizer:	70#N,40#P205 via 46-0-0+11-52-0 bd'cst & till-incorporated 9/90		

CLIMATIC and NURSERY MANAGEMENT DATA - SEEDING DATE #2

Seeding Date:	04/25/91	Soil Temp @ Sdg:	62F @ 2in., 57F @ 4in.
Harvest Date:	08/05/91	Root Penetration Depth:	N/A in.
Seeding Depth:	1.00 in.	Depth to Moisture at Sdg:	0.00 in.
Soil Series:	Telstad-Joplin Cl L	Probed Moist.Depth @ Sdg:	55.0 in.+
Previous Crop:	Fallow	Herbicide:	'Bronate' @ 1.5 pts/ac
Measured Soil Water on 04/02/91:	8.09 in.		(sampling depth = 48 in.)
Precipitation 04/02/91 to Seeding:	1.21 in		(1.08 in events > .1 in.)
Initial Stored Soil Water at Seeding:	9.30 in.		(sampling depth = 48 in.)
Measured Soil Water at Harvest:	3.65 in.		(sampling depth = 48 in.)
Growing Season Precipitation (Sdg.to 14 days prior to harvest maturity 'HM'):			
Total - all measurable events:	9.58 in.		
Total - all events >.1 inches:	8.91 in.		
Post Growing Season Precipitation (within 14 days of harvest maturity):			
Total - all measurable events:	0.28 in.		
Total - all events >.1 inches:	0.19 in.		
Adj'd Residual Soil Water @ (HM-14d):	3.37 in.		(sampling depth = 48 in.)
Soil Analysis on 4/02/91: (NO3,P,K at 0-6 in.; NO3 at 6-24, 24-36 & 36-48 in.):			
NO3(lbs/ac)= 150 , P(ppm olsen)= 33 , K(ppm)= 293 , pH= 7.1, O.M.(%) = 0.9			
Fertilizer:	70#N,40#P205 via 46-0-0+11-52-0 bd'cst & till-incorporated 9/90		

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CLIMATIC and NURSERY MANAGEMENT DATA - SEEDING DATE #3

Seeding Date:	05/09/91	Soil Temp @ Sdg:	59F @ 2in., 58F @ 4in.
Harvest Date:	08/19/91	Root Penetration Depth:	36.0 in.
Seeding Depth:	1.25 in.	Depth to Moisture at Sdg:	0.25 in.
Soil Series:	Telstad-Joplin Cl L	Probed Moist.Depth @ Sdg:	55.0 in.+
Previous Crop:	Fallow	Herbicide:	'Bronate' @ 1.5 pts/ac
Measured Soil Water on 04/02/91:	8.09 in.		(sampling depth = 48 in.)
Precipitation 04/02/91 to Seeding:	2.14 in		(1.91 in events > .1 in.)
Initial Stored Soil Water at Seeding:	10.23 in.		(sampling depth = 48 in.)
Measured Soil Water at Harvest:	4.21 in.		(sampling depth = 48 in.)
Growing Season Precipitation (Sdg. to 14 days prior to harvest maturity 'HM'):			
Total - all measurable events:	8.93 in.		
Total - all events >.1 inches:	8.27 in.		
Post Growing Season Precipitation (within 14 days of harvest maturity):			
Total - all measurable events:	1.20 in.		
Total - all events >.1 inches:	1.16 in.		
Adj'd Residual Soil Water @ (HM-14d):	3.01 in.		(sampling depth = 48 in.)
Soil Analysis on 4/02/91: (NO ₃ ,P,K at 0-6 in.; NO ₃ at 6-24, 24-36 & 36-48 in.):			
NO ₃ (lbs/ac)= 150 , P(ppm olsen)= 33 , K(ppm)= 293 , pH= 7.1, O.M.(%) = 0.9			
Fertilizer:	70#N,40#P205 via 46-0-0+11-52-0 bd'cst & till-incorporated 9/90		

CLIMATIC and NURSERY MANAGEMENT DATA - SEEDING DATE #4

Seeding Date:	05/17/91	Soil Temp @ Sdg:	62F @ 2in., 59F @ 4in.
Harvest Date:	08/19/91	Root Penetration Depth:	36.0 in.
Seeding Depth:	1.00 in.	Depth to Moisture at Sdg:	0.00 in.
Soil Series:	Telstad-Joplin Cl L	Probed Moist.Depth @ Sdg:	55.0 in.+
Previous Crop:	Fallow	Herbicide:	'Bronate' @ 1.5 pts/ac
Measured Soil Water on 04/02/91:	8.09 in.		(sampling depth = 48 in.)
Precipitation 04/02/91 to Seeding:	3.69 in		(3.43 in events > .1 in.)
Initial Stored Soil Water at Seeding:	11.78 in.		(sampling depth = 48 in.)
Measured Soil Water at Harvest:	4.63 in.		(sampling depth = 48 in.)
Growing Season Precipitation (Sdg. to 14 days prior to harvest maturity 'HM'):			
Total - all measurable events:	7.38 in.		
Total - all events >.1 inches:	6.75 in.		
Post Growing Season Precipitation (within 14 days of harvest maturity):			
Total - all measurable events:	1.20 in.		
Total - all events >.1 inches:	1.16 in.		
Adj'd Residual Soil Water @ (HM-14d):	3.43 in.		(sampling depth = 48 in.)
Soil Analysis on 4/02/91: (NO ₃ ,P,K at 0-6 in.; NO ₃ at 6-24, 24-36 & 36-48 in.):			
NO ₃ (lbs/ac)= 150 , P(ppm olsen)= 33 , K(ppm)= 293 , pH= 7.1, O.M.(%) = 0.9			
Fertilizer:	70#N,40#P205 via 46-0-0+11-52-0 bd'cst & till-incorporated 9/90		