

PROJECT TITLE: Relationships of beta-glucan and protein content and yield of oat and waxy, hulless barley with nitrogen fertilizer.

CO-PRINCIPAL INVESTIGATORS: Grant D. Jackson, CARC, Moccasin
Robert K. Berg, NARC, Havre
Gregory D. Kushnak, WTARC, Conrad
Thomas K. Blake, Bozeman

OBJECTIVE: To determine the effect of nitrogen on yield, yield components, and protein and beta-glucan content of 'Otana' oat and 'Shonkin' Barley.

SUMMARY: Nitrogen (N) rates of 0, 30, 60, and 90 lbs N/ac were applied to 'Shonkin' barley and 'Otana' oat at Moccasin, Havre and Conrad. Response data were similar to 1989, excellent grain yield responses to N were measured at Conrad and Moccasin. The Havre location did not respond to N; however, the experiment the experiment was conducted on fallow. Laboratory work on beta-glucan and protein content is not completed. In contrast to 1989, oat and barley responses were similar. field

RESULTS: The effect of N on 'Shonkin' barley and 'Otana' oat are summarized in Tables 1 through 6. Data were collected from recrop trials at Conrad and Moccasin and from fallow at Havre. Nitrogen, protein, and beta-glucan content are not available at time. Grain yields were highest at Conrad and were limited by drought at Moccasin. Yields at Havre were about the same as last year. Barley and oat responses were similar this year at Conrad where optimum yield was achieved with 60 lbs N/ac. Responses were similar at Moccasin also, however, optimum yields occurred at 30 lbs N/ac. Neither crop responded to N at Havre. this

TABLE 1. EFFECT OF NITROGEN ON 'OTANA' OAT SEEDED NO-TILL,
Western Triangle Ag. Research Center, Conrad, 1990.

TREATMENT	GRAIN YIELD	TEST WT.	TOTAL YIELD	PLANT HT.
lbs N/ac	lb/ac	lb/bu	lb/ac	in
60-N	3336	38.2	9315	37
90-N	3147	36.4	9819	39
30-N	2567	37.8	8187	36
0-N	2057	38.8	4826	36
EXPERIMENTAL MEANS	2777	37.8	8037	
F TEST FOR TRT.	13.95	3.58	5.15	
C.V. 1:	11.20	2.82	24.64	
C.V. 2:	5.60	1.41	12.32	
LSD (0.05)	497	1.7	3168	

Planting date: April 24, 1990

Harvest date: August 9, 1990

Previous crop: Barley

Growing season precip.: 4.61 in

Soil series: Scobey clay loam

Drill: 12 in spaced, double disc

Fertilizer: 11-51-0 applied with the seed, ammonium nitrate broadcast.

Soil test results:	Depth	pH	O.M. %	Olsen P ppm	K ppm	NO ₃ -N ---lb	NH ₄ -N N/ac---
	0-6"	7.8	1.9	24	441	16.4	5.7
	6-12"					9.4	5.2
	1-2'					7.8	13.8
	2-4'					9.2	25.6
	TOTAL					42.8	50.3

TABLE 2. EFFECT OF NITROGEN ON 'SHONKIN' BARLEY SEEDED NO-TILL.
Western Triangle Ag. Research Center, Conrad, 1990.

TREATMENT	GRAIN YIELD	TEST WT.	TOTAL YIELD	PLANT HT.
lbs N/ac	lb/ac	lb/bu	lb/ac	in
60-N	3803	62.7	11280	36
90-N	3623	60.9	10880	30
30-N	2720	61.4	8307	34
0-N	2104	62.0	5258	26
EXPERIMENTAL MEANS	3063	61.7	8931	
F TEST FOR TRT.	8.91	.75	19.87	
C.V. 1:	17.41	2.86	13.97	
C.V. 2:	8.71	1.43	6.99	
LSD (0.05)	853	NS	996	

NS denotes means are not significantly different at p=0.05.

Planting date: April 24, 1990

Harvest date: August 9, 1990

Previous crop: Barley

Growing season precip.: 4.61 in

Soil series: Scobey clay loam

Drill: 12 in spaced, double disc

Fertilizer: 11-51-0 with the seed, ammonium nitrate broadcast

Soil test results:	Depth	pH	Olsen P	K	O.M.	NO3-N	NH4-N
			ppm	ppm	%	---lb	N/ac---
	0-6"	7.8	24	441	1.9	16.4	5.7
	6-12"					9.4	5.2
	1-2'					7.8	13.8
	2-4'					9.2	25.6
	TOTAL					42.8	50.3

TABLE 3. 'SHONKIN' BARLEY RESPONSE TO NITROGEN FERTILIZER RATES UNDER DRYLAND FALLOW CONDITIONS. JON TESTER FARM, CHOTEAU COUNTY, BIG SANDY, MT. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MT. 1990.

N RATE	PLANT		TEST	GRAIN	STRAW	TOTAL	PLUMP	THIN
	HEIGHT	TILLERS	WEIGHT	YIELD	WEIGHT	YIELD		
LB/AC	INCH	NO/FT2	LB/BU	-----	CWT/AC	-----	-----	%
0	20.38	27.70	62.20	16.91	12.38	29.28	37.97	16.53
30	21.52	28.43	61.87	15.17	15.28	30.43	39.50	16.48
60	20.45	28.20	60.85	14.06	18.33	32.37	37.50	19.27
90	19.96	25.50	62.60	14.41	14.35	28.78	35.45	18.98
EXPERIMENTAL MEANS	20.58	27.46	61.88	15.14	15.08	30.21	37.61	17.81
F TEST FOR RATE	0.15ns	0.11ns	7.32**	0.17ns	0.42ns	0.06ns	0.29ns	0.37ns
C.V. 2:	8.32	14.64	0.45	20.19	25.44	20.94	8.26	14.02
LSD (0.05)	5.48	12.86	0.89	9.77	12.27	20.24	9.94	7.99

Each mean is the avg. of four replications (** = significant at 0.01 probability level; ns = not significant at $P < 0.05$).

Seeding Date: 05-09-90

Grain Harvest Date: 08-13-90

Seeding Depth: 0.75 in.

Previous Crop: Fallow

Measured Soil Water Content (Sampling Depth = 36"):

@ Sampling (05-09-90): 8.75 in.

@ Harvest (08-13-90): 3.65 in.

Precipitation (Myers Farms records):

6.34 in.

04-01-90 to Sdg (05-09-90):

1.64 in.

Sdg to Bundle/Grain Hrvst/Soil Sample (08-13-90):

4.70 in.

Soil Analysis (0-6" except NO₃ & soil; HOH also @ 6-12 12-24 & 24-36"):

pH: 8.3, O.M.: 1.2%, NO₃-N: 34 lb/ac, P: 7 ppm (Olsen), K: 240 ppm, SO₄-S: 36 ppm, Na: 0.04 meq/100g, E.C.: 1.84 mmhos/cm, Zn: 0.1 ppm

Soil Series: Joplin (calcareous)

Soil Taxonomy: Aridic Argiboroll

Fertilizer: N rates = urea (46-0-0) broadcast and disked at planting, all plots received 25 lb P205/ac (0-45-0) with seed.

Herbicide: None

TABLE 4. 'OTANA' OAT RESPONSE TO NITROGEN FERTILIZER RATES UNDER DRYLAND FALLOW CONDITIONS. JON TESTER FARM, CHOTEAU COUNTY, BIG SANDY, MT. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MT. 1990.

N RATE	PLANT HEIGHT	TILLERS	TEST WEIGHT	GRAIN YIELD	STRAW WEIGHT	TOTAL YIELD
LB/AC	INCH	NO/FT2	LB/BU	-----	CWT/AC	-----
0	28.44	17.70	40.18	17.13	17.68	34.80
30	27.16	16.00	39.13	17.04	12.10	29.15
60	25.51	16.32	39.15	16.20	9.63	25.83
90	27.39	16.38	38.85	17.99	12.62	30.63
EXPERIMENTAL MEANS	27.13	16.60	39.33	17.09	13.01	30.10
F TEST FOR RATE	1.03	ns 0.10	ns 0.25	ns 0.11	ns 1.25	ns 0.60
C.V. 2:	4.41	14.49	2.97	13.20	23.25	15.91
LSD (0.05)	3.83	7.70	3.79	7.22	9.68	15.33

Each mean is the avg. of four replications (ns = not significant at P < 0.05 probability level).

Seeding Date: 05-09-90

Grain Harvest Date: 08-13-90

Seeding Depth: 0.75 in.

Previous Crop: Fallow

Measured Soil Water Content (Sampling Depth = 36"):

@ Sampling (05-09-90): 8.75 in.

@ Harvest (08-13-90): 3.31 in.

Precipitation (Myers Farms records):

6.34 in.

04-01-90 to Sdg (05-09-90):

1.64 in.

Sdg to Bundle/Grain Hrvst/Soil Sample (08-13-90): 4.70 in.

Soil Analysis (0-6" except NO₃ & soil HDH also @ 6-12 12-24 & 24-36"):

pH: 8.3, O.M.: 1.2%, NO₃-N: 34 lb/ac, P: 7 ppm (Olsen),

K: 240 ppm, SO₄-S: 36 ppm, Na: 0.04 meq/100g, E.C.: 1.84

mmhos/cm, Zn: 0.1 ppm

Soil Series: Joplin

Soil Taxonomy: Aridic Argiboroll

Fertilizer: N rates = urea (45-0-0) broadcast and disked at planting, all plots received 25 lb P205/ac (0-45-0) with seed.

Herbicide: None

26a

TABLE 5. EFFECT OF NITROGEN ON 'OTANA' OAT.
Central Ag. Research Center, Moccasin. 1990.

TREATMENT	GRAIN YIELD	TEST WT.	PLANT HT.	TILLERS	TOTAL YIELD
lbs N/ac	lb/ac	lb/bu	in	#/3'	lb/ac
90-N	1457	37.2	28	72	3361
30-N	1288	40.0	27	73	3241
60-N	1262	38.2	24	73	2233
0-N	758	38.5	26	54	1585
EXPERIMENTAL MEANS	1191	38.4	26	68	2605
F TEST FOR TRT.	15.13	10.62	2.68	1.50	9.46
C.V. 1:	13.02	1.84	7.56	22.93	21.16
C.V. 2:	6.51	.92	3.78	11.46	10.58
LSD (0.05)	248	1.1	NS	NS	882

Planting date: April 18, 1990

Variety: Otana

Previous crop: Worked barley stubble

Soil series: Tamaneen clay loam

Drill: Haybuster 8000, usual positions of the seed and fertilizer were reversed, seed was planted by the opener point while nitrogen fertilizer was positioned on the surface on both sides of the seed. Nitrogen fertilizer was incorporated by opener action and packer wheels.

Fertilizer: Treble super phosphate, 30 lbs P205 with the seed.
Urea applied in the surface band.

Growing Season Rainfall: 6.53 inches

Soil Test Results:	Depth	NO3-N	NH4-N	pH	O.M.	Olsen P	K
		---lbs N/ac---			%	ppm	ppm
	0-6"	9.6	6.9	7.4	3.4	24	291
	6-12"	9.7	6.6				
	12-22"	5.1	5.3				
	TOTAL	24.4	18.8				

TABLE 6. EFFECT OF NITROGEN ON 'SHONKIN' BARLEY.
Central Ag. Research Center, Moccasin. 1990

TREATMENT	GRAIN YIELD	TEST WT.	TILLERS #/3'	TOTAL YIELD
lbs N/ac	lb/ac	lb/bu	#/3'	lb/ac
90-N	1292	49.5	117	2665
60-N	1227	52.1	135	3473
30-N	1114	50.7	122	3097
0-N	733	48.9	72	1920
EXPERIMENTAL MEANS	1091	50.3	111	2789
F TEST FOR TRT.	13.37	1.40	3.26	2.74
C.V. 1:	12.52	4.72	27.24	28.89
C.V. 2:	6.26	2.36	13.62	14.45
LSD (0.05)	219	NS	NS	NS

Planting date: April 18, 1990
 Previous crop: Worked barley stubble
 Soil series: Tamaneen clay loam
 Drill: Haybuster 8000, usual positions of the seed and fertilizer were reversed, seed was planted by the opener point while nitrogen fertilizer was positioned on the surface on both sides of the seed. Nitrogen fertilizer was incorporated by opener action and packer wheels.
 Fertilizer: Treble super phosphate, 30 lbs P2O5 with the seed. Urea applied in the surface band.
 Growing Season Rainfall: 6.53 inches
 Soil Test Results:

Depth	NO3-N	NH4-N	pH	O.M.	Olsen P	K
	---lbs N/ac---			%	ppm	ppm
0-6"	9.6	6.9	7.4	3.4	24	291
6-12"	9.7	6.6				
12-22"	5.1	5.3				
TOTAL	24.4	18.8				