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PROJECT TITLE: Evaluation of grain and residue relationships with spring wheat and barley cultivars grown under dryland conditions in northern Montana.

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Liberty County Conservation District - Chester
Liberty County USDA-SCS Work Unit - Chester
Graff Farms, Inc., North Joplin

OBJECTIVES:

It was the objective of this project to evaluate the relationships of residue production with grain yield for modern spring wheat and barley cultivars grown under dryland conditions in northern Montana in order to compare responses with residue production estimates currently being used in the development of conservation compliance plans in Montana by USDA-SCS.

RESULTS:

Individual year data for 18-20 spring wheat cultivars evaluated from 1989-1993 at Graff Farms, Inc. north of Joplin, Montana are presented in Tables 1 through 5, respectively. Factorial data analyzed by `Year' and `Cultivar' for plant height, yield, test weight, total residue production, and residue production per bushel of grain for 15 spring wheat cultivars grown each of the 5 years are summarized in Table 6. Years differed greatly as average residue (lbs/bu) ranged from a low of 73.5 in 1992 to 103.4 in 1991. The 5-year grand mean for spring wheat residue was 88.5 lbs/bu - only 7 percent below the SCS value.

Similar individual year data for 12-18 spring barley cultivars evaluated during the same 5-year period are presented in Tables 7-11, respectively. Factorial data for 10 spring barley cultivars grown each of the 5 years at the same location are summarized in Table 12. As with spring wheat, average barley residue (lbs/bu) differed greatly with year and ranged from 39.8 in 1992 to 70.3 in 1991. The 5-year mean of 56.2 lbs/bu is, however, 25 percent below the SCS estimate value.

Spring wheat produced more total dry matter than barley, but less grain. The ratio of residue to grain was 1.45 for spring wheat and 1.13 for barley (Figure 1.). Grain and residue relationships for spring wheat by years across cultivars and cultivars across years are graphically presented in Figures 2 and 2a, respectively. Grain and residue relationships for barley by years and culitvars are similarly presented in Figures 3 and 3a. For purposes of graph

clarity, the number of cultivars displayed was reduced to 8 for each crop. However, the summary means and statistical analyses are based on all 15 spring wheat cultivars and all 10 barley cultivars.

SUMMARY:

Farmers have become very concerned about management of crop residue in maintaining their compliance in the federal farm program. Management plans are based on estimates of the initial amount of residue present following harvest, and known subsequent effects of various types of fallow practices on longevity of the residue's effectiveness in protecting the soil from erosion. Considerable literature exists on the management of residue once it's produced, but information is lacking as to how growers might manage for increased residue production where necessary. Variety selection might be one means by which producers could prescribe differing amounts of residue. Little information is available pertaining to straw/grain relationships with newer crop varieties. For years, breeders have generally selected for more grain and less straw. In the early `80s' producers avoided varieties producing alot of residue in order that they could recrop without difficulty in getting the subsequent crop established. Interest in, and importance of, no-till production has since been renewed for both crop-fallow and recrop scenarios.

At the time this study was initiated, the Soil Conservation Service was estimating residue production at 110, 90-95, 75, and 60 lbs/bu grain harvested for winter wheat, spring wheat, barley, and oats, respectively when helping producers develop conservation plans. Based on limited research and producer experience, these values seemed high for local conditions and the varieties in common use. It was feared that if initial residue estimates were too high, there would be increased potential for not being in compliance at the end of the fallow period even though an otherwise good management plan was carefully followed.

To develop a preliminary database, collection of residue data was added to the standard off-station spring wheat and barley variety trials underway at Graff Farms, Inc. north of Joplin, Montana (materials and methods described in NARC off-station dryland fallow report). Prior to combine harvest, a 3-foot sample of the center row of each plot was carefully clipped at the soil surface - and bagged. The samples were oven-dried, weighed, and then threshed with dry residue values determined via subtraction of grain weight from the total dry matter. Results were statistically analyzed for each of the 5 years (1989-1993) and were further analyzed in 1993 as a factorial arrangement of treatments to separately evaluate years and varieties plus the interactive effects of these two variables.

FUTURE PLANS:

Decisions need to be made now as to whether the effort should be terminated, continued at this location, relocated to another single cropping environment or expanded to multiple locations representing a number of differing environments. The work is somewhat labor intensive and is thus expensive. Based on the effects of `year' during the first 5 years at this location, it would appear that a large number of location-years of data involving environments across the state would be desirable before any broadform changes in estimate values should be recommended. Interest expressed on the part of agency and producer clientele regarding further work, and availability of funding will determine whether or not the effort is continued in 1994.

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TABLE 1. EVALUATION OF DRYLAND FALLOW GRAIN AND RESIDUE PERFORMANCE OF TWENTY SPRING WHEAT CULTIVARS GROWN OFF-STATION AT GRAFF FARMS, INC., NORTH JOPLIN. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1989.

VARIETY or SELECTION	PLNT HT Inches	YIELD Bu/Ac 1/	TEST WT Lbs/Bu	PROTEIN %	RESIDUE Lbs/Ac 2/	RESIDUE Lbs/Bu 3/
PI483235 GLENMAN	23.36	47.01	60.77	15.80	3389.97	72.13
WA 6920 PENAWAWA (soft white)	21.76	45.75	59.70	15.10	3187.23	69.87
CI 17430 NEWANA	21.84	44.72	61.90	15.70	3319.54	69.23
CI 15930 OLAF	23.49	44.30	59.30	17.00	3114.67	69.60
CI 17828 PONDERA	22.80	44.29	60.87	17.00	3329.14	76.03
ND 606 AMIDON	24.80	44.21	60.63	16.80	3226.71	73.30
ND 582 STOA	25.33	43.79	60.33	17.60	3200.03	76.40
C982-324 RAMBO	22.99	43.33	61.73	16.70	3366.49	70.77
CI 17790 LEN	22.93	43.09	59.30	16.40	3338.75	85.77
CI 17920 MARSHALL	21.36	42.45	58.90	16.00	2643.04	65.47
WPB 906R WESTBRED 906R	23.91	42.28	57.97	17.80	2804.16	69.30
CI 17904 OWENS (soft white)	22.24	42.18	60.00	15.40	3379.29	82.77
CI 17429 LEW	26.23	41.56	61.83	17.10	3451.85	80.33
CI 17910 ALEX	27.41	40.60	61.47	17.10	3049.58	68.40
NK 751 NK 751	21.19	40.40	55.57	16.40	3029.31	78.77
MT 8182 YDING "S"/PCI "S"-28 (hard white)	22.89	40.30	59.63	16.80	2950.35	70.17
CANLANC LANCER	26.02	39.57	60.50	17.60	2824.44	70.43
NDCUT CUTLESS	24.97	39.32	60.53	17.40	3234.18	86.37
CI 13596 FORTUNA	25.01	38.60	61.10	17.30	3497.73	83.87
MT 8402 MT7336/SHORTANA (HI-LINE)	22.35	38.43	57.93	17.20	2870.32	83.40
EXPERIMENTAL MEANS	23.64	42.31	60.00	16.70	3160.34	75.12
C.V. 2: (S OF MEAN/MEAN)*100	2.53	5.74	.66	-	7.21	8.76
LSD (0.05)	1.71	6.96	1.14	-	652.47	18.83

1/ Based on 45 sqft harvest w/plot combine (precision > than 3 sqft hand hvst for `grain')
2/ Based on 3 sqft harvest w/hand clipper (includes all above-surf dry matter less grain)
3/ Based on hand harvest for residue and grain

CLIMATIC and NURSERY MANAGEMENT DATA

Seeding Date: 05/05/89
Harvest Date: 08/21/89
Seeding Depth: 1.25 in.
Soil Series: Joplin-Hillon
Previous Crop: Flw > Winter-Killed WW
Soil Temp @ Sdg: 71F @ 2in., 66F @ 4in.
Root Penetration Depth: N/A in.
Depth to Moisture at Sdg: 0.00 in.
Probed Moist.Depth @ Sdg: __._ in.
Herbicide:
Initial Stored Soil Water at Seeding: 7.59 in. (sampling depth = 48 in.)
Measured Soil Water at Harvest: 3.05 in. (sampling depth = 48 in.)
Growing Season Precipitation (Sdg.to 14 days prior to harvest maturity `HM'):
Total - all measurable events: 6.99 in.
Total - all events >.1 inches: 6.67 in.
Adj'd Residual Soil Water @ (HM-14d): 3.05 in. (sampling depth = 48 in.)
Initial Soil Analysis (NO3,P,K at 0-6 in.; NO3 at 6-24, 24-36 & 36-48 in.):
NO3(lbs/ac)= 144 , P(ppm olsen)= 19 , K(ppm)= 326 , pH= 7.5, O.M.(%) = 1.3
Fertilizer: 78#N,36#P2O5 (8#N,36#P2O5 via 11-51-0 w/winter wheat seed Fall 88), (70#N via 46-0-0 broadcast & disked in prior to replanting Spr 89)

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TABLE 2. EVALUATION OF DRYLAND FALLOW GRAIN AND RESIDUE PERFORMANCE OF TWENTY SPRING WHEAT CULTIVARS GROWN OFF-STATION AT GRAFF FARMS, INC., NORTH JOPLIN. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1990.

VARIETY or SELECTION	PLNT HT Inches	YIELD Bu/Ac 1/	TEST WT Lbs/Bu	PROTEIN %	RESIDUE Lbs/Ac 2/	RESIDUE Lbs/Bu 3/
WA 6920 PENAWAWA (soft white)	25.29	41.23	59.20	13.40	3781.60	98.93
CI 17828 PONDERA	27.05	39.10	61.23	16.50	4231.90	106.80
ND 606 AMIDON	30.20	39.00	60.93	15.70	3607.70	90.27
CI 17790 LEN	26.80	38.13	59.43	16.30	3458.30	80.23
WPB 926R WESTBRED 926R	26.02	37.10	59.03	16.40	3546.87	86.57
PI483235 GLENMAN	28.19	37.07	60.00	14.80	3760.27	89.83
CANLANC LANCER	33.67	36.87	61.13	16.80	4205.23	100.37
CI 17910 ALEX	29.97	36.80	61.57	15.10	3594.87	85.93
MT 8402 MT7336/SHORTANA (HI-LINE)	24.86	36.73	58.80	17.20	3739.97	88.50
ND 582 STOA	28.58	35.73	60.60	17.70	3569.27	100.37
CI 15930 OLAF	26.73	35.73	60.27	16.50	3498.87	90.87
CI 17430 NEWANA	25.79	35.70	60.97	15.70	3538.30	81.10
CI 17904 OWENS (soft white)	25.10	35.50	59.33	13.60	3635.40	104.87
ND 626 GRANDIN	28.20	34.93	59.53	16.80	3581.00	96.03
CI 17429 LEW	29.88	34.17	60.37	17.40	3872.30	107.10
ND 618 GUS	25.05	33.87	60.80	17.90	3207.50	94.37
WPB 906R WESTBRED 906R	26.26	33.30	58.87	16.70	3363.33	91.87
C982-324 RAMBO	25.38	32.57	62.33	16.10	3331.33	96.23
CI 13596 FORTUNA	29.00	32.13	61.70	15.70	3908.57	106.93
NDCUT CUTLESS	25.10	30.97	61.13	16.20	3432.67	106.83
EXPERIMENTAL MEANS	27.36	35.83	60.36	16.13	3643.26	95.20
C.V. 2: (S OF MEAN/MEAN)*100	2.68	3.43	.49	-	4.76	4.86
LSD (0.05)	2.10	3.51	.85	-	496.97	13.24

1/ Based on 45 sqft harvest w/plot combine (precision > than 3 sqft hand hvst for `grain')
2/ Based on 3 sqft harvest w/hand clipper (includes all above-surf dry matter less grain)
3/ Based on hand harvest for residue and grain

CLIMATIC and NURSERY MANAGEMENT DATA

Seeding Date: 05/03/90
Harvest Date: 08/16/90
Seeding Depth: 1.50 in.
Soil Series: N/A
Previous Crop: Fallow
Soil Temp @ Sdg: 64F @ 2in., 60F @ 4in.
Root Penetration Depth: N/A in.
Depth to Moisture at Sdg: 0.00 in.
Probed Moist.Depth @ Sdg: 55.0 in.+
Herbicide: None Applied - Hand Weeded
Initial Stored Soil Water at Seeding: 10.96 in. (sampling depth = 48 in.)
Measured Soil Water at Harvest: 4.54 in. (sampling depth = 48 in.)
Growing Season Precipitation (Sdg.to 14 days prior to harvest maturity `HM'):
Total - all measurable events: 5.32 in.
Adj'd Residual Soil Water @ (HM-14d): 4.54 in. (sampling depth = 48 in.)
Initial Soil Analysis (NO3,P,K at 0-6 in.; NO3 at 6-24, 24-36 & 36-48 in.):
NO3(lbs/ac)= 266 , P(ppm olsen)= 24 , K(ppm)= 361 , pH= 7.6, O.M.(%) = 1.3
Fertilizer: None Applied

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TABLE 3. EVALUATION OF DRYLAND FALLOW GRAIN AND RESIDUE PERFORMANCE OF EIGHTEEN SPRING WHEAT CULTIVARS GROWN OFF-STATION AT GRAFF FARMS, INC., NORTH JOPLIN. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1991.

ID	VARIETY or SELECTION	PLNT HT Inches	YIELD Bu/Ac 1/	TEST WT Lbs/Bu	PROTEIN %	RESIDUE Lbs/Ac 2/	RESIDUE Lbs/Bu 3/
WA 6920	PENAWAWA (soft white)	34.33	66.77	56.93	12.20	4801.70	82.97
CI 17904	OWENS (soft white)	36.23	63.47	55.93	11.90	5763.07	101.57
CI 17430	NEWANA	31.51	62.60	58.60	13.00	4712.07	85.20
ND 606	AMIDON	40.38	60.13	58.23	13.60	5691.60	127.13
C982-324	RAMBO	33.20	59.80	59.27	13.50	4698.20	84.63
CI 17790	LEN	33.99	59.70	58.37	13.40	5597.70	101.13
PI483235	GLENMAN	34.75	58.23	58.33	13.30	5126.07	98.47
WPB 926	WESTBRED 926	32.61	58.23	55.97	14.00	4641.63	84.73
MT 8402	HI-LINE	33.57	57.77	57.27	13.90	4937.20	94.67
CI 17828	PONDERA	33.57	57.50	58.30	13.90	5451.50	93.47
ND 618	GUS	37.24	55.27	58.67	14.70	5069.53	90.93
CI 15930	OLAF	33.75	55.07	56.50	14.20	5181.60	97.53
ND 626	GRANDIN	35.39	54.40	57.80	13.80	4623.50	90.27
ND 582	STOA	40.45	53.13	57.33	14.40	5015.13	112.70
NDCUT	CUTLESS	35.07	51.83	59.43	14.20	5109.00	108.37
CI 13596	FORTUNA	40.51	50.23	60.00	14.60	5351.23	122.03
CI 17429	LEW	40.85	49.40	59.47	15.00	5803.67	115.37
CANLANC	LANCER	44.86	42.30	58.67	15.20	5593.47	126.47
EXPERIMENTAL MEANS		36.24	56.44	58.06	13.83	5175.99	100.98
C.V. 2: (S OF MEAN/MEAN)*100		2.22	4.49	1.01	-	4.86	8.72
LSD (0.05)		2.31	7.28	1.69	-	722.40	25.32

1/ Based on 19 sqft harvest w/plot binder (precision > than 3 sqft hand hvst for `grain')
2/ Based on 3 sqft harvest w/hand clipper (includes all above-surf dry matter less grain)
3/ Based on hand harvest for residue and grain
Note: Crop suffered minor hail damage via storms on five (5) separate occasions
Delayed hvst w/binder (due to combine breakdown) resulted in moderate shatter loss

CLIMATIC and NURSERY MANAGEMENT DATA

Seeding Date: 05/06/91
Harvest Date: 08/29/91
Seeding Depth: 1.00 in.
Soil Series: N/A (clay loam)
Previous Crop: Fallow
Soil Temp @ Sdg: 58F @ 2in., 54F @ 4in.
Root Penetration Depth: 48.0 in.
Depth to Moisture at Sdg: 0.25 in.
Probed Moist.Depth @ Sdg: 55.0 in.+
Herbicide: N/A
Initial Stored Soil Water at Seeding: 10.15 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: 10.30 in.
Total - all events >.1 inches: 9.92 in.
Post Growing Season Precipitation (within 14 days of harvest maturity):
Total - all measurable events: 1.44 in.
Total - all events >.1 inches: 1.37 in.
Adj'd Residual Soil Water @ (HM-14d): 3.19 in. (sampling depth = 48 in.)
Soil Analysis on 5/6/91: (NO3,P,K at 0-6 in.; NO3 at 6-24, 24-36 & 36-48 in.):
NO3(lbs/ac)= 76 , P(ppm olsen)= 12 , K(ppm)= 216 , pH= 8.0, O.M.(%) = 1.6
Fertilizer: 70#N,40#P2O5 via granular blend bd'cst & till-incorp pre-plant

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TABLE 4. EVALUATION OF DRYLAND FALLOW GRAIN AND RESIDUE PERFORMANCE OF TWENTY SPRING WHEAT CULTIVARS GROWN OFF-STATION AT GRAFF FARMS, INC., NORTH JOPLIN. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1992. 1

ID	VARIETY or SELECTION	HEAD Date 1/	PLNT HT Inches	YIELD Bu/Ac 2/	TEST WT Lbs/Bu	PROTEIN %	RESIDUE Lbs/Ac 3/	RESIDUE Lbs/Bu 4/
CI 17904	OWENS (soft white)	167.00	24.21	52.63	59.37	13.60	3274.77	60.97
WA 6920	PENAWAWA (soft white)	167.00	20.55	48.37	59.93	13.20	2357.10	54.43
ND 626	GRANDIN	167.00	26.67	43.27	60.73	15.70	3285.40	73.90
ND 582	STOA	167.00	29.44	40.57	59.20	16.20	3064.57	61.60
MT 8849	RS6880/MT7819	167.00	24.48	39.47	59.70	18.50	3222.47	66.60
ND 606	AMIDON	170.00	27.80	38.93	58.30	18.30	3770.93	79.60
CI 17430	NEWANA	170.00	22.78	37.27	59.13	17.10	3799.73	94.63
CI 17828	PONDERA	174.00	24.48	36.53	60.13	17.50	2602.50	62.03
PI483235	GLENMAN	170.00	24.44	36.17	58.57	16.00	2863.93	58.00
NDCUT	CUTLESS	167.00	26.68	34.70	59.00	17.80	3029.33	67.53
CI 17429	LEW	170.00	27.62	34.03	59.83	17.50	2852.20	79.90
C982-324	RAMBO	167.00	22.52	32.70	59.93	15.70	3216.07	77.77
ND 618	GUS	167.00	25.07	31.77	59.13	15.90	2836.20	58.87
PI486139	KLASIC (hard white)	163.00	18.20	30.27	60.03	15.90	1587.77	55.10
CANLANC	LANCER	163.00	28.57	29.93	59.00	19.00	2351.77	70.57
CI 17790	LEN	167.00	25.49	29.50	59.57	17.00	3121.13	87.00
MT 8402	HI-LINE	163.00	23.75	27.77	60.57	16.60	1906.83	57.53
CI 13596	FORTUNA	170.00	27.43	25.73	57.53	19.00	2732.70	103.97
WPB 926	WESTBRED 926	163.00	23.10	25.40	59.63	16.30	2289.90	67.13
CI 15930	OLAF	167.00	25.84	22.60	59.00	17.00	2833.03	87.17
EXPERIMENTAL MEANS		167.30	24.95	34.88	59.42	16.68	2849.92	71.22
C.V. 2: (S OF MEAN/MEAN)*100		-	4.24	11.32	.45	-	11.84	9.80
LSD (0.05)		-	3.03	11.31	.76	-	966.08	19.98

1/ No. of Days from January 1 (167 = June 15)
2/ Based on 45 sqft harvest w/plot combine (precision > than 3 sqft hand hvst for `grain')
3/ Based on 3 sqft harvest w/hand clipper (includes all above-surf dry matter less grain)
4/ Based on 3 sqft hand harvest for residue and grain
Note: 4 in. wet snow on 8/24 resulted in lodging & head shatter to mature crop.

CLIMATIC and NURSERY MANAGEMENT DATA

Seeding Date: 04/08/92
Harvest Date: 08/31/92
Seeding Depth: 1.50 in.
Soil Series: Joplin-Hillon CL
Previous Crop: Fallow
Soil Temp @ Sdg: 55F @ 2in., 50F @ 4in.
Root Penetration Depth: N/A in.
Depth to Moisture at Sdg: 0.50 in.
Probed Moist.Depth @ Sdg: 55.0 in.+
Herbicide: None Applied
Initial Stored Soil Water at Seeding: 6.64 in. (sampling depth = 48 in.)
Measured Soil Water at Harvest: 3.07 in. (sampling depth = 48 in.)
Growing Season Precipitation (Sdg.to 14 days prior to harvest maturity `HM'):
Total - all measurable events: 9.23 in.
Total - all events >.1 inches: 8.25 in.
Post Growing Season Precipitation (Within 14 days of harvest maturity `HM'):
Total - all measurable events: .84 in. (.84 in events >.1 via snow 8/24)
Adj'd Residual Soil Water @ (HM-14d): 2.23 in. (sampling depth = 48 in.)
Initial Soil Analysis (NO3,P,K at 0-6 in.; NO3 at 6-24, 24-36 & 36-48 in.):
NO3(lbs/ac)= 96 , P(ppm olsen)= 10 , K(ppm)= 155 , pH= 7.8, O.M.(%) = 1.3
Fertilizer: 70#N,40#P2O5 via gran. blend banded 1.5 in. below seed at planting.

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TABLE 5. EVALUATION OF DRYLAND FALLOW GRAIN AND RESIDUE PERFORMANCE OF TWENTY SPRING WHEAT CULTIVARS GROWN OFF-STATION AT GRAFF FARMS, INC., NORTH JOPLIN. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1993. 1

ID	VARIETY or SELECTION	PLNT HT Inches	YIELD Bu/Ac 1/	TEST WT Lbs/Bu	PROTEIN %	RESIDUE Lbs/Ac 2/	RESIDUE Lbs/Bu 3/
CI 17904	OWENS (soft white)	37.64	79.57	61.07	10.59	6050.10	78.30
WA 6920	PENAWAWA (soft white)	37.56	76.43	60.80	10.41	5880.47	74.10
PI483235	GLENMAN	36.55	74.87	60.97	12.58	5726.83	71.27
MT 8849	RS6880/MT7819	38.92	67.57	61.30	13.45	6166.43	92.27
CI 17828	PONDERA	37.73	67.40	61.90	13.94	5341.60	77.87
ND 606	AMIDON	43.74	66.83	60.43	14.45	6362.77	107.93
MT 8402	HI-LINE	35.39	66.17	62.03	13.98	4550.93	68.90
PI486139	KLASIC (hard white)	26.51	66.07	59.60	13.02	3906.43	59.20
C982-324	RAMBO	37.22	65.77	61.07	13.25	6026.67	84.60
CI 17429	LEW	44.96	64.73	62.43	13.84	6767.17	92.97
CI 17430	NEWANA	35.91	63.77	61.17	12.32	4988.43	81.60
ND 626	GRANDIN	39.76	63.53	62.27	14.97	5943.47	90.10
ND 618	GUS	41.61	61.20	61.67	15.54	5222.13	100.90
WPB 926	WESTBRED 926	34.65	59.33	59.90	14.48	4975.60	77.67
CI 13596	FORTUNA	42.19	58.63	60.97	14.37	4916.93	90.20
NDCUT	CUTLESS	41.25	55.83	60.17	15.71	5671.33	99.80
CI 17790	LEN	37.36	55.50	61.20	12.74	5112.20	95.00
CANLANC	LANCER	43.54	54.77	61.13	16.10	6279.57	109.20
ND 582	STOA	44.75	51.90	60.67	14.31	5820.73	138.47
CI 15930	OLAF	38.18	50.57	60.40	15.04	5126.10	115.70
EXPERIMENTAL MEANS		38.77	63.52	61.06	13.75	5541.79	90.30
C.V. 2: (S OF MEAN/MEAN)*100		1.65	3.68	.33	-	5.20	5.83
LSD (0.05)		1.83	6.69	.57	-	825.07	15.06

1/ Based on 45 sqft harvest w/plot combine (precision > than 3 sqft hand hvst for 'grain')
2/ Based on 3 sqft harvest w/hand clipper (includes all above-surf dry matter less grain)
3/ Based on 3 sqft hand harvest for residue and grain.

Seeding Date: 05/11/93 Soil Temp @ Sdg: 70F @ 2in., 62F @ 4in.
Harvest Date: 10/04/93 Root Penetration Depth: 48.0 in.
Seeding Depth: 1.25 in. Depth to Moisture at Sdg: 0.00 in.
Soil Series: Joplin-Hillon CL Probed Moist.Depth @ Sdg: 55.0 in.+
Previous Crop: Fallow Herbicide: None Applied (hand weeded)
Initial Stored Soil Water at Seeding: 5.76 in. (sampling depth = 48 in.)
Measured Soil Water at Harvest: 5.17 in. (sampling depth = 48 in.)
Growing Season Precipitation (Sdg.to 14 days prior to harvest maturity 'HM'):
Total - all measurable events: 12.45 in. (51 precipitation days)
Total - all events >.1 inches: 11.68 in. (33 precipitation days)
Post Growing Season Precipitation (within 14 days of harvest maturity):
Total - all measurable events: .08 in. (1 precipitation day)
Total - all events >.1 inches: .00 in.
Adj'd Residual Soil Water @ (HM-14d): 5.09 in. (sampling depth = 48 in.)
Initial Soil Analysis (NO3,P,K at 0-6 in.; NO3 at 6-24, 24-36 & 36-48 in.):
NO3(lbs/ac)= 112 , P(ppm olsen)= 26 , K(ppm)= 296 , pH= 7.2, O.M.(%) = 1.4
Fertilizer: 55#N via 46-0-0 commercial topdress 05/01/93 prior to initial anal.
Harvest Soil Analysis (NO3,P,K at 0-6 in.; NO3 at 6-24, 24-36 & 36-48 in.):
NO3(lbs/ac)= 38 , P(ppm olsen)= 19 , K(ppm)= 272 , pH= 7.7, O.M.(%) = 1.2

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TABLE 6. FOUR-YEAR EVALUATION OF GRAIN AND RESIDUE PERFORMANCE OF FIFTEEN SPRING WHEAT CULTIVARS GROWN UNDER DRYLAND FALLOW CONDITIONS AT GRAFF FARMS, INC., NORTH JOPLIN. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1989-1993.

ID	YEAR/CULTIVAR	PLNT HT Inches	YIELD Bu/Ac 1/	TEST WT Lbs/Bu	PROTEIN %	RESIDUE Lbs/Ac 2/	RESIDUE Lbs/Bu 3/
FACTOR ANALYSIS - FACTOR 1 = YEAR							
1	1989	23.74	42.64	60.43	16.67	3249.00	76.68
2	1990	27.44	36.04	60.50	15.97	3705.00	96.62
3	1991	36.47	56.53	58.18	13.76	5256.00	103.40
4	1992	25.44	35.16	59.27	16.77	2918.00	73.51
5	1993	39.60	63.52	61.09	13.58	5641.00	92.39
		**	**	**	-	**	**
	F =	760.04	189.04	45.04	-	240.32	34.96
	P =	.0000	.0000	.0000	-	.0000	.0000
	LSD (.05) =	.72	2.58	.49	-	220.30	6.11
FACTOR ANALYSIS - FACTOR 2 = CULTIVAR							
1	AMIDON	33.38	49.81	59.71	15.77	4532.00	95.65
2	CUTLESS	30.61	42.53	60.05	16.26	4095.00	93.78
3	FORTUNA	32.83	41.06	60.26	16.19	4081.00	101.40
4	GLENMAN	29.46	50.66	59.73	14.50	4173.00	77.94
5	HI-LINE	27.98	45.37	59.32	15.78	3601.00	78.60
6	LANCER	35.33	40.67	60.09	16.94	4251.00	95.41
7	LEN	29.31	45.18	59.57	15.17	4126.00	89.83
8	LEW	33.91	44.77	60.79	16.17	4549.00	95.13
9	NEWANA	27.56	48.80	60.35	14.76	4072.00	82.35
10	OLAF	29.60	41.65	59.09	15.95	3951.00	92.17
11	OWENS	29.09	54.66	59.14	13.02	4421.00	85.69
12	PENAWAWA	27.90	55.71	59.31	12.86	4002.00	76.06
13	PONDERA	29.12	48.95	60.49	15.77	4191.00	83.24
14	RAMBO	28.26	46.83	60.87	15.05	4128.00	82.80
15	STOA	33.71	45.01	59.63	16.04	4134.00	97.91
		**	**	**	**	**	**
	F =	33.81	8.43	3.65	14.81	2.95	4.54
	P =	.0000	.0000	.0000	.0000	.0006	.0000
	LSD (.05) =	1.24	4.46	.84	.86	381.60	10.59
	GRAND MEANS (225 obs)	30.54	46.78	59.89	-	4154.00	88.53
	(75 obs)	-	-	-	15.35	-	-
Year x Cultivar Interactions		**	**	*	-	**	**

1/ Based on 45 sqft harvest w/plot combine (Yr 1,2,4 &5) 19 sqft hvst w/plot binder (Yr 3)
2/ Based on 3 sqft harvest w/hand clipper (all above-surf dry matter less grain, all Yrs)
3/ Based on hand harvest for residue and grain (all Yrs)
** Denotes Statistical Significance at P<=.01
* Denotes Statistical Significance at P<=.05
ns Denotes No Statistical Significance at P<=.05

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TABLE 7. EVALUATION OF DRYLAND FALLOW GRAIN AND RESIDUE PERFORMANCE OF TWELVE SPRING BARLEY CULTIVARS GROWN OFF-STATION AT GRAFF FARMS, INC., NORTH JOPLIN. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1989.

VARIETY or SELECTION	PLNT HT Inches	YIELD Bu/Ac 1/	TEST WT Lbs/Bu	PLUMP %	THIN %	PROTEIN %	RESIDUE Lbs/Ac 2/	RESIDUE Lbs/Bu 3/
MT 81161 LEWIS//KGS/SMT	24.55	58.86	46.23	54.70	14.40	15.10	2779.62	43.23
PI491534 GALLATIN	25.42	58.80	49.57	60.60	11.40	14.40	3204.30	47.13
MT140523 HECTOR/KLAGES	24.61	55.94	48.30	60.80	12.40	15.20	2700.66	44.17
MT 81616 TR440/CLARK (BEARPAW)	21.88	55.16	46.43	76.70	6.40	13.90	2746.54	59.37
CI 15856 LEWIS	26.51	54.89	49.43	72.00	7.00	15.40	2821.24	48.63
CI 15514 HECTOR	23.60	53.96	49.63	75.80	6.00	14.50	3328.08	61.23
CI 9558 PIROLINE	23.14	51.50	48.67	34.50	23.90	16.20	2826.57	51.80
PI483237 BOWMAN	26.57	51.44	49.63	91.00	1.60	15.40	2974.89	47.63
BA 1202 BUSCH AGR 1202	20.54	51.37	48.03	56.70	11.60	16.20	3012.24	60.27
CI 15229 STEPTOE	25.52	50.72	43.03	54.60	18.40	14.00	2900.20	47.80
SK 76333 HARRINGTON	20.72	45.94	48.80	85.80	2.90	15.50	3239.51	81.37
CI 15857 CLARK	24.84	45.50	47.53	62.20	11.20	15.10	2901.26	50.43
EXPERIMENTAL MEANS	23.99	52.84	47.94	54.70	14.40	15.08	2952.93	53.59
C.V. 2: (S OF MEAN/MEAN)*100	3.97	3.92	2.16	-	-	-	7.75	8.58
LSD (0.05)	2.79	6.08	3.04	-	-	-	670.80	13.49

1/ Based on 45 sqft harvest w/plot combine (precision > than 3 sqft hand hvst for `grain')
2/ Based on 3 sqft harvest w/hand clipper (includes all above-surf dry matter less grain)
3/ Based on hand harvest for residue and grain

CLIMATIC and NURSERY MANAGEMENT DATA

Seeding Date: 05/05/89
Harvest Date: 08/21/89
Seeding Depth: 1.25 in.
Soil Series: Joplin-Hillon
Previous Crop: Flw > Winter-Killed WW
Soil Temp @ Sdg: 71F @ 2in., 66F @ 4in.
Root Penetration Depth: N/A in.
Depth to Moisture at Sdg: 0.00 in.
Probed Moist.Depth @ Sdg: 48.0 in.
Herbicide:
Initial Stored Soil Water at Seeding: 7.59 in. (sampling depth = 48 in.)
Measured Soil Water at Harvest: 5.63 in. (sampling depth = 48 in.)
Growing Season Precipitation (Sdg.to 14 days prior to harvest maturity `HM'):
Total - all measurable events: 6.99 in.
Total - all events >.1 inches: 6.67 in.
Adj'd Residual Soil Water @ (HM-14d): 5.63 in. (sampling depth = 48 in.)
Initial Soil Analysis (NO3,P,K at 0-6 in.; NO3 at 6-24, 24-36 & 36-48 in.):
NO3(lbs/ac)= 144 , P(ppm olsen)= 19 , K(ppm)= 326 , pH= 7.5, O.M.(%) = 1.3
Fertilizer: 78#N,36#P2O5 (8#N,36#P2O5 via 11-51-0 w/winter wheat seed Fall 88), (70#N via 46-0-0 broadcast & disked in prior to replanting Spr 89)

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TABLE 8. EVALUATION OF DRYLAND FALLOW GRAIN AND RESIDUE PERFORMANCE OF TWELVE SPRING BARLEY CULTIVARS GROWN OFF-STATION AT GRAFF FARMS, INC., NORTH JOPLIN. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1990.

VARIETY or SELECTION	PLNT HT Inches	YIELD Bu/Ac 1/	TEST WT Lbs/Bu	PLUMP %	THIN %	PROTEIN %	RESIDUE Lbs/Ac 2/	RESIDUE Lbs/Bu 3/
PI483237 BOWMAN	25.60	57.00	50.27	93.50	1.60	13.00	3427.37	57.17
CI 15514 HECTOR	26.17	56.83	49.53	66.40	11.70	14.30	3299.30	63.07
CI 15229 STEPTOE	24.62	56.47	43.63	70.40	10.50	11.10	2979.20	48.53
MT140523 HECTOR/KLAGES	22.82	55.93	50.40	65.70	10.70	12.90	3827.50	54.73
PI491534 GALLATIN	23.82	55.03	50.27	68.40	9.60	14.60	3125.37	61.63
ND 9866 ND7014/BOWMAN SIB(STARK)	25.73	53.90	51.00	93.30	1.40	14.00	4071.83	53.37
CI 9558 PIROLINE	23.71	53.03	50.30	72.60	7.40	13.90	3621.57	64.53
PI531228 BEARPAW	21.82	52.10	49.83	73.90	8.00	14.10	3828.53	65.63
CI 15856 LEWIS	22.60	51.73	50.87	70.40	8.60	14.50	3296.10	61.77
CI 15857 CLARK	22.44	51.30	48.57	57.00	14.60	14.10	3464.70	74.10
SK 76333 HARRINGTON	21.76	50.90	49.83	77.60	5.90	13.10	3452.97	71.67
78Ab6871 CRYSTAL	21.92	49.40	50.43	76.10	5.70	14.10	3115.77	66.50
EXPERIMENTAL MEANS	23.58	53.64	49.58	73.78	7.98	13.64	3459.18	61.89
C.V. 2: (S OF MEAN/MEAN)*100	3.34	3.41	.86	-	-	-	7.11	5.56
LSD (0.05)	2.31	5.37	1.25	-	-	-	721.47	10.08

1/ Based on 45 sqft harvest w/plot combine (precision > than 3 sqft hand hvst for `grain')
2/ Based on 3 sqft harvest w/hand clipper (includes all above-surf dry matter less grain)
3/ Based on hand harvest for residue and grain

CLIMATIC and NURSERY MANAGEMENT DATA

Seeding Date: 05/03/90
Harvest Date: 08/16/90
Seeding Depth: 1.50 in.
Soil Series: N/A
Previous Crop: Fallow
Soil Temp @ Sdg: 64F @ 2in., 60F @ 4in.
Root Penetration Depth: N/A in.
Depth to Moisture at Sdg: 0.00 in.
Probed Moist.Depth @ Sdg: 55.0 in.+
Herbicide: None Applied - Hand Weeded
Initial Stored Soil Water at Seeding: 10.96 in. (sampling depth = 48 in.)
Measured Soil Water at Harvest: 3.88 in. (sampling depth = 48 in.)
Growing Season Precipitation (Sdg.to 14 days prior to harvest maturity `HM'):
Total - all measurable events: 5.32 in.
Adj'd Residual Soil Water @ (HM-14d): 3.88 in. (sampling depth = 48 in.)
Initial Soil Analysis (NO3,P,K at 0-6 in.; NO3 at 6-24, 24-36 & 36-48 in.):
NO3(lbs/ac)= 266 , P(ppm olsen)= 24 , K(ppm)= 361 , pH= 7.6, O.M.(%) = 1.3
Fertilizer: None Applied

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TABLE 9. EVALUATION OF DRYLAND FALLOW GRAIN AND RESIDUE PERFORMANCE OF FOURTEEN SPRING BARLEY CULTIVARS GROWN OFF-STATION AT GRAFF FARMS, INC., NORTH JOPLIN. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1991.

ID	VARIETY or SELECTION	PLNT HT Inches	YIELD Bu/Ac 1/	TEST WT Lbs/Bu	PLUMP %	THIN %	PROTEIN %	RESIDUE Lbs/Ac 2/	RESIDUE Lbs/Bu 3/
CI 15229	STEPTOE	35.60	67.67	44.37	64.70	16.20	10.70	3688.77	57.03
ND 9866	STARK	35.20	56.30	50.30	77.80	10.40	12.50	3310.00	73.83
MT140523	HECTOR/KLAGES	31.98	55.40	46.67	43.20	27.70	13.80	3519.13	61.07
PI491534	GALLATIN	35.37	52.37	49.40	60.00	15.40	12.90	3895.77	73.57
CI 15856	LEWIS	32.48	50.83	48.03	52.90	21.30	13.30	3059.20	75.70
CI 9558	PIROLINE	35.52	50.80	47.97	46.40	24.00	13.30	3872.33	67.63
PI483237	BOWMAN	32.74	50.47	50.60	89.00	4.30	13.00	3414.53	61.07
PI531228	BEARPAW	33.22	50.47	42.77	49.70	22.70	13.20	3917.10	69.07
CI 15514	HECTOR	34.49	47.90	47.27	48.50	24.90	13.10	3892.57	68.27
CI 15857	CLARK	34.74	45.20	46.97	63.10	15.70	12.50	3876.57	87.07
NS 78054	BARONESSE	31.26	41.90	44.70	46.30	23.50	12.50	4607.47	78.43
SK 76333	HARRINGTON	31.64	34.07	41.20	39.90	31.80	13.50	4143.33	82.07
MTSU 247	SHONKIN	32.85	24.53	48.20	6.30	73.00	15.40	3942.73	97.47
MN 52	EXCEL	30.31	13.30	41.20	39.60	38.10	12.20	3555.40	96.17
EXPERIMENTAL MEANS		33.39	45.80	46.40	51.96	24.93	12.98	3763.92	74.89
C.V. 2: (S OF MEAN/MEAN)*100		2.66	7.40	2.01	-	-	-	8.90	10.61
LSD (0.05)		2.59	9.85	2.71	-	-	-	973.77	23.09

1/ Based on 19 sqft harvest w/plot combine (precision > than 3 sqft hand hvst for `grain')
2/ Based on 3 sqft harvest w/hand clipper (includes all above-surf dry matter less grain)
3/ Based on hand harvest for both residue and grain
Note: Crop suffered minor hail damage via storms on five (5) separate occasions
Delayed hvst w/binder (due to combine breakdown) resulted in moderate shatter loss

CLIMATIC and NURSERY MANAGEMENT DATA

Seeding Date: 05/06/91
Harvest Date: 08/29/91
Seeding Depth: 1.00 in.
Soil Series: N/A (clay loam)
Previous Crop: Fallow
Soil Temp @ Sdg: 58F @ 2in., 54F @ 4in.
Root Penetration Depth: 38.0 in.
Depth to Moisture at Sdg: 0.25 in.
Probed Moist.Depth @ Sdg: 55.0 in.+
Herbicide: N/A
Initial Stored Soil Water at Seeding: 10.15 in. (sampling depth = 48 in.)
Measured Soil Water at Harvest: 4.69 in. (sampling depth = 48 in.)
Growing Season Precipitation (Sdg.to 14 days prior to harvest maturity `HM'):
Total - all measurable events: 10.02 in.
Total - all events >.1 inches: 9.64 in.
Post Growing Season Precipitation (within 14 days of harvest maturity):
Total - all measurable events: 1.72 in.
Total - all events >.1 inches: 1.65 in.
Adj'd Residual Soil Water @ (HM-14d): 2.97 in. (sampling depth = 48 in.)
Soil Analysis on 5/6/91: (NO3,P,K at 0-6 in.; NO3 at 6-24, 24-36 & 36-48 in.):
NO3(lbs/ac)= 76 , P(ppm olsen)= 12 , K(ppm)= 216 , pH= 8.0, O.M.(%) = 1.6
Fertilizer: 70#N,40#P2O5 via granular blend bd'cst & till-incorp pre-plant

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TABLE 10. EVALUATION OF DRYLAND FALLOW GRAIN AND RESIDUE PERFORMANCE OF FIFTEEN SPRING BARLEY CULTIVARS GROWN OFF-STATION AT GRAFF FARMS, INC., NORTH JOPLIN. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1992.

ID	VARIETY or SEL'N	HEAD DATE 1/	PLNT HT Inches	YIELD Bu/Ac 2/	TEST WT Lbs/Bu	PLUMP %	THIN %	PROTEIN %	RESIDUE Lbs/Ac 3/	RESIDUE Lbs/Bu 4/
PI491534	GALLATIN	174.00	22.49	74.67	49.83	93.70	2.70	12.80	2813.80	40.20
MT 81161	LEWIS//KGS/SMT	174.00	21.98	71.50	48.57	94.80	2.70	12.90	2034.87	31.70
NS 78054	BARONESSE	174.00	18.19	71.17	48.20	94.90	2.40	13.10	2714.57	37.50
MT860756	GALLATIN/BELLONA	170.00	20.89	70.63	49.40	95.70	1.60	12.40	2465.93	39.80
MT140523	HECTOR/KLAGES	174.00	22.39	68.90	48.73	94.50	2.30	13.80	2237.60	39.17
PI531228	BEARPAW	174.00	22.49	67.60	48.57	94.10	2.90	12.80	2827.67	43.70
CI 15856	LEWIS	178.00	22.03	64.50	49.23	91.70	3.30	13.50	2802.07	37.37
SK 76333	HARRINGTON	170.00	22.11	64.47	48.13	93.40	2.70	13.00	3156.30	39.70
PI483237	BOWMAN	170.00	18.91	63.57	47.63	95.90	1.70	13.60	2393.40	40.67
ND 9866	STARK	170.00	23.48	63.33	48.80	94.40	2.30	13.10	2591.83	39.67
CI 15514	HECTOR	174.00	24.38	61.47	49.37	92.20	3.40	13.40	2646.30	41.57
CI 15857	CLARK	178.00	21.89	61.27	48.37	93.00	3.80	13.20	2502.23	37.27
CI 15229	STEPTOE	170.00	18.07	60.23	42.77	96.90	1.40	12.20	2147.97	42.13
CI 9558	PIROLINE	174.00	22.24	57.67	49.53	93.40	2.20	13.50	2351.77	36.53
MN 52	EXCEL	174.00	21.19	42.43	46.27	96.80	1.20	12.10	2158.63	38.13
EXPERIMENTAL MEANS		173.00	21.52	64.23	48.23	94.36	2.44	13.02	2523.00	39.01
C.V. 2: (S OF MEAN/MEAN)*100		-	4.56	6.90	.95	-	-	-	8.86	7.70
LSD (0.05)		-	2.84	12.84	1.32	-	-	-	647.64	8.71

1/ No. of Days from January 1 (173 = June 21)
2/ Based on 45 sqft harvest w/plot combine (precision > than 3 sqft hand hvst for `grain')
3/ Based on 3 sqft harvest w/hand clipper (includes all above-surf dry matter less grain)
4/ Based on 3 sqft hand harvest for residue and grain
Note: 4 in. wet snow on 8/24 resulted in lodging & head shatter to mature crop

CLIMATIC and NURSERY MANAGEMENT DATA

Seeding Date: 04/08/92
Harvest Date: 08/31/92
Seeding Depth: 1.50 in.
Soil Series: Joplin-Hillon CL
Previous Crop: Fallow
Soil Temp @ Sdg: 55F @ 2in., 50F @ 4in.
Root Penetration Depth: N/A in.
Depth to Moisture at Sdg: 0.50 in.
Probed Moist.Depth @ Sdg: 55.0 in.+
Herbicide: None Applied
Initial Stored Soil Water at Seeding: 6.64 in. (sampling depth = 48 in.)
Measured Soil Water at Harvest: 5.09 in. (sampling depth = 48 in.)
Growing Season Precipitation (Sdg.to 14 days prior to harvest maturity `HM'):
Total - all measurable events: 9.23 in.
Total - all events >.1 inches: 8.25 in.
Post Growing Season Precipitation (within 14 days of harvest maturity `HM'):
Total - all measurable events: .84 in. (via 4 in. wet snow 8/24)
Total - all events >.1 inches: .84 in.
Adj'd Residual Soil Water @ (HM-14d): 4.25 in. (sampling depth = 48 in.)
Initial Soil Analysis (NO3,P,K at 0-6 in.; NO3 at 6-24, 24-36 & 36-48 in.):
NO3(lbs/ac)= 96 , P(ppm olsen)= 10 , K(ppm)= 155 , pH= 7.8, O.M.(%) = 1.3
Fertilizer: 70#N,40#P2O5 via gran. blend banded 1.5 in. below seed at planting.

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TABLE 11. EVALUATION OF DRYLAND FALLOW GRAIN AND RESIDUE PERFORMANCE OF EIGHTEEN SPRING BARLEY CULTIVARS GROWN OFF-STATION AT GRAFF FARMS, INC., NORTH JOPLIN. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1993.

ID	VARIETY or SEL'N	STAND %	PLNT HT Inches	YIELD Bu/Ac 1/	TEST WT Lbs/Bu	PLUMP %	THIN %	PROTEIN %	RESIDUE Lbs/Ac 2/	RESIDUE Lbs/Bu 3/
NS 78054	BARONESSE	100.00	34.53	90.53	49.40	95.00	1.90	11.55	4878.53	49.40
CI 15229	STEPTOE	100.00	34.66	90.40	59.83	92.60	3.70	11.22	3546.87	37.17
PI483237	BOWMAN	100.00	34.65	89.37	49.37	94.90	2.40	12.24	3604.47	54.33
MT890008	MT890008	100.00	38.43	87.03	48.57	95.70	2.00	11.07	4744.07	53.60
MT140523	MT140523	98.53	36.76	86.37	51.30	95.30	1.70	11.69	4486.93	51.50
CI 15856	LEWIS	100.00	38.65	84.63	52.03	95.10	2.30	11.54	4240.40	57.77
SK 76333	HARRINGTON	99.27	37.60	84.17	49.43	91.60	3.50	11.78	4450.63	51.93
PI537967	COLTER	100.00	33.32	83.80	43.77	83.00	6.30	10.91	3871.23	45.93
CI 9558	PIROLINE	100.00	37.95	83.37	51.27	92.80	2.50	11.86	4881.73	55.73
MT860756	MT860756	98.53	36.29	83.27	51.57	97.00	1.00	10.81	4687.53	56.70
MT851195	MT851195	100.00	36.59	82.10	50.37	95.40	1.90	12.06	4882.77	51.00
MT 81161	MT 81161	99.27	36.30	79.57	50.17	96.10	2.10	11.78	3968.33	46.50
MT851032	MT851032	100.00	34.44	77.70	50.67	95.30	1.40	11.19	3976.87	56.07
PI491534	GALLATIN	100.00	37.03	75.97	50.80	92.80	4.10	11.35	5053.53	66.53
CI 15514	HECTOR	100.00	36.71	75.37	50.27	93.90	2.70	12.02	3869.10	59.67
CI 15857	CLARK	98.53	35.13	73.90	50.10	93.00	2.80	11.67	4094.27	54.73
PI531228	BEARPAW	99.27	39.57	73.00	50.10	90.50	3.70	10.90	5415.27	59.00
ND 9866	STARK	99.27	39.50	71.80	50.47	96.30	1.80	11.69	4348.20	65.00
EXPERIMENTAL MEANS		99.59	36.56	81.80	50.53	93.68	2.66	11.52	4388.93	54.03
C.V.2:(S OF MEAN/MEAN)*100		.45	3.91	5.52	7.76	-	-	-	9.10	4.67
LSD (0.05)		1.28	4.10	12.97	11.27	-	-	-	1147.43	7.25

1/ Based on 45 sqft harvest w/plot combine (precision > than 3 sqft hand hvst for `grain')
2/ Based on 3 sqft harvest w/hand clipper (includes all above-surf dry matter less grain)
3/ Via 3 sqft hand harvest for residue and grain.

CLIMATIC and NURSERY MANAGEMENT DATA

Seeding Date: 05/11/93
Harvest Date: 10/04/93
Seeding Depth: 1.25 in.
Soil Series: Joplin-Hillon CL
Previous Crop: Fallow
Soil Temp @ Sdg: 75F @ 2in., 64F @ 4in.
Root Penetration Depth: 48.0 in.
Depth to Moisture at Sdg: 0.00 in.
Probed Moist.Depth @ Sdg: 55.0 in.+
Herbicide: None Applied (hand weeded)
Initial Stored Soil Water at Seeding: 5.76 in. (sampling depth = 48 in.)
Measured Soil Water at Harvest: 6.62 in. (sampling depth = 48 in.)
Growing Season Precipitation (Sdg.to 14 days prior to harvest maturity `HM'):
Total - all measurable events: 12.45 in. (51 precipitation days)
Total - all events >.1 inches: 11.68 in. (33 precipitation days)
Post Growing Season Precipitation (within 14 days of harvest maturity):
Total - all measurable events: .08 in. (1 precipitation day)
Total - all events >.1 inches: .00 in.
Adj'd Residual Soil Water @ (HM-14d): 6.54 in. (sampling depth = 48 in.)
Initial Soil Analysis (NO3,P,K at 0-6 in.; NO3 at 6-24, 24-36 & 36-48 in.):
NO3(lbs/ac)= 112 , P(ppm olsen)= 26 , K(ppm)= 296 , pH= 7.2, O.M.(%) = 1.4
Fertilizer: 55#N via 46-0-0 commercial topdress 05/01/93 prior to initial anal.
Harvest Soil Analysis (NO3,P,K at 0-6 in.; NO3 at 6-24, 24-36 & 36-48 in.):
NO3(lbs/ac)= 36 , P(ppm olsen)= 19 , K(ppm)= 387 , pH= 7.4, O.M.(%) = 1.5

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TABLE 12. FOUR-YEAR EVALUATION OF GRAIN AND RESIDUE PERFORMANCE OF TEN SPRING BARLEY CULTIVARS GROWN UNDER DRYLAND FALLOW CONDITIONS AT GRAFF FARMS, INC., NORTH JOPLIN. NORTHERN AGRICULTURAL RESEARCH CENTER. HAVRE, MONTANA. 1989-1993.

FACTOR ANALYSIS - FACTOR 1 = YEAR

ID	YEAR/CULTIVAR	PLNT HT Inches	YIELD Bu/Ac 1/	TEST WT Lbs/Bu	PLUMP %	THIN %	PROTEIN %	RESIDUE Lbs/Ac 2/	RESIDUE Lbs/Bu 3/
1	1989	24.28	52.34	48.10	67.40	10.12	14.96	2964.00	53.95
2	1990	23.54	54.03	49.35	71.59	8.86	13.56	3432.00	62.28
3	1991	33.78	50.52	46.52	55.74	20.40	12.93	3728.00	70.25
4	1992	21.70	64.43	48.22	93.88	2.64	13.18	2588.00	39.83
5	1993	36.87	81.65	51.45	93.25	2.94	11.63	4364.00	54.84
		**	**	**	-	-	-	**	**
	F =	477.10	125.31	5.50	-	-	-	67.58	55.52
	P =	.0000	.0000	.0005	-	-	-	.0000	.0000
	LSD (.05) =	.88	3.25	2.18	-	-	-	234.50	4.25

FACTOR ANALYSIS - FACTOR 2 = CULTIVAR

1	BEARPAW	27.80	59.65	47.54	76.98	8.74	12.98	3747.00	59.35
2	BOWMAN	27.70	62.36	49.50	92.86	2.32	13.45	3163.00	52.18
3	CLARK	27.81	55.43	48.31	73.66	9.62	13.31	3368.00	60.72
4	HARRINGTON	26.77	55.90	47.48	77.66	9.36	13.38	3689.00	65.35
5	GALLATIN	28.83	63.36	49.97	75.10	8.64	13.21	3619.00	57.80
6	HECTOR	29.07	59.09	49.21	75.36	9.74	13.46	3407.00	58.77
7	LEWIS	28.45	61.31	49.92	76.42	8.50	13.65	3244.00	56.24
8	MT 140523	27.71	64.50	49.08	71.90	10.96	13.48	3354.00	50.13
9	PIROLINE	28.51	59.27	49.55	67.94	12.00	13.75	3511.00	55.24
10	STEPTOE	27.70	65.09	46.73	75.84	10.04	11.84	3053.00	46.53
		*	**	ns	*	ns	**	**	**
	F =	2.37	4.16	1.08	2.30	1.50	4.33	3.71	6.56
	P =	.0179	.0001	.3858	.0372	.1852	.0007	.0005	.0000
	LSD (.05) =	1.24	4.59	3.09	12.22	6.05	.74	331.60	6.01
	GRAND MEANS (150 obs)	28.03	60.60	48.73	-	-	-	3415.00	56.23
	(50 obs)	-	-	-	76.37	8.99	13.25	-	-
	Year x Cultivar Interactions	**	**	ns	-	-	-	*	**

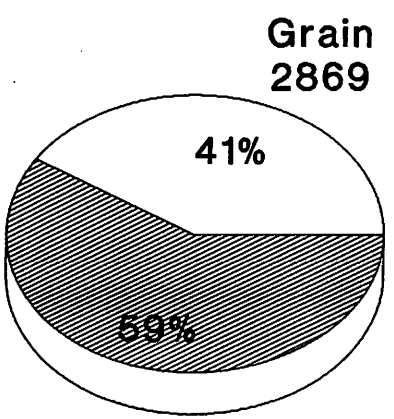
1/ Based on 45 sqft harvest w/plot combine (Yr 1,2,4 &5) 19 sqft hvst w/plot binder (Yr 3)
2/ Based on 3 sqft harvest w/hand clipper (all above-surf dry matter less grain, all Yrs)
3/ Based on hand harvest for residue and grain (all Yrs)

** Denotes Statistical Significance at P<=.01
* Denotes Statistical Significance at P<=.05
ns Denotes No Statistical Significance at P<=.05

Grain & Residue Relationships

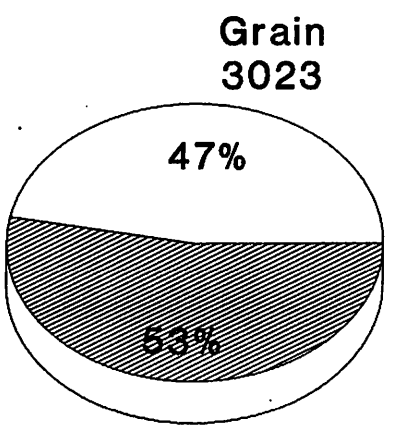
Average Lbs/Acre (1989-1993)

Graff Farms, Inc., North Joplin



15 Spring Wheats
(Ave Total Dry Matter = 7023)

Residue/Grain Ratio = 1.45



10 Spring Barleys
(Ave Total Dry Matter = 6438)

Residue/Grain Ratio = 1.13

Figure 1.
MSU/AES/NARC-Havre

Grain and Residue Relationships
(15 Spring Wheat Varieties, 1989-1993)
Graff Farms, Inc., North Joplin

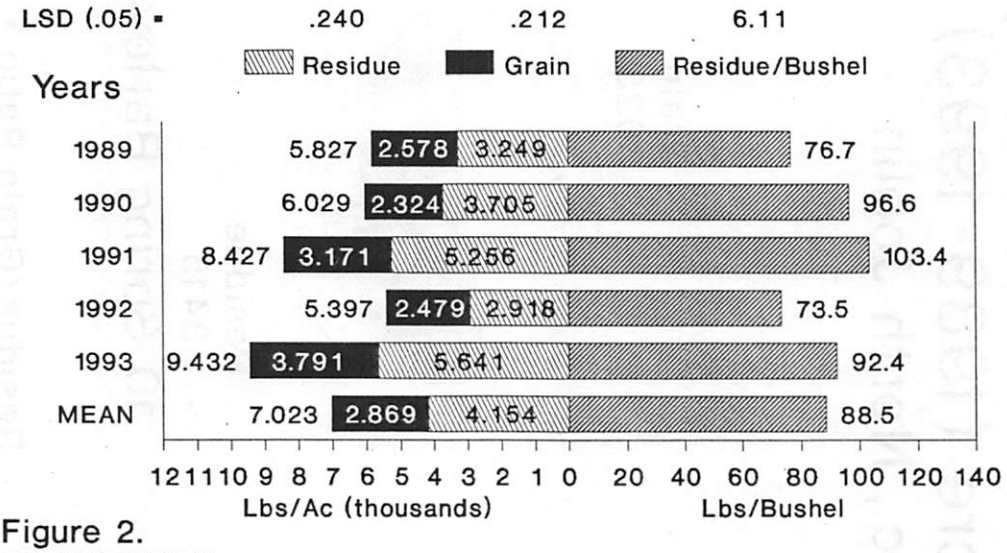


Figure 2.
MSU/AES/NARC-Havre

Grain and Residue Relationships
(8 Spring Wheat Varieties, 1989-1993)
Graff Farms, Inc., North Joplin

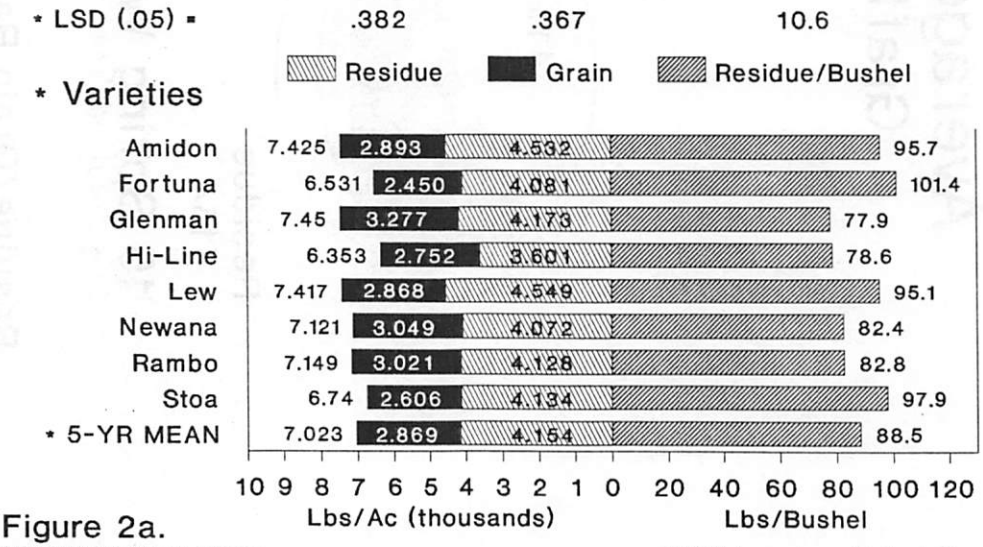


Figure 2a.
MSU/AES/NARC-Havre

* ANOVA based on 15 Varieties

Grain and Residue Relationships
(10 Spring Barley Varieties, 1989-1993)
Graff Farms, Inc., North Joplin

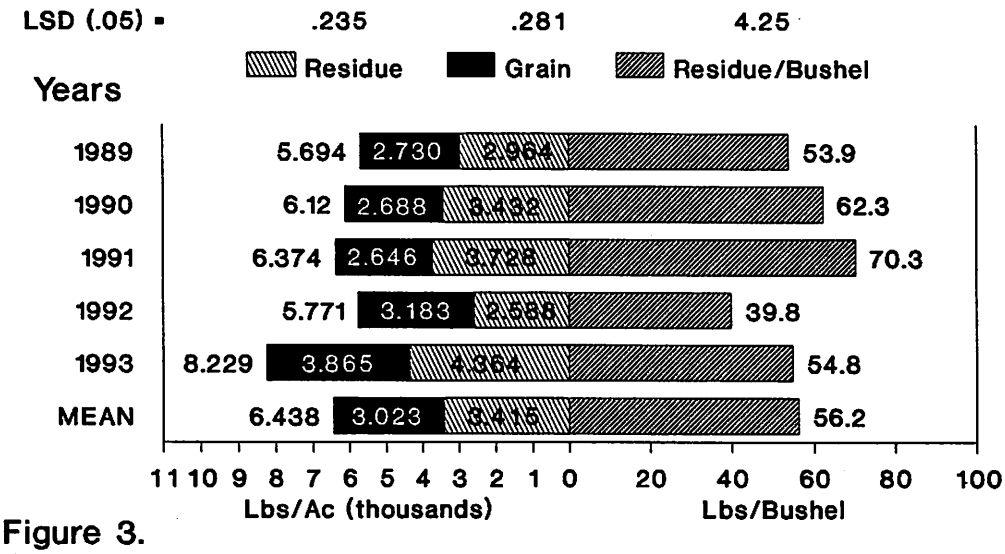


Figure 3.
MSU/AES/NARC-Havre

Grain and Residue Relationships
(8 Spring Barley Varieties, 1989-1993)
Graff Farms, Inc., North Joplin

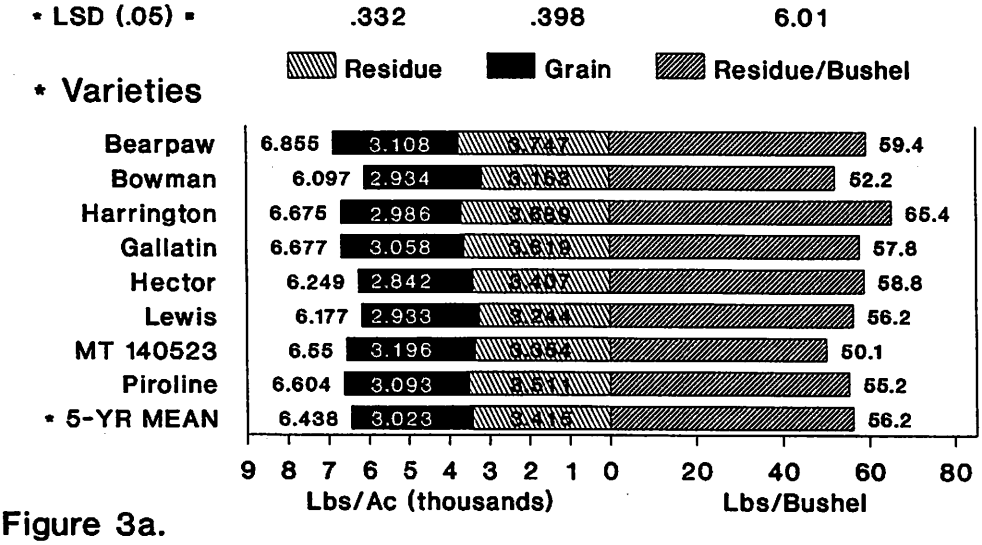


Figure 3a.
MSU/AES/NARC-Havre

* ANOVA based on 10 Varieties