

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

PROJECT LEADER: Gregg R. Carlson, Agronomist - Havre

PROJECT PERSONNEL: T.L. Allen, Res Spec (NARC) - Havre
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 state by USDA-SCS.

RESULTS:

Preliminary 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 over a 4-year period at Graff Farms, Inc. north of Joplin, Montana are summarized in Table 1. Years differed widely as average residue (lbs/ bu) ranged from a low of 73.5 in 1992 to 103.4 in 1991. The 4-year grand mean for spring wheat residue was 87.6 lbs/ bu - only 8 percent below the SCS value. Similar data for 10 spring barley cultivars grown over the same 4-year period at the same location are presented in Table 2. 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 4-year mean of 56.6 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 1.43 for spring wheat and 1.13 for barley (Figure 1.). Grain and residue relationships for spring wheat and barley are graphically presented in Figures 2 and 3, respectively.

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 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 no-till production is still strong, but federal farm policy has resulted in a reduction of recrop acreage and has increased concern regarding maintenance of adequate residue through fallow periods.

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 4 years (1989-1992) and were further analyzed in 1992 as a factorial arrangement of treatments to separately evaluate years and varieties plus the interactive effects of these two variables.

FUTURE PLANS:

We plan to collect residue data at this location for at least one additional year. Decisions will be made following the 5th year of evaluation as to whether the effort should be terminated, continued at this location only, or expanded to additional locations representing differing environments. Based on the effects of 'year' during the first 4 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 changes in estimate values should be recommended.

TABLE 1. 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. 1992.

FACTOR ANALYSIS - FACTOR 1 = YEAR						
ID	YEAR/CULTIVAR	PLNT HT	YIELD	TEST WT	PROTEIN	RESIDUE
		Inches	Bu/Ac	Lbs/Bu	%	Lbs/Ac
		1/			2/	
		3/				
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 86.62
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
		**	**	**		** **
	F =	450.16	106.15	34.37	-	200.80 40.59
	P =	.0000	.0000	.0000	-	.0000 .0000
	LSD (.05) =	.75	2.68	.53	-	204.40 6.47
FACTOR ANALYSIS - FACTOR 2 = CULTIVAR						
1	AMIDON	30.79	45.56	59.52	16.10	4074.00 82.58
2	CUTLESS	27.96	39.20	60.02	16.40	3701.00 82.28
3	FORTUNA	30.49	36.67	60.08	16.65	3873.00 104.20
4	GLENMAN	27.68	44.61	59.42	14.98	3785.00 78.61
5	HI-LINE	26.13	40.17	58.64	16.23	3364.00 81.03
6	LANCER	33.28	37.15	59.83	17.15	3744.00 91.86
7	LEN	27.30	42.60	59.17	15.77	3879.00 88.53
8	LEW	31.15	39.78	60.38	16.75	3995.00 85.67
9	NEWANA	25.48	45.06	60.15	15.38	3842.00 82.54
10	OLAF	27.45	39.42	58.77	16.17	3657.00 86.29
11	OWENS	26.95	48.43	58.66	13.63	4013.00 87.54
12	PENAWAWA	25.48	50.52	58.94	13.48	3532.00 76.55
13	PONDERA	26.97	44.34	60.13	16.23	3904.00 84.58
14	RAMBO	26.02	42.09	60.82	15.50	3653.00 82.35
15	STOA	30.95	43.29	59.37	16.48	3712.00 87.77
		**	**	**	**	* **
	F =	22.02	4.56	3.44	10.18	1.80 2.50
	P =	.0000	.0000	.0001	.0000	.0463 .0038
	LSD (.05) =	1.45	5.20	1.02	.95	395.70 12.53
GRAND MEANS (180 obs)		28.27	42.59	59.59	-	3782.00 87.56
(60 obs)		-	-	-	15.79	- -
Year x Cultivar Interactions		**	ns	ns	-	* *

1/ Based on 45 sqft harvest w/plot combine (Yr 1,2,4) 19 sqft harvest 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

TABLE 2. 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. 1992.

FACTOR ANALYSIS - FACTOR 1 = YEAR										
ID	YEAR/CULTIVAR	PLNT HT	YIELD	TEST WT	PLUMP	THIN	PROTEIN	RESIDUE	RESIDUE	
		Inches	Bu/Ac	Lbs/Bu	%	%	%	Lbs/Ac	Lbs/Bu	
		1/			2/					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	
		**	**	**	-	-	-	**	**	
	F =	319.95	36.66	20.09	-	-	-	41.00	63.27	
	P =	.0000	.0000	.0000	-	-	-	.0000	.0000	
	LSD (.05) =	.85	2.90	.73	-	-	-	221.50	4.60	
FACTOR ANALYSIS - FACTOR 2 = CULTIVAR										
1	BEARPAW	24.85	56.32	46.90	73.60	10.00	13.50	3330.00	59.44	
2	BOWMAN	25.86	55.61	49.53	92.35	2.30	13.75	3053.00	51.64	
3	CLARK	25.98	50.82	47.86	68.82	11.32	13.73	3186.00	62.22	
4	HARRINGTON	24.06	48.83	46.99	74.17	10.82	13.77	3498.00	68.71	
5	GALLATIN	26.77	60.21	49.77	70.68	9.78	13.68	3260.00	55.62	
6	HECTOR	27.16	55.02	48.95	70.73	11.50	13.83	3292.00	58.54	
7	LEWIS	25.91	55.48	49.39	71.75	10.05	14.18	2895.00	55.86	
8	MT 140523	25.45	59.03	48.52	66.05	13.27	13.92	3071.00	49.78	
9	PIROLINE	26.15	53.24	49.12	61.72	14.38	14.23	3168.00	55.12	
10	STIEPTOE	25.95	58.76	43.45	71.65	11.63	12.00	2929.00	48.88	
		**	**	**	*	ns	**	ns	**	
	F =	3.43	4.92	21.66	2.45	1.57	4.25	1.93	5.40	
	P =	.0013	.0000	.0000	.0345	.1754	.0016	.0603	.0000	
	LSD (.05) =	1.35	4.58	1.15	14.82	7.49	.88	350.20	7.28	
GRAND MEANS (120 obs)		25.82	55.33	48.05	-	-	-	3178.00	56.58	
(40 obs)		-	-	-	72.15	10.50	13.66	-	-	
Year x Cultivar Interactions ** ** ** - - - ns *										

1/ Based on 45 sqft harvest w/plot combine (Yr 1,2,4) 19 sqft harvest 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 (1989-1992)

Graff Farms, Inc., North Joplin

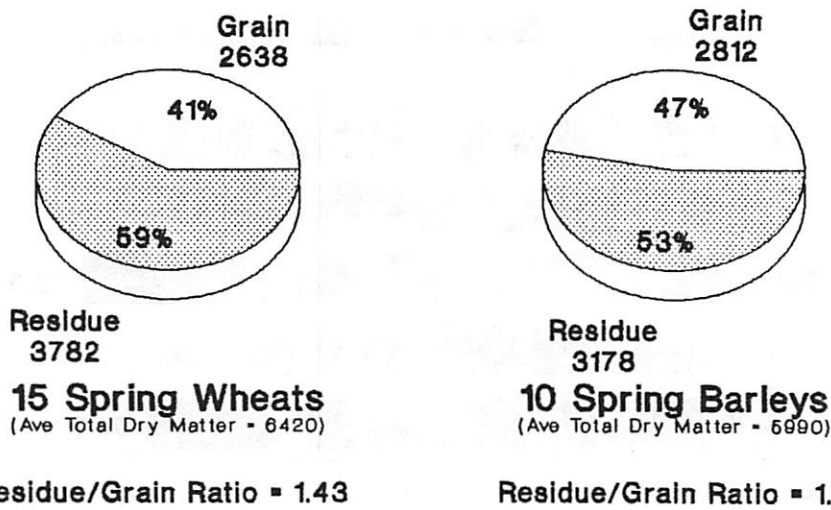


Figure 1.
MSU/AES/NARC-Havre

Grain and Residue Relationships

(15 Spring Wheat Varieties, 1989-1992)

Graff Farms, Inc., North Joplin

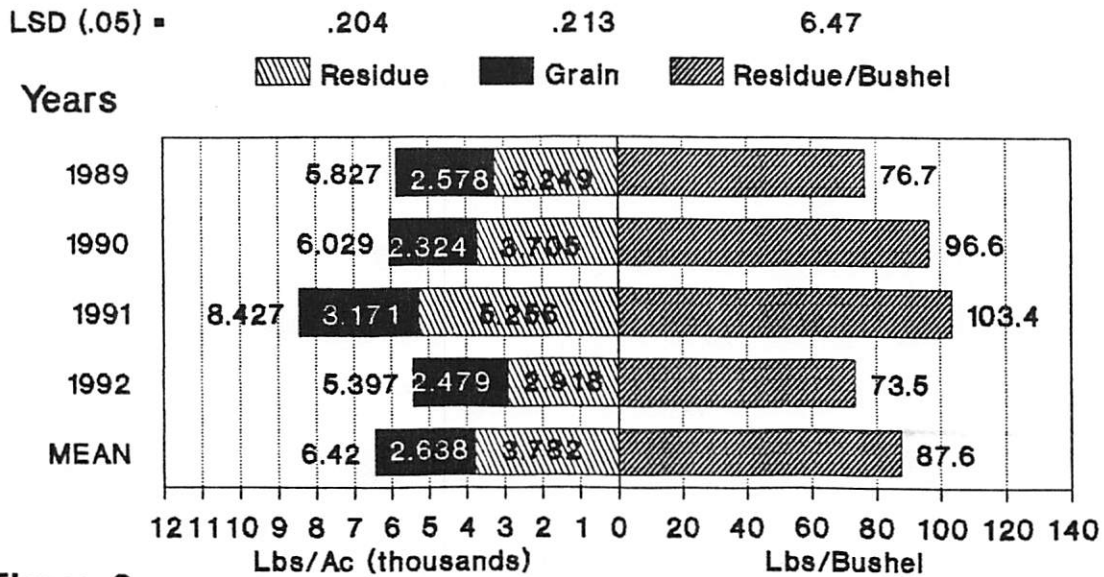


Figure 2.
MSU/AES/NARC-Havre

Grain and Residue Relationships (10 Spring Barley Varieties, 1989-1992) Graff Farms, Inc., North Joplin

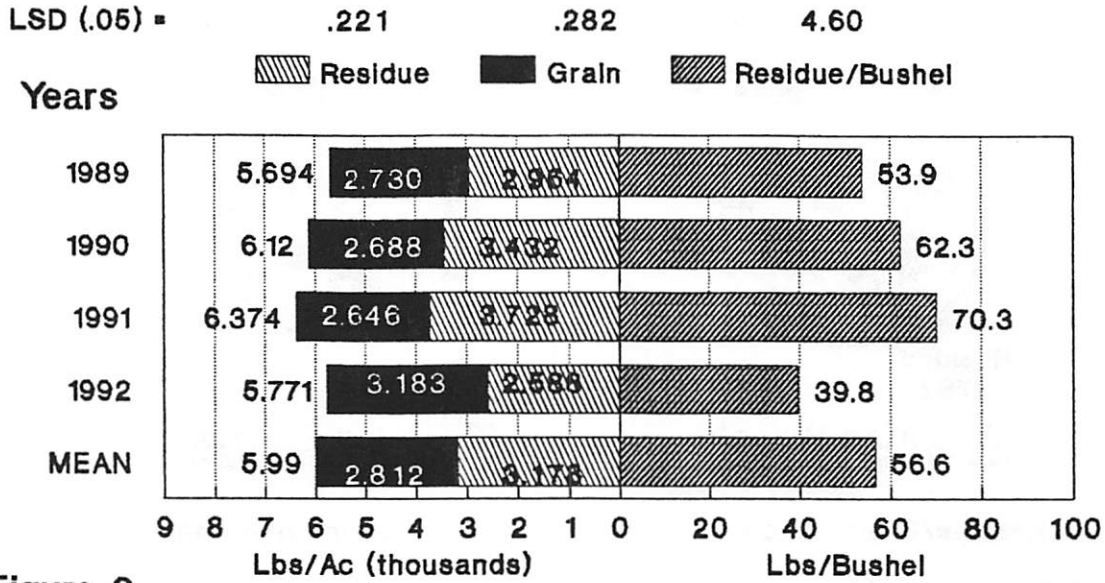


Figure 3.
MSU/AES/NARC-Havre