Irrigated Dual Purpose Wheat Planting Dates, Seeding Rates, Varieties in Southeastern Colorado, 2002 to 2004

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Dual-purpose wheats, wheats utilized for both livestock forage grazing and grain yield, are frequently grown throughout the Southern High Plains. Typically in Colorado, dual purpose wheats are raised primarily for grain and secondarily for livestock forage. Although conditions for both forage removal and grain harvest do not occur each year, livestock grazing is an added benefit and income for wheat producers during high wheat forage production years. We conducted this study to determine the effects of seeding rates, planting dates, and varieties on irrigated winter wheat forage and grain production.

Materials and Methods:

We conducted this study at the Plainsman Research Center near Walsh, Colorado for three years: 2001-02, 2002-03 and 2003-04. We planted four winter wheat varieties, Custer, Intrada, Jagger, and TAM 107, at three seeding rates, 60, 120, and 180 lb/A, with an early planting date (August 24, 2001, September 4, 2002, and September 9, 2003) one treatment set for both forage and grain, and with a late planting date treatment (September 24, 2001, October 1, 2002 and September 29, 2003) one treatment set for both forage and grain and another treatment set for grain only. We planted the 5 ft. X 22 ft. plots using a four-row, 12 in. spacing drill in a randomized complete block design with four replications. We fertilized the site with 75 lb N/A as NH_3 applied with a sweep plow. We hand-harvested forage samples, one meter of row from each plot end, and dried them in an oven for at least two days for forage dry weight yields. The forage plots were mowed with a finishing mower to simulate livestock grazing. To compensate for N forage removal, we surface applied liquid N from 65 to 85 lb N/A to the first planting date treatments and 19 to 25 lb N/A to the second planting date treatments. For weed control, we applied Express 0.33 oz/A and 2,4-D 0.38 lb/A in the spring. We furrow irrigated the site with about 7 to 12 A-in./A of total applied water. We harvested the plots for grain with a self-propelled combine and weighed them in a digital scale. Grain yields were adjusted to 12% moisture content.

Results:

Forage yields were not significantly different between varieties and their means were pooled for forage yield analysis. For all three years of this study, the 180 lb/A seeding rate produced significantly higher forage yield than the 60 lb/A seeding for both early and late planting dates (Fig. 1). In 2002 and 2004 there were no significant forage yield differences between 180 and 120 lb/A seeding rates for both planting dates; moreover, these two seeding rates produced significantly more forage than the 60 lb/A rate (Table 1). In 2003 the 180 lb/A seeding rate produced significantly more forage than the 120 lb/A seeding rate for both planting dates. There was a significant forage yield difference between the 120 lb/A seeding rate and the 60 lb/A seeding rate for the late planting date, but not the early planting date for 2003.

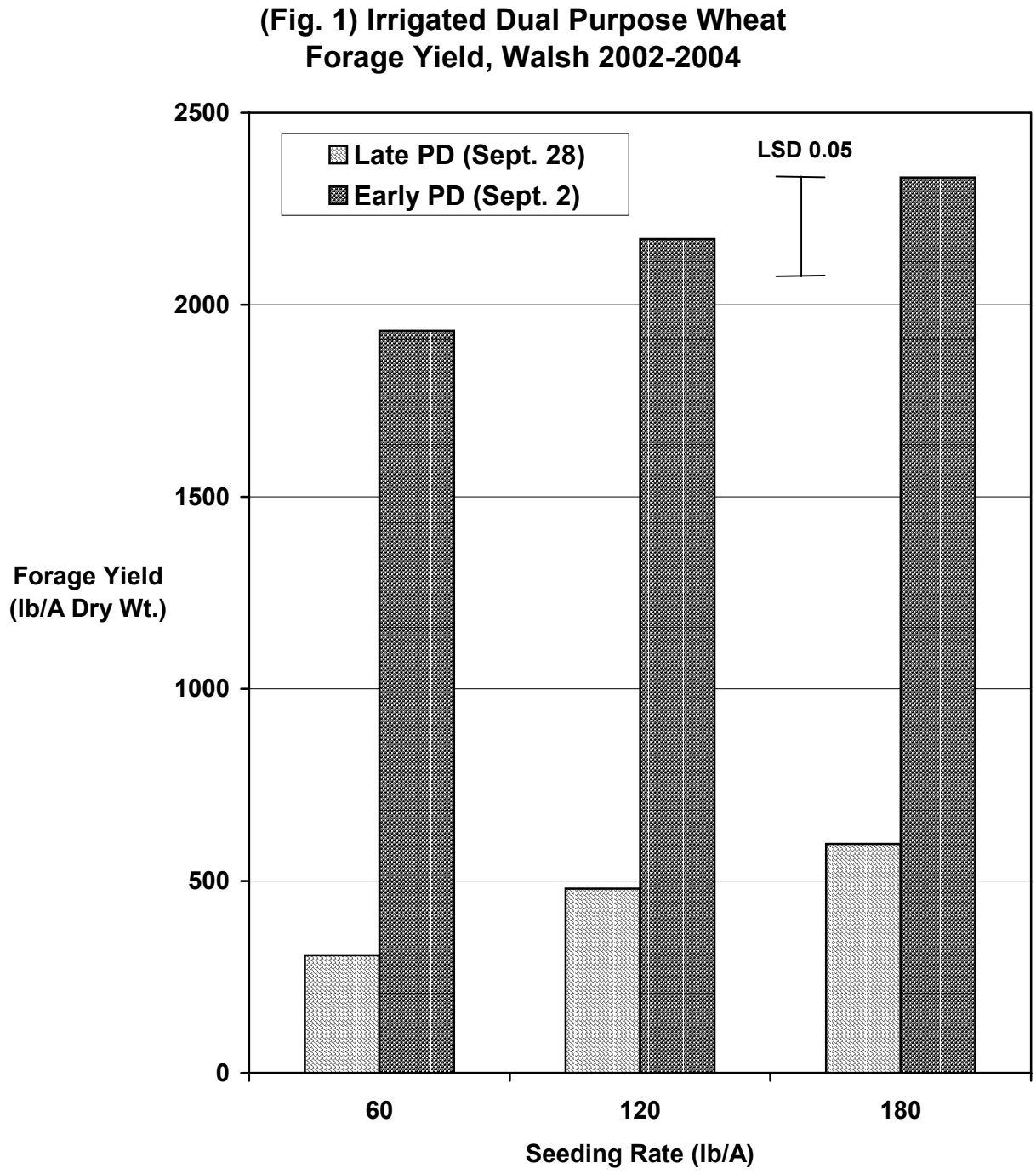

Fig. 1. Forage yield from irrigated dual purpose wheat at Walsh, 2002 to 2004. The average for the early date of planting was September 2 and the average for the late date of planting was September 28. The seeding rates were 60, 120, and 180 lb/A.

Table 1.-Irrigated Dual Purpose Wheat Forage Yields at Walsh, 2002-04.

Seeding Rate	Forage Yield Planting Date		Seeding Rate Average
	Early	Late	
	----------lb/A----------		
	---Year 2002---		
	Aug 24	Sept 24	
60 lb/acre	2410	470	960
120 lb/acre	2930	650	1193
180 lb/acre	3070	800	1290
Average 2002	2800	640	1148
LSD 0.05	175	152	
	---Year 2003---		
	Sept 4	Oct 1	
60 lb/acre	1769	193	654
120 lb/acre	1699	342	680
180 lb/acre	2094	512	869
Average 2003	1854	349	734
LSD 0.05	341	143	
	---Year 2004---		
Seeding Rate	Sept. 9	Sept. 29	
60 lb/acre	1616	256	936
120 lb/acre	1885	448	1167
180 lb/acre	1830	477	1154
Average 2004	1777	394	1085
LSD 0.05	183	113	

Forage yields are pooled means of varieties.
Forage yields are dry weights.

Forage variable net income for the early planting date for all three years (September 2 average) provided from $36.96 to $66.61/A more than the grain only late planting date (September 28 average) (Fig. 2). Income derived from seeding rate was dependent on grazing lease rate. At the $0.25/lb gain lease rate, the 120 lb/A seeding rate produced the highest variable net income. The incomes for the 120 lb/A and 180 lb/A seeding rates were the same at the $0.30/lb lease rate. At the $0.35/b lease rate, the 180 lb/A seeding rate produced slightly more income than the 120 lb/A seeding rate. Variable net income was negative for the late planting date when using $0.25/lb gain grazing lease rate, but slightly positive when using $0.35/lb gain grazing lease rate for all seeding rates compared to grain only late planting date. These variable net incomes include grain yield loss or gain at $3.40/bu compared to grain only late planting date yield, seed cost over 60 lb/A at $0.083/lb and replacement of N removed with forage at $0.20/lb of N and $4/A fertilizer application cost.

For two of three years, there were no significant grain yield differences between seeding rates, therefore grain yields for the seeding rates were pooled for grain yield analysis. For individual years, grain yield differences for the early planting date varied from 8 bu/A less to 3 bu/A more than grain only late planting date (Table 2). Overall, the late planting date with forage removal ranged from 4 bu/A less to 2 bu/A more than the grain only late planting date. For the three years of this study, the early planting date averaged 1 bu/A more than the grain only late planting date, and the late planting date with forage removal yielded 1 bu/A less than the grain only late planting date.

TAM 107 produced significantly more grain yield than Intrada and Jagger for all three years of this study (Table 2). Hailstorms in 2003 and 2004 greatly reduced grain yields for these years. In 2004, grain yields of TAM 107 were significantly higher than Jagger, Custer, and Intrada for both planting date treatments. In 2003, grain yields of TAM 107 and Custer were significantly higher than Jagger and Intrada for both planting dates. The higher grain yields for TAM 107 were due to less seed shattering from hail compared to Jagger, Custer, and Intrada. In 2002 of the four wheat varieties tested, TAM 107 and Custer produced significantly higher grain yield than either Intrada or Jagger. Jagger had higher plant loss from freeze damage (winter-kill) than any of the other varieties tested (data not shown). Winterkill of Jagger was more evident in the early planting date than in the late planting date. Winter damage to the early planting date caused Jagger to produce significantly less grain than TAM 107, Custer, and Intrada.

Discussion:

Overall, forage yield increased with increasing seeding rates with the 180 lb/A rate producing the highest yield for both early and late planting dates. A study conducted from 2000 to 2002 at the Panhandle Research and Extension Center at Goodwell, Oklahoma (Krenzer et. al, 2003) also reported forage yields increasing with 60, 120, and 180 lb/A seeding rates.

There were no significant forage yield differences between the varieties for both planting date treatments for all three years of this study. The wheat varieties tested: TAM 107, Intrada, Custer and Jagger, produced similar amounts of forage. The study conducted at Goodwell, Oklahoma (Krenzer, et. al, 2003) found minor three-year average differences between the wheat varieties with TAM 107 and Intrada producing

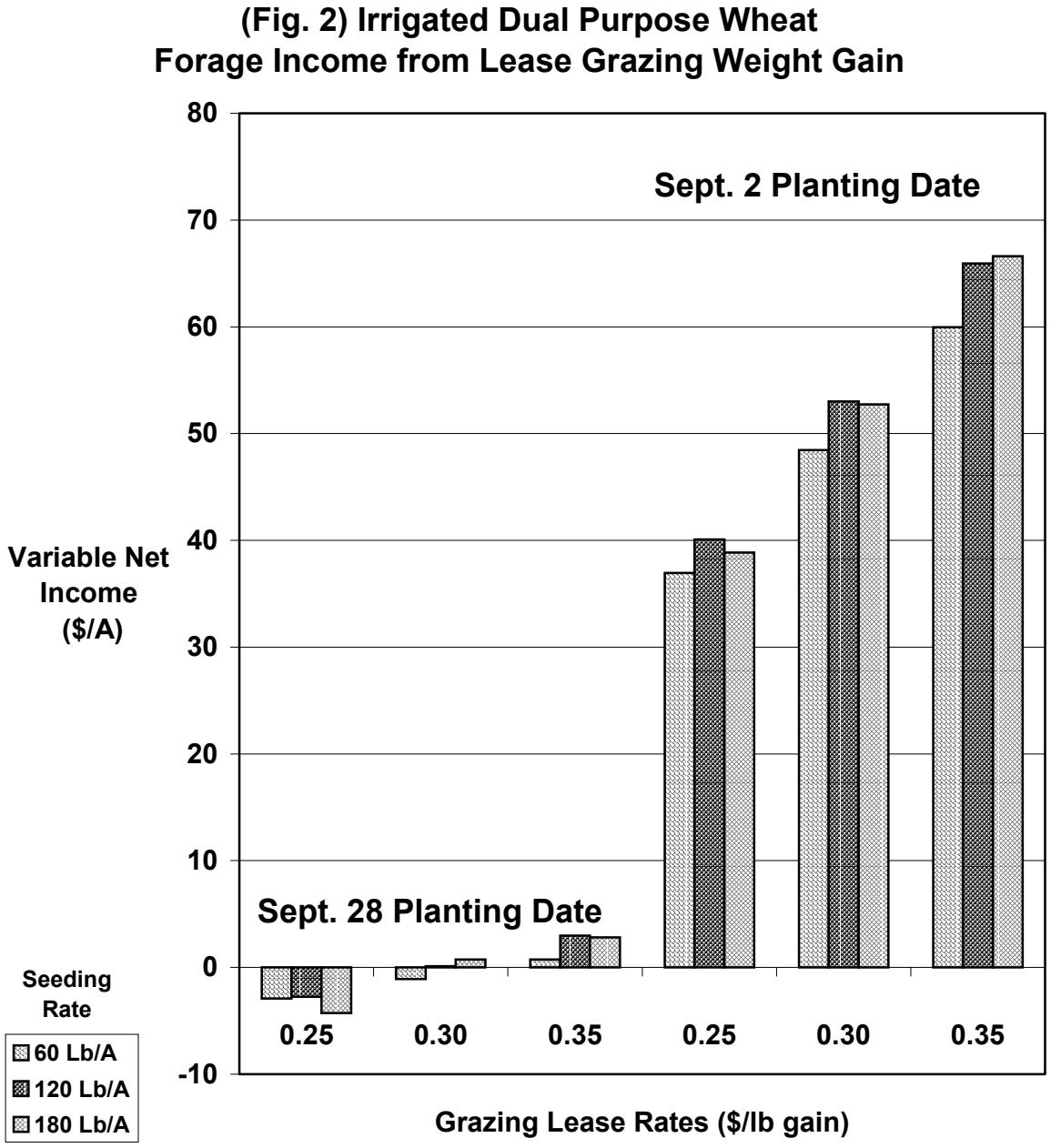

Fig. 2. Forage income from irrigated dual purpose wheat at Walsh, 2002 to 2004. The average for the early date of planting was September 2 and the average for the late date of planting was September 28. The seeding rates were 60, 120, and 180 lb/A. The forage values are on based on 2 lb/day gain from 500 lb calves grazing for two months with a price per lb gain of $0.25/lb, $0.30/lb, and $0.35/lb. Cost of forage was grain yield loss or gain at $3.40/bu compared to the average late planting date where grain yields but not forage yields were taken. Cost of forage also includes seed cost over 60 lb/A at $0.083/lb and replacement of N removed with forage ($0.20/lb of N and application cost $4/A).

Table 2.-Irrigated Dual Purpose Wheat Grain Yields at Walsh, 2002-04.

Variety	Grain Yield ----------Planting Date---------- Early	Late	Late (grain only)	Varietal Average
	----------bu/A----------			
		---Year 2002---		
	Aug 24	Sept 24	Sept 24	
TAM 107	36	43	43	41
Custer	34	42	41	39
Intrada	31	39	36	35
Jagger	25	39	37	34
Average 2002	31	41	39	37
LSD 0.05	5	5	5	
		---Year 2003---		
Variety	Sept 4	Oct 1	Oct 1	
TAM 107	38	32	33	34
Custer	32	32	35	33
Intrada	18	19	19	19
Jagger	22	18	18	19
Average 2003	28	25	26	26
LSD 0.05	7	4	5	
		---Year 2004---		
Variety	Sept 9	Sept 29	Sept 29	
TAM 107	31	21	29	27
Custer	19	15	16	17
Jagger	21	13	18	17
Intrada	18	12	15	15
Average 2004	22	15	19	19
LSD 0.05	5	2	3	

Grain yields are pooled means of seeding rates.
Grain yields are adjusted to 12% seed moisture content.

higher forage yields than Custer and Jagger, but there was no mention if these forage yield differences were significant.

The method we used to assign value for the forage was wheat forage leasing based on livestock weight gain. We consulted with David Schutz, Manager of the Eastern Colorado Research Center, who suggested using 2 lb per calf per day gain with a 3% body weight intake per day for dry wheat forage. He also stated that the standard weight gain price ranged from $0.25 to $0.35/lb. We made these assumptions for our lease grazing; we started with 500 lb calves and they grazed for two months. On average, the calves weighed 560 lb and ingested 3% of their body weight (16.8 lb/day) and they gain 2 lb/day. Our assumptions were similar to the results from a steer grazing management study reported by Oklahoma State University researchers (Horn et. al, 1999). They reported turning out 556 to 649 lb steers on winter wheat for 63 to 90 day grazing periods and the steers gained 2.1 to 2.2 lb/day while ingesting 15.2 to 16.4 lb/day of forage for their intensity early stocking (IES) grazing treatments.

For all years of this study, forage income using the lease grazing weight gain method had positive incomes for all the early planting date treatments and negative incomes for 2003 and 2004 early planting date treatments, regardless of the grazing lease ($/lb gain) rate. Income from seeding rate was dependent on grazing lease rate with 120 lb/A and 180 lb/A seeding rates providing more variable net income than the 60 lb/A seeding rate for all grazing lease rates. At the lowest lease rate ($0.25/lb gain) the 120 lb/A seeding rate produced the highest variable net income, whereas at the highest lease rate ($0.35/lb gain) the 180 lb/A seeding rate produced the highest variable net income. For the range of grazing lease rates used, there were only minor variable net income differences (around $1/A) between the 120 lb/A and 180 lb/A seeding rates. The only income advantage for the 180 lb/A seeding rate was at the highest lease rate; therefore, the 120 lb/A seeding rate was sufficient for achieving high income. Since the late planting date treatment averaged only marginal amounts of forage and provided only minimal variable net income, we found that there was insufficient forage to make grazing economically feasible especially for grazing lease rates below $0.30/lb gain. Fortunately growers would not have experienced income loss from grazing the forage produced by the late planting date because growers would not have attempted to graze the limited amount of forage produced by the late planting date. The forage income for the average early planting date treatment ranged from $36.96/A to $66.61/A more than the grain only late planting date. This extra income from forage makes lease grazing of early-planted, dual-purpose wheat a profitable activity.

For the duration of this study, there was only limited grain yield change due to forage removal, ranging from 8 bu/A less to 3 bu/A more than the grain only planting date. The average change in grain yield was plus or minus 1 bu/A difference between the grain only late planting date and the late and early planting dates with both forage and grain harvests. Therefore, forage income was not dependent on grain yield change due to forage removal. This is in contrast to the report by Oklahoma researchers (Hossain, Epplin, and Krenzer, 2003); they found late planted wheat (September 30) produced 18% more grain and 68% less forage than early planted wheat (September 10). They concluded that planting date for dual purpose wheat grazing was dependent on expected forage and grain prices.

Grain yields were low all three years of this study due to winterkill and hail damage. TAM 107 with its tolerance to hail and winter damage produced higher yields than Intrada and Jagger each year of this study. Under the adverse conditions of this study, TAM 107 produced the highest grain yields, and since there was no varietal difference in forage production, TAM 107 was the top ranking dual purpose wheat tested.

Grain yield can be greatly reduced by environmental stresses such as the ones encountered throughout this study. Even though grain yields were low, the early planting date forage yields remain high and profitable. Grazing wheat provides additional income not realized by solely harvesting wheat for grain. We believe that growing wheat for both forage and grain is a viable economic strategy to increase income and reduce risk of wheat harvested for grain alone.

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