NITROGEN FERTILIZATION OF WINTER CEREAL/LEGUME FORAGES

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SUMMARY

Fall planted cereal/legume forages are occasionally planted as the first crop in a double cropping system. The forages are generally swathed and chopped for ensilage but could be fed as greenchop.

Fall planted winter cereal or cereal/legume forages were evaluated at Parma in 1985 and 1986 at three nitrogen (N) rates (60, 120 or 180 lb/A) to determine (1) the productivity of forages differing in the cereals and legumes composition and (2) how these would be affected by moderate N rates.

Winter wheat cereal forage was the most productive. Including peas reduced silage production but generally increased quality by increasing protein. Cereals grown without peas were not generally more responsive to N applied above 60 lb/A. The percentage of peas in the harvested forage was reduced with increasing N rates.

INTRODUCTION

Winter forages are sometimes considered by forage producers (1) to conserve irrigation water in short water years, (2) to use as the first crop of a double crop system in attempts to increase total forage production, or (3) to insure available forage ensilage in the fall while other crop ensilage is being cured. winter cereal as well as winter cereal/legume mixes can be used for these purposes. Inclusion of legumes which fix atmospheric nitrogen (N) can improve forage quality but may reduce total forage production. Forage response to fertilizer N may depend on the cereal/legume mix. Information on the response of cereal and cereal/legume mixes would be helpful in determining N rates to apply for optimum yield and maximum economic returns.

METHODS

Field studies were conducted with cereal and cereal/legume forage mixes using different nitrogen (N) rates in 1984-85 and 1985-86 at the Southwest Idaho Research and Extension Center at Parma. Forage treatments consisted of the following: (1) fall planted soft white winter wheat (Stephens), (2) soft white winter wheat (Stephens) planted with Austrian winter peas (Melrose) in separate operations, (3) a Ferry Morse mix of soft red winter wheat, winter oats and winter peas (4) a Ferry Morse mix of soft red winter wheat, 833 winter oats and winter peas (5) Ferry Morse 833, winter oats and (6) a Northrup King spring forage mix of spring wheat, oats, peas, and vetch. The N rates were 60, 120 and 180 lb/A applied preplant and incorporated using ammonium nitrate in 1984 and urea in 1985. The treatments were arranged in a randomized complete block-split plot design with four replications. Main plots were the forage treatments and subplots were the N rates.

The previous crops were spring wheat and sweet corn in 1984 and 1985 respectively. All sites were soil sampled and considered not to require additional fertilizer based on the soil test results. All forages were

drilled in seven inch rows. Seeding rates for each treatment were as follows: (1) 100 lb/A Stephens wheat (2) 50 lb/A Stephens wheat, 50 lb/A Melrose peas (3 & 4) 33 lb/A soft red winter wheat, 33 lb/A winter oat and 33 lb/A winter pea, (5) 100 lb/A winter oats and (6) 100 lb/A of the mix (proportion of cereals and legumes not given). The forages were planted October 8 and October 7 in 1984 and 1985 respectively.

Fall stand counts were taken November 26, 1984 and November 11, 1985. Spring stand counts were taken March 28, 1985 and March 13, 1986. Forages were harvested June 11, 1985 and June 9, 1986 using a Hege small plot forage harvester. Forages were harvested from 40.8 ft^2 in each plot. Forages were harvested when the wheat was in the soft dough stage. Composition of the final harvest sample was measured by subsampling the harvested forage and weighing each cereal and legume component separately.

RESULTS

Forages

Forages differed significantly in silage produced (Table 1). Wheat produced more silage than other forages. Winter oats produced more silage than the spring forage (Mix D), but produced less than the winter wheat and pea mixes (A, B & C). The winter wheat and pea mixes (A, B & C) did not differ significantly. These results are consistent with similar studies conducted in north Idaho. Winter cereals were generally more productive than cereal/legume mixes. The poor production of winter oats and the spring forage (Mix D) resulted from species that were intolerant of freezing winter temperatures.

Dry matter content of forages all differed significantly. winter wheat was dryer than winter oats which in turn was drier than all the other forages. The spring forage mixture was dryer at harvest in 1986 than in 1985 because there was greater survival of the winter oats in the mix (Table 1). Peas and other legumes were wetter than the cereals at the time of harvest.

Nitrogen

Nitrogen significantly increased silage production (Table 1). Silage production increased as the N rate was increased to the 120 lb rate but did not increase further with the 180 lb rate. Silage production increased approximately 1.5 T/A as the N rate increased from 60 to 120 lb N/A. Assuming N costs of $.25/lb, silage prices of $10/T are necessary to cover the costs of the extra N.

There were no significant interactions between the various forages and N rates. The presence of legumes in the forage mixes could be expected to minimize the response to N fertilizer since they are presumably fixing atmospheric N. winter wheat silage, however, was not responsive to N rates above 120 lb/A even though legumes were not present. Only winter oats appeared to respond to the highest N rate (data not shown).

Forage Protein

Forage protein concentrations were not evaluated statistically due to the use of composite samples. Nevertheless, cereals such as wheat or oats grown without peas or other legumes resulted in numerically lower protein concentrations (Table 2). Thus, inclusion of legumes will increase protein concentrations of harvested forages.

Forage protein of winter wheat was apparently increased with N when grown without peas (Table 2). There was no affect of N on forage protein when peas were included in the mix.

The capability of legumes to fix atmospheric N, and perhaps increase the availability of N to wheat will generally reduce the protein response to N at rates above 60 lb/A.

Cereal and Legume Survival

Survival calculations for some cereals and practically all the peas exceeded 100 percent because of plants which emerged following the fall readings (Table 3). winter cereal survival tended to be higher in 1986 than in 1985 because the readings for the 1986 crop were taken earlier in the fall. An early winter in the fall of 1985 precluded the emergence of all cereals and peas until after the fall readings were taken.

Winter survival was better in Stephens wheat than in the winter oats. Poor survival of winter oats in the Ferry Morse forage mixes (B & C) can probably be attributed to the loss of winter oats in those mixes. The mix containing the 833 winter oat had better winter cereal survival than the other Ferry Morse mix. The fall planted spring mix had the lowest survival of cereals in 1985 and was significantly lower than all other forages except winter oats in 1986.

Pea survival generally exceeded cereal survival because fewer peas emerged and were counted in the fall as indicated by the fall and spring counts of peas in the stands in 1985 (Table 4). Peas did not differ significantly in their survival in the various mixes. Legume survival was not affected by N. Legume composition differed significantly among forages containing peas and N reduced the legume percentage (Table 5). Legume content of the wheat/pea forage mixes (A, B & C) ranged from 28.9 to 36.1%.

Table 1. Winter forage performance as affected by species and nitrogen at Parma in 1985 and 1986.

	1985 Forage			1986 Forage		
	Silage T/A	Dry Matter %	Protein %	Silage T/A	Dry Matter %	Protein %
Forage						
Winter Wheat	18.41/	32.0	6.7	21. 7	29.9	6.6
Winter Wheat + Peas (Mix A)	15.2	22.3	11.8	17 .0	20.8	13.8
Winter Wheat + Peas (Mix B)	14.4	24.5	11.5	17.7	23.4	10.3
Winter Wheat + Peas (Mix C)	14.5	24.5	--	18.2	23.6	
Winter Oats	11.1	29.5	6.7	12.2	27.8	7.1
Spring Wheat. Peas Oats and Vetch	8.9	25.2	10.4	11.8	20.1	13.3
LSD.05	1.2	1.7		2.2	.7	
N Rate						
60	13.0~/	27.0	--	15.3	24.7	9.7
120	14.4	26.8	--	17.0	24.7	9.2
180	13.9	25.3	--	17.0	23.4	10.1
LSD.05	.8	1.2		1.5	2.0	

1/ Values for forages are averaged across all N rates and reps with the exception of protein. Protein values represent analysis of composites from all reps for the 120 lb N rate only.

2/ Values for N rates are averaged across all forages and reps with the exception of protein. Protein values represent analysis of composites from all reps for only the (1) wheat and (2) wheat plus peas (Mix A).

Table 2. Forage protein as offered by wheat or wheat and pea forages and N in 1985 at Parma.

Forage	N Rate (lb/A)		
	60	120	180
Wheat	7.31[1]	6.7	8.6
Wheat and Peas	12.0	11.8	11.6

1/ Values are for composites of samples from all reps.

Table 3. Cereal and legume survival as indicated by percentageof fall stands recorded in the spring. Parma, 1985 and 1986.

Treatment	Cereal Survival		Legume Survival	
	1985	1986	1985	1986
	(%)		(%)	
1. Winter Wheat (cereal)	95	106	--	--
2. Winter Wheat in Mix A	96	116	105	181
3. Winter Wheat and Oats in Mix B	70	78	110	244
4. Winter Wheat and Oats in Mix C	82	103	111	213
5. Winter Oats	76	25		
6. Spring Wheat and Oats in Mix D	20	34	65	234
LSD.05	10	18	51	128

Table 4. Legume survival as affected by forage. Parma, 1985 and 1986.

Forages	1985 Fall Count	1985 Spring Count	1986 Fall Count	1986 Spring Count
	Plants/ft^2			
Winter wheat + peas (Mix A)	3.42	3.51	1.88	2.57
Winter wheat + peas (Mix B)	2.14	2.24	.93	1.58
Winter wheat + peas (Mix C)	1.95	2.13	.68	1.14
Spring Forage (Mix D)	.81	.46	.47	.96
LSD.05	.53	.62	.38	.41

Table 5. Percent legume as affected by harvested wheat/legume mixes.

Treatment	Legume Portion[1] at Planting		Legume Portion[2] at Harvest
	(%)		(%)
Forages			
Winter Wheat and Peas (Mix A)	50		36.1
Winter Wheat and Peas (Mix B)	33		30.1
winter Wheat and Peas (Mix C)	33		28.9
Spring Forage	--[3]		40.5
		LSD.05	6.5
N Rates (lb/A)			
60			37.0
120			34.7
180			30.1
		LSD.05	5.6

[1]Portions are based on air dry seed weights.
[2]Portions are based on oven dry weights.
[3]Portion was not given.