FIELD CORN RESPONSE TO NITROGEN AS AFFECTED BY PREVIOUS WINTER CROP[1]

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Testing double cropping systems in the irrigated areas of the Pacific Northwest led us to evaluate late-planted corn response to N fertilizer when following either a winter cereal grown for silage or winter peas plowed down as green manure.

METHODS

Stephens soft white winter wheat and Melrose winter field pea were each planted at 100 lbs/acre on 18 September and 8 October 1984 at Kimberly (split block, RCB) and Parma, Idaho (split plot, RCB), respectively. Previous crops were small white dry beans and spring wheat and the soil NO_3-N values in September were 28 and 22 lbs acre^{-1} ft^{-1} at each location, respectively. Soil Zn, K, and P were adequate; however, 200 lbs N/acre as NH_4NO_3 or $(NH_4)_2SO_4$ were fall applied only to the wheat at the two respective locations. Dry matter and total N yields at both locations were determined for wheat forage and pea foliage on 11 June 1985.

On 11 June the peas were disked and wheat swathed, chopped, and removed. Fields were plowed to incorporate pea foliage and grain stubble. Peas were just beginning to bloom at Kimberly, but had been blooming for 7 to 10 days at Parma. Wheat was in the watery-ripe to milk-ripe stage at Kimberly while it was at the milk-ripe to soft-dough stage at Parma. Recommended rates of 2 qt/acre Eradicane (Kimberly) or a mixture of 2.5 qt/acre Bladex plus 3 qt/acre Lasso (Parma) herbicide were incorporated with an additional roller harrowing. Ammonium nitrate nitrogen at rates of 0, 50, 100, 150, or 200 lbs N/acre was incorporated simultaneously with the herbicide at Kimberly. The NH_4NO_3 was sidedressed using the same nitrogen rates on 28 June at Parma. A 76-day hybrid field corn (Pioneer 3969) was planted 14 June at 30,000 plants/acre on 30-inch spaced rows at both locations. The corn was furrow irrigated soon after planting and later as needed.

Dry matter, NO_3-N and total N were determined on whole corn plants harvested at Parma on 10 July corresponding to the 5-6 fully-emerged-leaf stage. Total N was also determined on ear leaf samples harvested on 29 July, following tasseling. High moisture ear corn (HMEC) and grain yields were determined on 21 October at Parma. Corn silage yields and N concentrations were determined 17-18 September and 26 September at Kimberly and Parma, respectively.

RESULTS AND DISCUSSION

Wheat forage yields of 3.0 and 5.2 ton dry matter/acre (9 and 15 ton silage/acre at 67% moisture) contained 180 and 176 lbs N/acre at Kimberly and Parma, respectively.

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The green-manure pea foliage yielded 1.7 and 2.9 tons dry matter/acre containing 150 and 188 lbs N/acre at the Kimberly and Parma locations, respectively.

Corn was irrigated 3 July after the sidedressing of N on 28 June and prior to the collection of whole plants on 10 July. The corn following peas had greater ($P<.05$) dry matter (not shown), NO_3-N, and total N uptake (N yield) on 10 July than corn planted after wheat at Parma (Table 1). Sidedressed N increased NO_3-N and total N concentration ($P<.001$), and N yield ($P<.05$) in the corn (Table 1), but did not increase dry matter produced by 10 July (data not shown). There was limited opportunity for corn yields to be affected by sidedressed N during this short period, even though N concentrations were increased.

Corn N yield at 1 month after planting averaged 5.5 lbs/acre or 30% more after peas than after grain. The increased N yield following peas this early after incorporating pea residue indicates a rapid mineralization of legume N.

Ear leaf N concentration on 29 July was higher ($P<.01$) in corn following peas than when following wheat and was consistently increased by fertilizer N at Parma (Table 1). The high moisture ear corn (HMEC) and grain yields at Parma were not affected by the previous crop, except at the lower N rates where yields were greatest following peas (Table 2).

Corn silage yields were greater following peas than when following wheat at both Parma and Kimberly. Silage yields of corn following green manure peas at Kimberly were equivalent to corn following wheat and fertilized with 150 lbs N/acre. The contribution of peas to corn-silage yields at Parma was equivalent to about 50 lbs N/acre. The overall average silage yield of 21.8 T/A at Parma was greater than the yield of 18.8 T/A at Kimberly, reflecting the 16% greater number of growing degree days (1734 vs. 1500) at Parma (based on 40-86F).

Appreciable amounts of N were mineralized from the root/nodule and pea vine material at both Parma and Kimberly. That these amounts (50 vs. 150 lb N/A) were not more similar might be attributed to a greater mineralization rate at Parma because of the incorporated legume or soil nitrogen. The area had been an orchard until three years previous. The mineralizable soil N levels in this old orchard area is being checked. The pea root and vine mass contained N which was not released for the 1985 corn crop. Therefore, N concentrations and yield from a spring wheat grown on the same area will be measured in 1986 at both Parma and Kimberly.

CONCLUSIONS

Nitrogen and time management are important ingredients in a double cropping system. Knowledge of the readily mineralizable N pool and the amount of N taken up by both winter and summer crop is essential. A winter pea crop may provide some of the N required for a subsequent short season corn crop. High moisture ear corn, corn grain and silage yields, however, may be considerably less than yields obtained with full season corn hybrids.

Those who have tried double cropping also recognize the value of converting quickly from one crop to the next. Minimum tillage may expedite the planting of the summer crop. Double cropping will work for some, but not all producers in the central and southwestern Idaho irrigated areas.

Table 1. Nitrogen concentration and yield of short-season corn as affected by fertilizer nitrogen and previous winter crops of green-manure peas or winter wheat harvested as forage at Parma, Idaho, 1985.

N rate	Whole plants, 5-6 leaf stage, 10 July			Ear leaf, 29 Jul
	NO_3-N	Total N	N yield	Total N
	ppm	%	lb/A	%
Following peas				
0	5690	3.65	20.8	2.18
50	7410	4.13	22.5	2.74
100	7310	4.15	23.8	2.93
150	7720	4.22	21.3	3.10
200	7720	4.20	24.4	3.13
Average	7170	4.07	22.5	2.82
Following winter wheat				
0	3660	3.15	14.1	1.65
50	6860	4.07	17.1	2.56
100	6780	4.24	18.6	2.83
150	5970	4.16	18.3	3.01
200	7310	4.25	17.0	3.20
Average	6120	3.97	17.0	2.65
Analyses of variance				
Previous crop	**	NS	**	**
N rate	***	****	*	****
Interaction	NS	*	NS	***

* = P<.10
** = P<.05
*** = P<.01
**** = P<.001

Table 2.--Yield and nitrogen concentration of short-season corn as affected by fertilizer nitrogen and previous winter crops of green-manure peas or winter wheat harvested as forage in 1985.

	Kimberly silage			Parma silage			Parma yields	
N rate	Yield[1]	N conc.	N yield	Yield[1]	N conc.	N yield	HMEC[2]	Grain[3]
Lbs/A	T/A	%	Lbs/A	T/A	%	Lbs/A	T/A	Bu/A
Following winter peas								
0	19.1	.67	84	21.0	.88	123	5.15	117
50	20.5	.76	103	23.0	1.00	152	5.43	123
100	21.5	1.08	153	22.8	.99	149	5.87	133
150	20.6	1.04	141	22.9	1.11	166	6.54	149
200	20.6	1.10	150	24.2	1.15	183	6.25	143
Average	20.5	.93	127	22.8	1.02	155	5.85	133
Following winter wheat								
0	12.7	.50	42	15.1	.85	85	2.94	65
50	15.6	.54	56	23.1	.87	133	6.01	136
100	18.0	.61	73	21.9	.97	139	6.40	145
150	19.1	.68	87	23.5	1.05	162	6.39	144
200	20.0	.86	114	21.2	1.09	151	6.31	142
Average	17.1	.64	72	20.9	.97	134	5.61	127
Analyses of variance								
Previous crop	***	****	****	**	NS	**	NS	NS
N rate	*****	****	****	**	****	****	****	****
Interaction	***	*	NS	*	NS	NS	***	***

[1]Silage yield is corrected to 67% moisture.
[2]HMEC yield is corrected to 33% moisture.
[3]Grain yield is corrected to 15.5% moisture.

* = P<.10
** = P<.05
*** = P<.01
**** = P<.001