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CORN VARIETY PERFORMANCE AT STEPHENVILLE UNDER IRRIGATION AS AFFECTED BY MANURE APPLICATION

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Summary

Three high-leaf (LFY) experimental corn varieties and DK683SR were grown as silage under irrigation at the Stephenville Center and compared to locally accepted Terra 1185. Manure at 5 tons/acre dry matter (DM) was applied to half of each plot. Two of the LFY varieties as well as the DK683SR had yields and quality equal to Terra 1185. Application of manure did not affect yields or plant tissue phosphorus (P) concentration.

Introduction

Corn is the silage of choice for the dairy industry in the Cross Timbers. Low fiber content, high yields and high palatability make it attractive for farmers as well as dairy managers. New varieties with herbicide resistance or increased leafiness have come on the market. One of the objectives of this study was to look at the yield and nutritional quality indicators for a new herbicide resistant commercial variety, DK683SR, as well as some leafy (LFY) experimental varieties.

Manure is produced in concentrated amounts on large dry lots. The mineral content in this manure, especially its composted form, is generally high compared to soil concentrations. Removal of P by crops may help to avoid an excessive soil build-up of relatively stable P and the consequent negative environmental impacts on surface water run-off. A further objective of this study was to determine P uptake differences among varieties and how this relates to residual P concentration in the experimental plots.

Procedure

Five corn varieties were seeded under pivot irrigation on Windthorst soils at the Stephenville Agricultural Research and Extension Center in 1998 in plots consisting of four 28 ft rows with 3 ft between rows. These included 3 leafy (LFY) experimental varieties with higher leaf percentage, post-ready DK683SR and Terra 1185. These were managed as described in Table 1.

The plots were split with a 5 ton DM dairy manure/acre (0.58% P and 1.3% nitrogen [N], DM basis) applied to half along with sufficient N fertilizer to total 150 lbs N/acre. The other half of the plot received 150 lbs N/acre as ammonium nitrate. In May, a further 50 lbs/acre of N was

applied to all plots. Initial soil tests indicated 16 ppm soluble P present in the soil. Irrigation was applied as needed (see Table 2) and, when added to the rainfall, season moisture totaled slightly over 14".

One 10ft row in each sub-plot was hand-harvested at a 5 in. stubble height on July 9, 105 days after planting when the ears reached one half to two thirds milk stage. Dry matter %, DM yield and ear/plant ratio (at field moisture) were measured. In the laboratory, neutral detergent fiber (NDF), acid detergent fiber (ADF), lignin, crude protein (CP) and P concentrations on a whole plant, DM basis, were determined using traditional wet chemistry analysis.

Results

There were no statistical differences in DM yields among entries (Table 3). In selecting among these varieties, quality indicators should be the main determinant.

Crude protein and P concentrations were similar among the entries, averaging 8.0% and 0.24%, respectively, for all entries (Table 3). DK683SR and LFY2309L had the lowest fiber and lignin concentrations relative to the other entries (Table 4).

Manure application did not have a significant effect on plant P and N content (Table 5). Overall average P removed from the soil was the equivalent of 22 ppm. Soil samples taken from sub-plots after the trial and batched by block, indicated an average 18.5 ppm soluble P for manure plots and 10.5 ppm soluble P for the untreated plots. There were no measurable differences in soil organic matter, which averaged 0.4 % overall.

Conclusions

One of the main conclusions to be drawn from this study is that DK683SR produces as much DM yield and had lower fiber concentrations compared to Terra 1185. A further conclusion is that at least one of the LFY varieties is likewise competitive.

Manure at 5 tons/acre did not greatly affect the corn P concentration. Since nearly as much P was removed (46 lbs/acre) from the soil by the corn as was added by the manure (58 lbs/acre), the application of manure equivalent to 10 t/acre manure at 50% moisture would not lead to excessive accumulated soil P. The 40 lbs/acre P extracted by the corn in the plots with no manure would be unsustainable in the low P soils of the region (16 ppm P average over the experimental field). Over several seasons, manure should positively affect corn growth by providing P, among other benefits. Manure application at higher rates needs to be tested to determine whether DM silage and CP yields will maintain or increase compared to plots receiving equivalent levels of commercial fertilizer. Long term, cumulative effects would also be of

interest in view of the extractive nature of P uptake by corn relative to low soluble P in the soil. More careful study of fixed and soluble soil P dynamics (it is estimated that only 1% of soil P is in plant available form) may also explain the high rate of P removal by corn relative to the low soil concentration prior to seeding.

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Table 1. Calendar of agronomic practices.

Event	Date	Quantity	Description
Previous Crop	1997	--	Peanut
Cultivation	January	--	Complete
Fertilizer	February	Zn 8 #/acre	Incorporated
		N 150 #/acre	Incorporated
Manure	February	5 tons/acre	Incorporated
Seeding	March 25	--	36” rows
Thinning	April 25	54 plants/28”	--
Weeding	April 25	--	Mechanical
		--	Hoe inter-row
Fertilizer	May 7	N 50 #/acre	Side-dressed
Weeding	May 10	--	Hoe
Weeding	June 15	--	Hoe
Harvest	July 9	--	--

Table 2. Rainfall and irrigation calendar.

Date	Type	Quantity
January	Rain	2.60”
February	Rain	2.53”
March	Rain	4.25”
April	Rain	0.30”
	Pivot	2.00”
May	Rain	4.55”
	Pivot	3.00”
June	Rain	2.33”
	Pivot	1.00”
July	Rain	0.08”
Total moisture		14.26”

Table 3. Dry matter percentage, whole plant dry matter production, ear as percent of stalk & ear field weight, crude protein and phosphorus in 5 corn varieties.

ENTRY	DM	DM	Ear	CP	P
	%	lbs/acre	%	%	%
LFY2309L	34.1	20,328	17.6	8.2	0.24
LFY2334L	30.0	17,086	19.4	8.0	0.25
LFY2556L	29.7	19,314	29.5	8.1	0.22
Terra 1185	32.8	17,465	28.6	7.7	0.23
DK683SR	29.5	18,691	24.8	8.0	0.25
P Value		0.18	0.000	>0.50	>0.50
s.d.		1,372	2.2	0.34	0.01

Table 4. Whole plant neutral detergent fiber (NDF), acid detergent fiber (ADF), cellulose (C) and lignin concentrations on a DM basis.

ENTRY	NDF	ADF	Cellulose	Lignin
	----------%----------			
LFY2309L	56.4 ab*	30.0 bc	27.2 bc	2.75
LFY2334L	59.0 a	32.5 ab	29.5 ab	2.95
LFY2556L	59.9 a	33.7 a	30.3 a	3.33
Terra 1185	58.3 a	32.6 ab	29.4 ab	3.28
DK683SR	52.9 b	29.3 c	26.7 c	2.65
P Value	0.0001	0.0009	0.001	0.07
s.d.	1.4	0.9	0.8	0.18

*Values in the same columns followed by different letters differ (P<0.05) according to Duncan's Multiple Range Test.

Table 5. Mean effect of manure application at 5 t/acre DM on 5 corn variety P and CP characteristics, DM basis.

Manure Application:	5 tons/acre manure	No manure	P value	s.d.
lbs DM yield/acre	18,786	17,332	0.20	1,372
% plant P	0.244	0.231	0.19	0.68
lbs P DM yield/acre	45.8	40.0		
ppm/acre from soil	23	20		
% plant CP	8.11	7.99	0.22	0.18
lbs CP DM/acre	1,524	1,385		