1997 Manure Source Trial at the Ken Rosmann Farm

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One of the common questions organic growers ask is whether cattle manure is equivalent to poultry manure in both corn yield produced and the cost of hauling and application. To try to answer this question **Ken Rosmann**, organic farmer and manager of the Heartland Marketing Co-op, and I set up an experiment in 1997 to compare the two sources. The research was supported by Practical Farmers of Iowa.

The plots were on a Marshall silty clay loam soil with 2-5% slopes on a legume-grass pasture from 1996. Plots were 420 ft. by 30 ft.(0.3 acre). The two treatments were randomized within each of three replications. 18 or more rows of corn were borders on both sides and one end.

We sampled the manure and soil prior to manure application (see Table 2). We estimated that to meet the nitrogen needs of the crop, 2.1 tons of poultry and 10.4 tons of cattle manure were needed per acre. (Keep in mind that pre-season calculations based on credits and yield goals are approximations). Due to spreader limitations we applied 2.5 tons of poultry and 8.2 tons of cattle manure per acre. This produced significant differences in nutrient application. The manure was plowed down the same day it was applied (May 9). Corn was planted the next day in 30-inch rows, with 12 rows per plot. Emergence occurred uniformly on May 31.

A soil Late Spring Nitrate Test (LSNT) was conducted on June 13 when corn was 6 in. tall (Table 3). We also took an leaf sample at late pollination (see Table 3). Based on the ISU publication "Nitrogen Fertilizer Recommendations for Corn in Iowa" (Pm-1714), the LSNT indicated another 30 lb. N per acre might be recommended for the cattle manure plots, but an organic source of nitrogen was not available. The ear leaf test also showed the nitrogen level was lower in the cattle manure plots than in the poultry manure plots. Other nutrients were about the same at pollination, when leaf samples were taken.

Table 3. Late spring soil nitrate, mid-season ear leaf nutrients, and late-season stalk nitrate-N, Ken Rosmann farm.

	Cattle	Poultry
	Late Spring Soil Nitrate Test † (ppm N03 - N)	
	19	28
	Ear Leaf Analysis † (percent)	
Nutrient		
N =	2.67	2.81
P =	0.27	0.26
K =	1.87	1.8
S =	0.18	0.17
Mg =	0.2	0.2
Ca =	0.39	0.36
	End-of-Season Stalk Nitrate † (ppm)	
Avg.:	490	2,390
Range:	90 (low) to 1,180 (optimal)	1,300 (optimal) to 4,410 (excess)

† One composite sample represented all three replications of the same manure source.

Weed populations were very low throughout the summer. Second generation European Corn Borer (ECB) egg mass counts were very high, so the field was treated with Bacillus thuringiensis (Bt) granules in mid August. Stalk rot and ECB tunneling in the plots at maturity were much less than in untreated fields in the area. Rainfall was below average in July and August. The crop matured before the fall freeze.

We took end-of-season cornstalk nitrate samples in each plot on October 10 (see Table 3). All three nitrate samplings followed planned sampling patterns. Due to the great variability there was no significant difference between the treatments for cornstalk nitrate. Ken Rosmann observed some late season nitrogen deficiency on the lower leaves, with more on the cattle manure plots. Some of the stalk nitrate samples in these strips also suggested that the crop might have responded to additional N.

The middle six rows of each plot were harvested on November 8. Plant populations varied from 24,750 to 26,500, with less than 100 plants per acre difference between the averages of the two treatments. Individual plot lengths were measured. Grain moisture ranged from 17.0 to 17.6 %, and yields reported are adjusted to 15.5% moisture at 56 lb. test weight (Table 1). The average yield of the poultry manure plots was just two bushels per acre higher than yield of the cattle manure plots. There were inconsistent responses among replications for both stalk nitrates and grain yield. More replications would help even out the variability, but even so there was little suggestion of a yield difference between the two treatments. The legume stand was variable in 1996, which probably contributed to the yield variability.

Economics

An economic analysis is important because poultry manure must be purchased, while cattle manure is produced on the farm (see Table 4). The cost of loading, hauling, and spreading purchased (poultry) manure must be charged against the crops, but loading and spreading manure from an on-farm (cattle) feeding enterprise should be charged against that enterprise, because the manure must be removed from the feed lots or pits. Only the cost of hauling the on-farm manure from the building site to the field was charged to the crop.

Table 4. Financial analysis, corn following on-farm cattle manure or purchased poultry manure, Ken Rosmann farm.

	Poultry	Cattle		**Hauling or Loading & Spreading	
	$/Ton			Poultry	Cattle
Product Cost	$8.00	0.00		Load/Spread	Hauling
Hauling Charge	$5.00	**$4.30	Hauling		*$53.5/hr.
Loading-Spreading	**$6.85	0.00	Load/Spread	*$53.5/hr.	
Total	$19.85	$4.30	Loads/hr.	6	5
			$/Load	$8.90	$10.70
Tons/Acre	x 2.5	x 8.2	Tons/Load	1.3	2.5
Cost/Acre	$49.65	$35.25	$/Ton	$6.85	$4.30

* from the ISU publication "1997 Iowa Farm Custom Rate Survey" (Fm-1698).

These plots were located about one mile from the feed lots. The poultry manure had been piled in the field. Using average costs and the actual application rate in this study, the poultry manure cost about $14.40 per acre more than the cattle manure, or about $7.20 per bu. for the two-bushel-greater yield (Table 4). This represents a hypothetical economic loss since Ken's organic corn currently sells for about $4.00 per bushel.

If the intended application rates were applied, the cattle manure (at 10.4 T/A.) would have cost $44.75 per acre to apply (not $35.25), while the poultry manure (at 2.1 T/A.) would have cost $41.70 per acre (not $49.65). Yields may have been different too. Individual growers should recalculate this using their own costs.

Table 1. "A/B" Deep Placement and Manure Management Trials

COOPERATOR	CROP	TREATMENT "A"			TREATMENT "B"	"A/B" Deep Placement and Manure Management Trials						
						TRT "B"		DIFFERENCE				
		DESCRIPTION	YIELD (bu.)	TREATMENT COST	DESCRIPTION	YIELD (bu.)	TREATMENT COST	YIELD DIFF.	YLD LSD (bu.)	YLD SIG.	$ BENEFIT OF TRT "A"	COMMENT
MUGGE	SOYBEANS	DEEP BAND FOR 1996 CORN	56.8	$0.00	NO DEEP BAND	57.6	$0.00	-0.8	1.5	N.S.	$0.00	DEEP BANDING INCREASED CORN YIELD IN 1996
OLSON	CORN	DEEP BAND NPK FOR '96 CORN	178.3	$0.00	NO DEEP BAND	176.5	$0.00	1.8	17.8	N.S.	$0.00	DEEP BANDING INCREASED CORN YIELD IN 1996
BOES	CORN	3 T POULTRY MANURE	133.5	$29.00	NO MANURE	146.6	$0.00	-13.0	29.4	N.S.	($29.00)	AFTER LEGUME-GRASS PASTURE, MORE MANURE MAY NOT PAY
ROSMANN, K.	CORN	OFF-FARM POULTRY MANURE	126.0	$49.65	ON-FARM BEEF MANURE	124.0	$35.25	2.0	25.2	N.S.	($14.40)	LOADING AND SPREADING CHARGED TO BEEF OPERATION

Table 2. Cattle and poultry manure analysis and estimated crop-available nutrients, Ken Rosmann farm.

	Manure Analysis		Soil Test		Manure Nutrients Available	
	Cattle	Poultry	Analysis	Recommen-dation	Cattle	Poultry
	lb./ton		ppm	lb./acre	8.2 Ton/acre	2.5 Ton/acre
N =	11 (7)	47 (35)	6	73 †	57 lb/acre	87 lb/acre
P =	8 (5)	59 (41)	6 L	75	41 lb/acre ‡	102 lb/acre
K =	11 (11)	51 (51)	196 VH	0	90 lb/acre	127 lb/acre
S =	1	10	OM = 2.7%			
Mg =	2	11	pH = 6.0			
Ca =	5	39	buffer pH = 6.7	1,300 ¶		
Zn =	0.05	0.69				
Moisture %:	72.1	34.6				

( ) = lb. of estimated *available* nutrient per acre. See 'Managing Manure Nutrients for Crop Production,' Pm-1596.

† 148 bu/acre yield x 1.1 = 163 – 90 lb./acre N credit from legumes = 73 lb. N/acre needed.

‡ Planned to add 400 lb./acre rock phosphate, but could not.

¶ lb. per acre of 100% ECCE lime. Not applied in 1997.