THE USE OF ORGANIC SOIL AMENDMENTS FOR WINTER WHEAT PRODUCTION IN KENTUCKY

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Most animal manures are land-applied in the fall after crops have been harvested or spring prior to planting. Surface application of manures in the fall have more potential for nitrogen (N) loss when applied to fallow land compared to land cropped to winter wheat. The current availability coefficient (AC) for fall applied manure to winter wheat is 50%, which indicates that 50% of the total N should be available for wheat N use. The availability is known to vary depending on manure source, environmental conditions, and proportion of nutrients in organic forms.

This study was conducted to determine the N availability of fall applied organic fertilizers and resulting wheat grain yields compared to urea-N fertilizer. The effects of three organic fertilizer sources and rate on wheat yield and nitrogen AC were compared to urea-N on a Zanesville silt loam soil following corn. Composted swine manure (CSM), poultry litter (PL), and a processed biosolid - Louisville Green (LG) were applied at rates of 100, 150, and 200 lbs total N/A. Commercial fertilizer (CF) was split applied in the spring at rates of 0, 30, 60, 90, and 120 lb N/A. In 2011-2012, 40 lbs of N was applied as urea at planting. Total nutrient analysis for CSM, PL, and LG were 1.5-2.2-1.9, 2.8-2.6-2.6, and 5-3-0 respectively. Grain yield was collected and analyzed. The response curve for the CF (urea) was generated and used to determine the amount of equivalent urea-N was utilized for grain yield from the organic amendments. The amount of equivalent urea-N was divided by the amount of total N to determine AC.

In 2011, CF responded to added N with maximum yields being achieved with 120 lbs N (Table 1). LG appeared to be the superior organic product based on yield response data, but N availability was ≤ 20.7% of urea-N for all LG treatments (Table 1). The AC for PL was less than 10% at all rates used and was equivalent to approximately 9 to 15 lbs of urea-N. Composted swine manure additions were not different from the untreated check. This suggests that the majority of N contained within CSM is in stable organic forms that were resistant to mineralization or the N that did mineralize was lost and not utilized for wheat growth.

Overall yields were higher in 2012 than 2011. The CF treatments produced maximum yield with ≥90 lbs N/A. These CF ≥ 90 results were similar to all rates of LG and the 100 and 200 rates of PL. Both PL and LG had higher yields and AC in 2012, but considerable variation within sources (35 – 40% differences in AC) was present. Averaged across N rates, the AC for PL was 35.9% and 40.8% for the LG in 2012. Yields and AC for CSM were the lowest of the three sources and often not different than the untreated check.

For the two years of this study there was considerable variation within organic sources, coupled with low AC and wheat grain yields. This suggests that adequate N is not being supplied to the plant at these rates and that supplemental inorganic N should be considered to maximize wheat yield. This study is on-going and results will be made available as new information is generated.

Table 1. Wheat Grain Yields And N Availabilities For The 2011 Crop. LSD = 6.7				
Production Function: $Y= -0.0031X^2 + 0.7662X + 23.091$ (R^2=0.9899)				
N Source	**N-Rate**	**Yield (bu/A)**	**Eq. Urea-N**	**% N Avail†**
CF	0	21.9e	0	-
	30	45.6c	30	-
	60	58.3b	60	-
	90	64.5b	90	-
	120	72.1a	120	-
CSM	100	20.3e	-3.6	≤ 0
	150	19.5e	-4.6	≤ 0
	200	22.4e	-0.9	≤ 0
PL	100	29.9d	9.2	9.2
	150	31.6d	11.7	7.8
	200	33.9d	15.0	7.5
LG	100	33.2d	14.0	14.0
	150	43.9c	31.1	20.7
	200	46.8c	36.3	18.1

† Availabilities are compared to commercial fertilizer N response data. Slight differences in equivalent urea-N and subsequent availabilities are attributed to the variation in the fitted line verses the actual response. Values followed by the same letter are not different at the 90% CI.

Table 2. Wheat Grain Yields And N Availabilities For The 2012 Crop. LSD = 15.56				
Production Function: $Y= -0.0016X^2 + 0.4879X + 71.087$ (R^2=0.9987)				
N Source	**N-Rate**	**Yield (bu/A)**	**Eq. Urea-N**	**% N Avail†**
CF	0	70.8fg	0	-
	30	85.1cdef	30	-
	60	94.0abcd	60	-
	90	101.8ab	90	-
	120	106.4ab	120	-
CSM	100	67.9g	-6.4	≤ 0
	150	75.4fg	9.2	7.4
	200	76.5efg	11.6	7.1
PL	100	96.5abcd	66.7	66.7
	150	81.6defg	23.3	15.6
	200	91.7bcde	50.7	25.3
LG	100	91.8bcde	50.9	25.4
	150	92.7abcd	53.7	26.9
	200	108.0a	140.3	70.2

† Availabilities are compared to commercial fertilizer N response data. Slight differences in equivalent urea-N and subsequent availabilities are attributed to the variation in the fitted line verses the actual response. Values followed by the same letter are not different at the 90% CI.