TECHNICAL NOTE

MANURE APPLICATION RATE BASED ON RUNNING AVERAGE MANURE ANALYSIS VALUES

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Contribution no. I-362, received 20 October 1982, accepted 10 February 1983

Phillips, P. A. 1983. Manure application rate based on running average manure analysis values. Can. Agric. Eng. 25: 57–58.

Manuals such as the Canada Animal Waste Management Guide (Agriculture Canada 1979) publish average manure nutrient values for various species of farm livestock. However, the nutrient content of manure from a specific farm during a given year can vary substantially from these average values depending on animal ration, climate, type of storage, and dilution which may have occurred. Wastage of valuable nutrients because of poor estimating from book values may be a concern unless a direct analysis of manure can be done at the time of spreading. Often there is insufficient time for such direct analysis results to be useful during that spreading event and by the next year the analysis could be quite different. Tests on liquid dairy manure from a tie-stall barn near Ottawa indicate that year-to-year variations in nitrogen (N), phosphorus (P), and potassium (K) of ± 30% are common, hence absolute faith in book values, or subsequent errors in adjusting book values, may result in nutrient wasteage. Methods for predicting manure nutrient value from feed intake analysis or production level (e.g. Bulley and Holbek 1982) are not yet sufficiently developed for general use by producers. Therefore, methods based on direct analysis should be considered as a potential part of a land application program.

The delay which usually occurs in receiving the manure nutrient analysis results need not be a source of concern providing the nutrient contents of a particular manure system can be determined over a period of years. While spreading is underway and the manure is well agitated, a sample should be removed and sent for analysis. Even though spreading will be completed by the time the result comes back, that result can still be used. By starting initially with an estimate, direct analysis results will gradually develop a running average manure nutrient value for a particular system which, when extended over several years, should provide a satisfactory basis for calculating manure application rates. Therefore, if there is some doubt as to the accuracy of estimating nutrient content from available book values, then direct analysis results may be utilized as was done in the following situation.

After thorough agitation, four or five samples of liquid dairy manure in the in-ground covered concrete storage adjoining an Ottawa-area tie-stall barn were collected, and nitrogen concentrations were determined. This was done each spring and fall for 6.5 yr giving an average overall concentration of 0.249% N as shown in Table I. Assuming that the current results were not available at the time of spreading it would have been a simple matter, for that year, to average all previous analyses and use that average concentration to compute manure volumes for application to fields. The data in Table I can be used to indicate whether or not this approach would be reasonable.

Since an estimate must be used for the first spreading event we can intentionally "estimate" erroneous values, for example 0.32% N which is too high in this case, and 0.18% N which is too low. Table I indicates the computed manure N concentration for each year based on the running average commencing with the high and the low initial estimate. At the bottom of Table I is a summary showing the overall N concentration which actually occurred (0.249%) and the average N concentration from the running average calculations for both cases. The overall error is one factor which should be examined carefully. Had the farmer simply used 0.32% or 0.18% N for the 6.5 yr his errors would have been 29% and −28%, respectively. By using the running average the magnitude of this error is reduced to −2% and −6% for the high and low estimates, respectively. Cor-

TABLE I. DAIRY MANURE CONCENTRATIONS IN A LIQUID MANURE TANK NEAR OTTAWA FROM 1973 TO 1970 AND CALCULATED NITROGEN CONCENTRATIONS EACH YEAR BASED ON THE RUNNING AVERAGE

			Example 1.	Example 2
Date		Direct analysis	Run. Avg Conc. (%)	Run. Avg Conc. (%)
Fall	1973	0.195	0.320†	0.18†
Spring	1974	0.240	0.195	0.195
Fall	1974	0.290	0.218	0.218
Spring	1975	0.191	0.242	0.242
Fall	1975	0.260	0.229	0.229
Spring	1976	0.310	0.235	0.235
Fall	1976	0.252	0.248	0.248
Spring	1977	0.249	0.248	0.248
Fall	1977	0.244	0.248	0.248
Spring	1978	0.193	0.248	0.248
Fall	1978	0.267	0.242	0.242
Spring	1979	0.264	0.245	0.245
Fall	1979	0.285	0.246	0.246
Overall mean		0.249	0.243	0.233

†Estimated value.

respondingly, the manure applications which would be computed from these concentrations would also reflect this reduced error.

Also of importance is the variability which will occur from year to year between the actual manure N applied and the estimated N applied as calculated from the running average N concentration; the latter would normally be equal to the amount required by the planned crop. Details of these calculations have not been tabulated here but this can easily be done. For example, if the crop requirement were assumed to be 300 kg N/(ha·yr) (150 kg N/ha spring and fall), the mean amounts of actual N applied during 6 yr, for the high and low estimate cases, based on volumes computed from the running average concentrations, would be 310 and 321 kg N/ha·yr), respectively. The standard deviation of these amounts would be about 37 or approximately 12% of the mean. The standard deviation indicates the range within which about two-thirds of the values will fall.

This example indicates that calculating nutrient concentration using the running average approach can work satisfactorily. Nitrogen is only one of several important nutrients which manure supplies to the soil, and attention to other nutrients in manure such as phosphorus and potassium can result in reduced nutrient wastage and saving money. If energy costs continue to escalate these savings will become more significant.

REFERENCES

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