NITROGEN CONTENT IN CATTLE, SHEEP AND POULTRY MANURES ITS ESCALATION AND SHORTFALL OVER TIME

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ABSTRACT*: The vast majority of manures are stored on open lots for longer periods. As the result much of the Nitrogen content in the manures is lost to the atmosphere due to volatilization, or leached into the ground surface. A study was conducted to quantify Nitrogen content of different manures and its increasing trends over the time period. The samples of cattle, sheep and poultry manures were collected in polyethylene bags from livestock department and poultry sheds, Faculty of Animal Husbandry and Veterinary Sciences, Sindh Agriculture University, Tandojam. The samples were tested at different stages after excretion (i.e. Day-1, Day-2, Day-3, Day-5, Day-10, Day-15, Day-30, Day-60 and Day-90). Nitrogen content was then determined following the method adopted by Kjeldahl digestion method. Nitrogen (N) content significantly ($p < 0.05$) increased in all manures; however, the maximum N content was recorded on 15th day. The increase in N content was 3.9 times in first five days and 5.9 times in total 15 Days in cattle manures, while in sheep and goat manure was 2.33 times in first five days and 3 times in all 15 days, and in poultry manure 2.25 times in first five days and 2.7 times in all 15 days. However, a gradual decline was witnessed after 30th day, which continued as the time passed. After a period of 90 days, 25% of N content loss was recorded in cattle manure, 23% in sheep and goat manure and 27% in poultry manure.*

Keywords: Nitrogen content, manures, volatilization, open lots.

INTRODUCTION

Manures are bulky organic materials, mainly plant residues and animal excreta, which have been used as fertilizer for various crops, since ancient times. These manures are rich source of nutrients and promote microbial activity in the soil, and improve its structure, aeration capabilities and water holding capacity. This is consistent with Wortmann and Walters, 2006) who concluded that the application of manure improves soil physical properties as well as reduces runoff and erosion for several years [13]. The manures contain abundant quantity of Nitrogen approximately 4200-8100 mg/Lin liquid and solid manures, respectively [4].Nitrogen is an essential plant nutrient; it stimulates root growth and development in plants and is associated with the photosynthesis activity. Plant responds quickly to the application of nitrogen. It encourages above ground vegetation and gives deep green color to the leaves. It improves quality of leafy vegetative and protein content of food grains [6]. Nitrogen is taken into the plant from soil in both organic and inorganic forms. It enters the plant as either the ammonium or nitrate ion [9]. In warm, well aerated, slightly acidic to slightly alkaline soils NO_3 form predominates with the exception of crops such as paddy (rice). Most agriculturally important plant growth on well-drained upland soils absorbs Nitrogen as nitrates. Nitrates are toxic to plants, but fortunately nitrates do not accumulate under most soil conditions. Regardless of the form Nitrogen is absorbed by plants, it is converted within the plant to –N, NH, or NH_2 form. This reduced Nitrogen is used in the synthesis of amino acid and finally proteins [12].

In contrast manures are not managed properly, before its application to the fields. The vast majority of manures are stored on open lots for longer time periods. As the result much of the Nitrogen content in the manures is lost to the atmosphere due to volatilization, or leached into the ground surface. Application of fresh manure or slurry on the soil surface can result in volatilization losses as high as 50% of the total N in some situations [8]. Ammonia volatilization is undesirable, because ammonia is atmospheric pollutant that can pollute terrestrial and aquatic environments through dry and wet deposition [1]. It is now high time that the manures may be practiced as source of N for crop plants. Therefore with this aim in mind a study was taken in hand to quantify N content of different manures and its increasing trends over the time period.

MATERIALS AND METHODS

A study was conducted to investigate the status of Nitrogen (N) one of the essential macro-nutrient in different manures (i.e. cattle, sheep and poultry) at different stages after excretion.The samples of cattle, sheep and poultry manures were collected from livestock department and poultry sheds, Faculty of Animal Husbandry and Veterinary Sciences, Sindh Agriculture University, Tandojam in polyethylene bags. The samples were tested at different stages after excretion (i.e. Day-1, Day-2, Day-3, Day-5, Day-10, Day-15, Day-30, Day-60 and Day-90). Each day five samples of each manure were collected. Thus, in total 45 samples of each manure were procured and the average of five samples was considered as a representative figure. To avoid the sample errors, the sample collection was made on different days. The Nitrogen content in fresh manures was considered as control. Nitrogen content was then determined following the method adopted by Kjeldahl digestion method [3]. All samples were analyzed at the laboratory of Soil Science, Nuclear Institute of Agriculture (NIA), Tandojam.

RESULTS AND DISCUSSION

The results showed that Nitrogen (N) content significantly ($p< 0.05$) increased in all manures; however, the maximum N content was recorded on 15th day. The increase in N content was 3.9 times in first five days and 5.9 times in total 15 Days in cattle manures (Table 1), while in sheep and goat manure was 2.33 times in first five days and 3 times in all 15 days (Table 2), and in poultry manure 2.25 times in first five days and 2.7 times in all 15 days (Table 3). The increase in N may be due to the decomposition of manure by bacteria that released more and more N. This is consistent with Mikkelsen and Hartz, 2008 [8] who reported that the manure Nitrogen is available in both organic and inorganic forms. However, the conversion of inorganic forms of N to ammonia is rapid, but the conversion of the organic forms of N to an available form is slow. About 60% of the nitrogen becomes available during the first weeks; the remaining N is converted very slowly and may not be available until the next crop or season [7].It was also observed that the poultry manures were relatively rich in N content than those of sheep and cattle manures. This is consistent with Preuschet al., 2002, who concluded that the poultry manure had a higher content of Nitrogen [11].

Table 1. Nitrogen (N) content in cattle manure at different stages after excretion.

No. of days	Temperature (°C)		Sun Shine (hr)	Total Nitrogen (%)	Total Nitrogen
	Min.	Max.			
Day-1	23	40	11	0.2788	3.9 times increase in five days
Day-2	24	42	11	0.5577	
Day-3	25	41	10.5	1.11	
Day-5	28	43	10	1.115	
Day-10	25	45	11	1.39	5.9 times increase in all 15 days
Day-15	28	43	10	1.67	

Table 2. Nitrogen (N) content in sheep and goat manure at different stages after excretion.

No. of days	Temperature (°C)		Sun Shine (hr)	Total Nitrogen (%)	Total Nitrogen
	Min.	Max.			
Day-1	23	40	11	0.836	2.33 times increase in five days
Day-2	24	42	11	1.59	
Day-3	25	41	10.5	1.67	
Day-5	28	43	10	1.59	
Day-10	25	45	11	2.509	3 times increase in all 15 days
Day-15	28	43	10	2.5099	

Table 3. Nitrogen content in poultry manure at various stages after excretion.

No. of days	Temperature (°C)		Sun Shine (hr)	Total Nitrogen (%)	Total Nitrogen
	Min.	Max.			
Day-1	23	40	11	1.115	2.25 times increase in five days
Day-2	24	42	11	1.95	
Day-3	25	41	10.5	2.509	
Day-5	28	43	10	2.509	
Day-10	25	45	11	3.069	2.7 times increase in all 15 days
Day-15	28	43	10	3.0678	

Table 4. The loss of Nitrogen content in different manures with the passage of time.

No. of days	Temperature (°C)		Sun Shine (hr)	Total Nitrogen (%)					
	Min.	Max.		Cattle Manure	Total loss (%)	Sheep and goat Manure	Total loss (%)	Poultry Manure	Total loss (%)
D-30	25	41	10.5	1.2	25	2.31	23	2.78	27.4
D-60	28	43	10	0.95		1.81		2.31	
D-90	25	45	11	0.9		1.77		2.018	

However, a gradual decline was witnessed after 30th day, which continued as the time passed. After a period of 90 days, 25% of N content loss was recorded in cattle manure, 23% in sheep and goat manure and 27% in poultry manure.

This may be because after 15 days, manure started drying, which slowed down the decomposition of bacteria and thus, the N content lost due to the volatilization and leaching. This is consistent with Charles and Donald, 1993 who reported that nitrogen can be lost through volatilization in the form of ammonia and by leaching and runoff from manure stored in open lots [5]. Nitrogen loss from the stored manure varied from 25 to 41% of the total Nitrogen [14]. Barker and Zublena, 1993 concluded that much of the nutrients can be lost through vitalization, and surface runoff during the time

between manure voiding by the animal and transport to the field for spreading. They further concluded that only 35% of N was available for land application after handling, storage and application losses [2].

However, this loss of N content could be minimized through proper storage and handling techniques and timely application to the fields. This is consistent with OSU (2000), who reported that the nutrient composition of manure is affected by housing and the handling system [10]. Nutrient losses from storage and handling reduce the amount of nutrient available for land application. Phosphorous and potassium losses are usually negligible, but N losses can be significant. Additionally, land application methods also affect the amount of nutrients available for crop uptake. Most losses occur with 24 hours of application. Therefore, manure should be incorporated into soil as soon as possible after application.

CONCLUSIONS

The study has shown that the Nitrogen (N) content significantly ($p< 0.05$) increased in all manures; however, the maximum N content was recorded on 15th day. The increase in N content was 3.9 times in first five days and 5.9 times in total 15 Days in cattle manures, while in sheep and goat manure was 2.33 times in first five days and 3 times in all 15 days, and in poultry manure 2.25 times in first five days and 2.7 times in all 15 days. However, a gradual decline was witnessed after 30th day, which continued as the time passed. After a period of 90 days, 25% of N content loss was recorded in cattle manure, 23% in sheep and goat manure and 27% in poultry manure. It is therefore suggested to properly manage and apply manures at right time to the fields.

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