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Research Article

Influence of Organic Manures on Fodder Yield and Nutrient Composition of *Dolichus trilobus* in *Punica granatum* Based Hortipastoral System

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ABSTRACT

Livestock play a significant role in countries economy. Livestock production is mainly limited by insufficient fodder and poor nutrition. Effective utilization of organic manures plays an effective role in proper nutrition and increasing the green fodder production of fodder crops. In this context an experiment was conducted to study the effect of different organic manures on the green fodder yield of Dolichus trilobus in Punica granatum based hortipasture system with different organic manure practice. Pillipesara (Dolichus trilobus) was grown on a degraded wasteland under Punica granatum based hortipasture system in North Eastern Agroclimatic zone of Tamil Nadu during 2017. The experiment was laid out in Randomized Complete Block Design (RCBD) with four treatments replicated thrice. Treatments consisted of three different manures on N equivalent basis viz., cattle manure, goat manure, swine manure and a control (without manure). Manures were incorporated as per the treatment as basal application. Fodder was harvested on 60th day at different places and fresh weight was recorded and Dry matter production (DMP) was estimated. Harvested plant material was weighed, dried and the ground subsamples were taken for analysis of crude protein (CP) and crude fibre (CF) as per AOAC, (2000) method. The growth performance of Dolichus trilobus revealed that application of 100% cattle manure on Nitrogen equivalent basis performed better in terms of fresh fodder yield (17.58 MT/ha) and dry fodder yield (3.52 MT/ha) under Punica granatum based hortipasture system. Higher crude protein of 16.52 % and crude fibre content of 21.24 % was observed with the application of 100% cattle manure on Nitrogen equivalent basis treatment. Hence, application of 100 % Cattle manure on N equivalent basis can be effectively utilised as a source of nutrient for the crop to enhance the nutrient composition of the fodder crop grown in the system.

Keywords: *Pillipesara, Organic manures, Green fodder yield, Nutrient composition and hortipasture*

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INTRODUCTION

Fodder crop cultivation in agriculture needs lot of importance. Sustainable livestock production depends on regular fodder availability. Fodder production is inadequate because of low or poor fertility of soil (Iqbal et al., 2009). Organic nutrient management is important to maintain the fertility of the soil and also to maintain the productivity of crop grown in the system. Over the years, yield of many crops have reduced drastically due to the humiliating environment of soils and poor fertility management to improve the fertility of the soil. At present, about 25–30 percent of nutrient requirement of crops can be met by various organic sources. Supplementation of entire quantity of Nitrogen through FYM sustains crop productivity. In the meantime, attempts to use inorganic fertilizer to restock the soil nutrient have not be successful because of high cost, sometimes, the adulterated product has adverse effect on the soil, water and plants, hence, there is need to look for other sources of maintaining the soil fertility in order to enhance crop yield.

Dolichus trilobus is a dual purpose crop yielding good fodder and green manure, herbaceous creeper grows into a short dense cover crop. It does not produce a bulky yield and can be grown in all seasons. The main benefit of using this crop as fodder is that legumes fix nitrogen from the atmosphere and convert it into a form that is available to other plants. In this context, a study was formulated to identify the suitable organic manure for the growth of *Dolichus trilobus* in *Punica granatum* based hortipasture system with different organic manure practice.

MATERIALS AND METHODS

The experiment was conducted at the piggery unit of Post Graduate Research Institute in Animal Sciences, Kattupakkam. The soil samples were collected at a depth of 15cm for analysis before the experiment was initiated. The tillage operations were performed in the field and beds were formed. Initially *Punica granatum* trees was planted at a spacing of 5m x 5 m. Different plots were separated for imposing the treatments.

Treatments consisted of three different manures on N equivalent basis *viz.,* cattle manure, goat manure, swine manure and a control (without manure). Manures were incorporated as per the treatment as basal application. Seeds of *Dolichus trilobus* was sown as the understorey of *Punica granatum.* The experiment was laid out in Randomized Complete Block Design (RCBD) with four treatments replicated thrice. Weeds were removed. Fodder was harvested on 60^{th} day at different places and fresh weight was recorded. Harvested plant material was weighed, dried and the ground subsamples were taken for analysis of crude protein (CP) and crude fibre (CF) as per AOAC, (2000) method. Five plants were removed from the sample rows, air dried and then oven dried at $80^0 \pm 2^0$C till a constant weight was recorded. Dry matter production was expressed in kg ha^{-1}.

RESULTS AND DISCUSSION

This experiment was conducted to determine the effect of different organic sources of nutrition on *Dolichus trilobus in Punica granatum* based hortipasture system. The data in respect of soil nutrient composition before and after *Dolichus trilobus* establishment in *Punica granatum* based hortipasture system is presented in Table 1.

Table 1: Soil nutrient composition before and after *Dolichus trilobus* establishment in *Punica granatum* based hortipasture system

Treatments	pH	EC	Available Nitrogen (Kg ha^{-1})	Available Phosphorus (Kg ha^{-1})	Available Potassium (Kg ha^{-1})	Organic Carbon (%)
Initial	6.95	0.026	251	9.6	393	0.52
T_1 - Cattle manure	7.67	0.039	352	41.6	428	0.69
T_2 - Goat manure	7.27	0.026	352	37.2	425	0.62
T_3 - Swine manure	7.24	0.023	301	33.1	421	0.50
T_4 - without manure	7.21	0.021	276	23.2	406	0.46

The organic manure treatment significantly increased soil nutrient composition. Soil available nitrogen content increased by 27% after the cattle manure treatment, while soil available nitrogen content without manure application was similar to that of initial soil values. The available phosphorus content in the soil increased more than 50% compared to control. Similar to available phosphorus, exchangeable potassium concentrations were significantly increased in all organic manure treatments. Electrical conductivity was increased after the organic manure treatments, and the highest electrical conductivity was observed in the soil treated with the cattle manure.

The results of this study were in agreement with the results of several studies that have shown organic manure treatment increased soil pH, but chemical fertilizer treatments, such as NPK fertilizer, decreased soil pH (Liu et al., 2010). The decrease of soil pH by NPK fertilizer may be explained by leaching of basic cations, such as potassium from the soil. However, Si Ho Han et al. (2016) reported that soil pH decreased by 0.3–0.7 after 11 years of organic manure treatment (with livestock byproducts) at base rich soil, and that the decrease was greater when the amount of manure treatment was increased. Another study reported that long-term treatments with anaerobic swine liquid reduced the soil pH (Adeli et al., 2008). Generally, organic manure with livestock byproducts increases soil pH, but the effects differ depending on the organic matter content, treatment amounts, and soil properties.

A total of 40% organic matter content in organic manure is believed to increase the content of nitrogen, phosphorus and potassium in the soil (Table 1). The organic matter of manure allows plants to use the nutrients for a long time, due to its slow decomposition, and reduces the loss which is not utilized by the plants (Bhandari et al. 2002). In the present study, the phosphorus content of the soil was increased by the cattle manure, indicating that the plant was not able to utilize a large quantity of the phosphorus that was provided by fertilization and that it accumulated on the soil surface, as reported by Singh et al. (2007). Major cations, including potassium, and nitrogen and phosphorus were increased by organic manure treatment due to their high content in organic manure.

The growth performance of *Dolichus trilobus* revealed that application of 100% cattle manure on Nitrogen equivalent basis performed better in terms of both fresh and dry fodder yield under *Punica granatum* based hortipasture system. Nitrogen content of cattle manure, goat manure and swine manure was analysed and it is 0.4, 0.9 and 0.5 %, respectively.

Biomass yield and nutrient responses

The effect of organic manures on biomass yield of *Dolichus trilobus* in *Punica granatum* based hortipasture system is presented in Table 2.

Table 2: Effect of organic manures on nutrient content and biomass yield of *Dolichus trilobus* in *Punica granatum* based hortipasture system

Treatments	Crude protein (%)	Crude fibre (%)	Dry yield (MT/ha)	Fresh yield (MT/ha)
T_1 - 100 % Cattle manure on N equivalent basis	16.52 ± 0.18^{c}	21.24 ± 1.20^{c}	3.52 ± 0.28^{c}	17.58 ± 1.39^{c}
T_2 - 100 % goat manure on N equivalent basis	13.60 ±0.12^{bc}	20.67 ±0.29^{bc}	2.88 ± 0.17^{bc}	14.39 ± 0.85^{bc}
T_3- 100 % pig manure on N equivalent basis	11.33 ±0.88^{ab}	19.87 ±0.15^{ab}	2.68 ± 0.29^{ab}	13.42± 1.46^{ab}
T_4- Control (without manure)	10.07 ±0.15^{a}	11.53 ±0.09^{a}	2.10 ± 0.08^{a}	10.50± 0.40^{a}

Mean of four replicates, Values bearing different superscripts in same column differ significantly (P< 0.05)
NS - No significant variation

All fertilization treatments significantly increased the nutrient content and green fodder yield of *Dolichus trilobus in Punica granatum* based hortipasture system (Table 2). This indicated that the fertilization treatments affected carbohydrate distribution in the plants. However, higher biomass yield and nutrient composition were seen with cattle manure application because of the increased nutrient availability that occurred by the supply of other essential nutrients and the by improvements in the quality of the soil due to the pH increase. The results of this study showed that the utilization of organic manure, without inorganic fertilizer, could maintain biomass productivity at a level similar to inorganic fertilizer and enhance the quality of soil.

Higher crude protein of 16.52 % and crude fibre content of 21.24 % was observed with the application of 100% cattle manure on Nitrogen equivalent basis treatment. Application of 100 % Cattle manure on N equivalent basis increased the biomass yield and nutrient content of *Dolichus trilobus* under *Punica granatum* based hortipasture system. Hence, Cattle manure can be effectively utilised as a source of nutrient for the crop to enhance the nutrient composition of the fodder crop grown in the system. This result in accordance with the earlier finding of Cooke (2002), who noted that nitrogen application, had no effect on fruit size.

Soil nutrient management is essential for sustainable biomass production and for maintaining soil quality. Organic manure increased soil pH, the concentrations of nitrogen, phosphorus, and major nutrients. This study confirmed that organic manure originating from livestock byproducts not only promoted the growth of fodder crop but also improved soil conditions. Therefore, organic manure should be considered as an alternative to inorganic fertilizers in the organic livestock crop production systems.

CONCLUSION

The biomass yield of *Dolichus trilobus* under *Punica granatum* based hortipasture system increased with the application of 100 % Cattle manure on N equivalent basis. From the result of the study, it can be concluded that the use of animal manure in crop production is desirable as it had variable impacts on the growth and yield of crops. The use of 100 % Cattle manure on N equivalent basis will improve soil organic matter status, nutrient availability and good crop yield as well as ensures stability of soil structure. Therefore it is advisable to use cattle manure for the production of understorey crops and fruit trees grown in the system.

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