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The Impact of Combinations of Poultry Manure on Mulberry Plants Variety G-4

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Abstract

The success of silkworm rearing is depended on mulberry leaf yield and quality defined by utilization of chemical fertilizers along with other manures with its management in cultivation of mulberry plantation. The key factor that affects soil fertility, plant growth and crop quality also defined by fertilizers. However, the continuous application of chemical fertilizers will also invite adverse soil conditions along with crop failures. The present study was undertaken to supplement the chemical fertilizers application in a mulberry garden with high yielding mulberry variety of "Genotype-4(G4)" to analyze the growth, yield, and biochemical contents in an instant available through different fertilizer combination practices. The field experiment conducted in a randomized block design, with five replications at Salem, Tamil Nadu, India. There were twelve treatments, absolute control with zero application of fertilizer (T_0), control with 100% recommended dose of fertilizer with farm yard manure (T_1), 5 MT Poultry manure with 100% RDF and Green manure (T_2), 7.5 MT Poultry manure with 100% RDF and Green manure (T_3), 10 MT Poultry manure with 100% RDF and Green manure (T_4), 5 MT Poultry manure with 75% RDF, Green manure and bio fertilizer (T_5), 7.5 MT Poultry manure with 75% RDF, Green manure and bio fertilizer (T_6), 10 MT Poultry manure with 75% RDF, Green manure and bio fertilizer (T_7), 5 MT Poultry manure with 50% RDF, Green manure and bio fertilizer (T_8), 7.5 MT Poultry manure with 50% RDF, Green manure and bio fertilizer (T_9), 10 MT Poultry manure with 50% RDF, Green manure and bio fertilizer, 100% RDF with farmyard manure and green manure. Few major parameters are tested and the results are the highest 10 leaf area (3698 cm^2), leaf number per plant (321), total leaf weight per plant (1213.60 g), height of the plant (211.33), total biomass (1982.60), length of longest shoot (179.53 cm) and total leaf yield per hectare per year (35242.94 kg) were noticed in T_7 treatment followed by T_1, T_{10} and T_{11} treatments. The highest moisture (75.27%), total nitrogen, total phosphorus (12.10%), total potassium (1.65%), total sugar (16.65%), crude protein (18.98%), and soluble carbohydrate (13.66%) were also recorded in T_7 treatment as compare to other treatments. The outcome of research experiment proves that among the ten fertilizer management practices of 10mt poultry manure with 75% NPK with green manure and biofertilizers generate similar impact of 100% NPK application in mulberry G4 variety.

***Key words*:** G4, Liquid fertilizer, Silkworm, Foliar spray, Photosynthesis, Pruning

Sericulture activities mainly depended on mulberry leaf quality and quantity which used to feed the silkworm for rearing, the quality of leaf ultimately influences the cocoon productivity as also the quality of raw silk [1]. The continuous production of mulberry leaves is a practice of commercial rearing of silkworm for a long time need proper care of the soil which will results sustainable leaf yield and quality through proper soil fertility management. Based on the research and development in sericulture invented best practices of silkworm rearing with advanced mulberry varieties like G4 it is possible to produce 60-70MT/ha/year of foliage is harvested from one hectare of mulberry garden [2]. For producing the large quantity of mulberry leaves farmers using a ratio of chemical fertilizer to mulberry plantations are highest among the perennial plantations i.e. 360:180:180 (N:P:K) [3]. Mulberry leaf production in India is mainly dependent on the application of chemical fertilizers which are help plants to produce continuingly without compromising quantity and quality [4]. However, the continuous application of chemical fertilizers is not recommendable due to it can change the nature of soil, making it either too acidic or too alkaline, reduce soil fertility, harm the microbes present in soil, eutrophication etc. [5]. Further, the ratio of chemical fertilizer applying to mulberry plantations are highest among the tree plantations i.e. 360(Urea):180:180 (N:P:K) [3]. This practice not only affecting the environment but also farmers economy for producing cocoon also. Hence, it is need of the hour to find a supplementation and farmers friendly organic and biological fertilizers and its management for reducing the application of chemical fertilizer for sustainable sericulture.

In search of manures which can compensate supplementation of chemical fertilizers leads to poultry manure

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which contains the highest quantity of carbon and nitrogen amongst the manures commonly available for farmers [6]. The utilization of poultry manure in mulberry cultivation is an un explored area which generally considered as a farm yard manure. The production of poultry meat in India is fifth in the world accordingly the production of poultry manures also accumulating and become un attended pollution [7]. The application of poultry manures in other edible crops are tested and proven that enhancing of carbon nitrogen content in the soil and increased production in rice [8], wheat [9], maize [10] etc. The effective utilization of poultry manures not only with application management of fertilizer but also depending on the application of other biofertilizers and green manures to convert the available carbon and nitrogen to plant. The application of biofertilizers like *Azosprillum spp* [11], phospho bacteria [12] and potash mobilizing bacteria [13] are more effective with green manure [14] for sustainable crop production. Hence a combination of poultry manure with biofertilizers and green manure can supplement the application of chemical fertilizers. The present investigation was carried out to study the effect of combination of poultry manure with biofertilizers and green manure in mulberry with the objectives of supplementation of chemical fertilizers and analyze the (N, P, and K) content in mulberry leaf.

MATERIALS AND METHODS

The field experiment was laid out in the farmers field No. 30.2 at D. Perumapalayam village of Salem District and it is located at 11.71 °E Latitude and 78.22 °N Longitude at an altitude of 278 m above Mean Sea Level, during the year 2019 to 2021.The soil was black cotton type. The experiment was conducted with 12 treatment combinations (Table 1) under Randomized Block Design (RBD) with three replications.

Table 1 Treatment details

T_0:	Absolute control without any fertilizer
T_1:	Control (100% RDF) + Farm Yard Manure (FYM) (GM)
T_2:	5 MT Poultry Manure+ 100% Recommended Dose of Fertilizer (RDF) + Green Manure *(Sesbania aculeata)*
T_3:	7.50MT Poultry Manure+ 100% RDF + Green Manure
T_4:	10MT Poultry Manure+ 100% RDF + Green Manure
T_5:	5MT Poultry Manure+ 75% RDF + GM+ Recommended dose of Bio-Fertilizer (*Azosprillum* spp., Phospho bacteria and potash mobilizing
T_6:	7.5MT Poultry Manure+ 75% RDF + GM+ Recommended dose of Bio-Fertilizer (*Azosprillum* spp., Phospho bacteria and potash mobilizing bacteria)
T_7:	10 MT Poultry Manure+ 75% RDF + GM+ Recommended dose of Bio-Fertilizer (*Azosprillum* spp., Phospho bacteria and potash mobilizing bacteria)
T_8:	5MT Poultry Manure+ 50% RDF + GM+ Recommended dose of Bio-Fertilizer (*Azosprillum* spp., Phospho bacteria and potash mobilizing bacteria)
T_9:	7.5MT Poultry Manure+ 50% RDF + GM+ Recommended dose of Bio-Fertilizer (*Azosprillum* spp., Phospho bacteria and potash mobilizing bacteria)
T_{10}:	10MT Poultry Manure+ 50% RDF + GM+ Recommended dose of Bio-Fertilizer (*Azosprillum* spp., Phospho bacteria and potash mobilizing bacteria)
T_{11}:	100 % RDF + GM+ Farm Yard Manure (FYM)

PM: Poultry Manure, RDF: Recommended Dose of Fertilizer, GM: Green Manure, BF: Bio Fertilizer, FYM: Farm Yard Manure

Selection of plant

Five plants in each treatment were selected at random and labelled for recording observations in each of the five replications. The following characters were recorded during 60th day after pruning the crop.

Quantitative and qualitative analysis of G4 mulberry variety

The quantitative analysis as number of leaves per plant shoots per plant, total leaf weight per plant, number of leaves per shoot, leaves per plant, leaf area, shoot length, plant height, total biomass, leaf weight per plant, Hight of the plant, Length of longest shoot, Total biomass, Total leaf yield per hectare per year, Moisture content as per the standard analysis.

RESULTS AND DISCUSSION

Effect of poultry manure on the growth and development of mulberry var. G4- physical analysis

Number of shoots per plant

The number shoots developed from each plant after pruning showed significant differences among all the treatments (Table 2). The no. of shoot per plant ranged from 6.93 in T_0 to 10.80 in T_7. However, the difference between plants in full dose of chemical fertilizer and that of T_7 with 75%Chemical fertilizer and 10MT poultry manure also give almost similar results indicating the possibility of replacing 25% of chemical fertilizer with 10MT poultry manure.

Number of leaves per plant

The number of leaves per plant showed significant variation among the treatments as it ranged from 183.87 in T_0 to 321.60 in T_7 (Table 1). Since silkworm feeds only the leaf, the number leaf per plant plays a major role in deciding the number of shoots to be fed to the silkworm.

Leaf area (cm^2)

The area of leaf also showed significant variations among the treatments (Table 1). The total leaf area per plant was in the range of 44874.33cm^2 in T_0 to 119465.64 cm^2 in T_7. Here also it could be observed that the difference between T_1 and T_7 is almost negligible indicating that T_7 combination of fertilizers can be adopted.

Plant height in cm

Plant height is an indication of the growth rate of plants and in sericulture high growth rate is a desirable character as it decides the amount of leaf available for silkworm rearing. In this experiment, the height of the plant showed significant variation indicating that fertilizer application affected the growth rate of the plant. The highest plant height was recorded in T_1 (215.13 cm) which was significantly higher compared to all other treatments but at par with that of T_7 (211.33cm).

Table 1 (a) Growth and development of mulberry var. G4 as influenced by different dosage of poultry manure

Treatment	No. of shoot per plant	No of leaf per shoot	Leaf area (cm^2)	Plant height (cm)	No. of leaves per plant	Shoot length (cm)
T_0	6.93	27.22	44874.33	179.33	183.87	147.02
T_1	10.73	29.48	115550.28	215.13	316.60	179.53
T_2	9.47	29.23	85911.96	203.60	278.01	168.22
T_3	9.40	29.02	84378.80	205.67	267.79	168.40
T_4	9.93	29.86	83027.87	206.93	287.88	168.20
T_5	8.00	29.02	72757.89	199.53	233.51	161.98
T_6	8.93	29.17	82227.64	201.93	262.36	167.04
T_7	10.80	29.81	119465.66	211.33	321.68	172.09
T_8	9.40	29.54	85938.75	198.67	273.35	160.22
T_9	9.20	29.58	80462.37	202.67	262.56	168.91
T_{10}	9.20	29.23	86704.00	205.53	267.37	165.09
T_{11}	10.40	29.76	99777.52	210.67	300.75	171.36

Table 2 (b) Effect of poultry manure on the growth and development of mulberry var. G4 chemical analysis

Treatment	Nitrogen content (%)	Phosphorus content (%)	Potassium content (%)	Total sugar (%)	Crude protein
T_0	2.68	0.27	1.32	14.06	16.72
T_1	2.95	0.34	1.61	16.33	18.42
T_2	2.70	0.31	1.58	15.17	16.85
T_3	2.75	0.31	1.54	15.69	17.17
T_4	2.94	0.31	1.64	15.99	18.38
T_5	2.76	0.30	1.52	15.22	17.24
T_6	2.80	0.30	1.58	15.62	17.51
T_7	3.04	0.34	1.65	16.65	18.98
T_8	2.81	0.30	1.49	15.80	17.55
T_9	2.83	0.31	1.53	15.51	17.66
T_{10}	2.83	0.31	1.54	15.68	17.68
T_{11}	2.93	0.32	1.67	16.04	18.32

The results concerning the impact of addition of manures and fertilizers on the uptake of macronutrients in G4 are given in (Table 2), respectively. The data indicating that, the macronutrient uptake (N, P and K) in G4 is improved to a significant extent with the sole and combined application of organic manures and inorganic fertilizers. The content of nitrogen in the G4 variety ranging from 2.68% to 3.04% and the most available nitrogen with treatment of T_7. Followed by Phosphorus content also ranging from 0.27% to 0.34% and G4 were recorded highest in treatment T_7, which was significantly higher than other treatments and control. Similarly, the highest values for potassium were observed under the treatment T_7 involving the combined application of poultry manure + 75% N. Also, the results of (Table 2) demonstrated that, the treatment impacted maximum in treatment T_7. The Poultry manure 10 MT Poultry Manure + 75% RDF + GM + Recommended dose of Bio-fertilizer (*Azosprillum* spp., Phospho bacteria and potash mobilizing bacteria) application and was lowest in treatment T_0. The results are stating the 25% of reduction of NPK application in the field.

CONCLUSION

The investigation into the effect of poultry manure on the growth and development of mulberry var. G4 revealed significant improvements in various growth parameters with the application of poultry manure, especially when combined with chemical fertilizers. The number of shoots per plant increased notably, with T_7 (75% chemical fertilizer + 10MT poultry manure) showing the highest number of shoots at 10.80, closely matching the results of the full chemical fertilizer dose. This suggests that 25% of the chemical fertilizer can be replaced with poultry manure without compromising shoot development. Leaf production, which is crucial for silkworm feeding, was also enhanced in the T_7 treatment, with the number of leaves per plant reaching 321.60, significantly higher than the control treatment (T_0). The total leaf area per plant was highest in T_7 (119465.66 cm^2), indicating robust foliage growth conducive to silkworm rearing. Plant height, another critical growth indicator, was significantly improved with the application of fertilizers. The tallest plants were observed in T_1 (full chemical fertilizer dose) and T_7, indicating that poultry manure can effectively complement chemical fertilizers to achieve optimal plant height. The chemical analysis further supported these findings, showing higher nutrient content (N, P, and K) and total sugar and crude protein in the T7 treatment. The results demonstrated that the combined application of poultry manure and reduced chemical fertilizers improved the nutrient uptake in mulberry plants, enhancing their growth and development. Overall, the study concludes that the application of poultry manure, particularly in combination with 75% of the recommended chemical fertilizer dose, is highly effective in promoting the growth and development of mulberry var. G4. This approach not only supports sustainable agricultural practices by reducing chemical fertilizer usage but also ensures optimal plant growth for sericulture purposes.

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