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PRELIMINARY INVESTIGATION ON THE EFFICACY OF ORGANIC FERTILIZERS ON THE GROWTH AND BIOCHEMICAL TRAITS OF MULBERRY

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ABSTRACT Mulberry is the only source of nutrition of silkworm *Bombyx mori* L. and acts as a major player in the production of quantitative quality of cocoon. Though the plants are easily propagated and balanced nutrition of leaves earmark overall development of the silkworm. Growth and quality of mulberry leaves depends on the soil fertility profile, abiotic factors and management. FYM is the important organic resource for agriculture production in mulberry farming system in tropical countries and is a good source of NPK. In sericulture industry, lot of biodegradable waste silkworm litter is recovered from the rearing trays which contain substantial proportion of organic Nitrogen**.** In the present investigation, comparative growth performance and photochemical studies were conducted to ascertain the superiority of the growth and leaves nutrition. The growth parameters such as number of branches, number of leaves, leaf area, petiole length, inter nodal distance, length of the shoot and shoot thickness were recorded after one month, two months and three months of application of the manure. Exponential increase in protein and carbohydrate content noticed in plants treated.

KEYWORDS : Mulberry, Silkworm litter, FYM, Organic fertilizer

INTRODUCTION:

Mulberry is grown in India since time immemorial and due to the presence of morin, β-sito sterol and other secondary metabolites, it is the only plant consumed by the silkworm to produce cocoon. Both indigenous and exotic varieties are available in nature but most of the plants lack one or the other parameter from the rearing perspective. Growing mulberry plants with nutritionally superior leaves is the major concern and farmers indiscriminately using chemical fertilizers and its application may hamper the quality of soil resulting in the allelopathic effect.

Mulberry is grown in both tropical and temperate countries of the world and requires abiotic factors for its growth and development. In India, mulberry is grown on a variety of soils, predominantly on red loam, sandy loam with a pH range of 6.8. In some parts of India mulberry is cultivated in black soils. Several factors are responsible for successful cocoon crop (Miyashita, 1986). They are mulberry leaf (38.2%), climate (37%), silkworm race (4.2%) and rearing technique (9.3%) etc. The Soil fertility has a direct bearing on the nutrient status of leaf. The mineral elements like Nitrogen, Sulphur, Phosphorus, Potassium, Calcium, Magnesium, Sodium and Iron are essential for plant growth.

Mulberry being a perennial plant exhausts a lot of nutrients from the soil. Therefore, maintenance of soil fertility becomes a very important criterion. The soil alone cannot meet the entire nutritional requirements and hence addition of nutritional supplements such as fertilizers becomes very essential. Farmyard manure (FYM) is one of the principal organic manures used for the cultivation of mulberry. It is prepared by using cow dung, cow urine, waste straw and other dairy wastes. It is highly useful and has many beneficial properties like, is rich in nutrients, small portion of nitrogen is directly available to the plants while large portion is made available as and when the FYM decomposes. However, such organic manures are in short supply. This has led to their inadequate application, due to which soil health and leaf qualities are adversely affected. This situation has created a renewed interest in biological transformation of sericulture byproducts into organic manures (Chowdhary et. al, 1993).Sericulture byproducts like silkworm excreta can form excellent biological resource to fulfill the shorter supply of organic manures and needs to be exploited.

In the present study, an attempt was made to study the comparative effect of FYM and silkworm litter on the morphological parameters and phytochemistry of mulberry plants and to investigate the effectiveness of alternative nutrient supplements.

MATERIALS AND METHODS:

Experimental site and design:

Experiment was carried out in the mulberry garden, Maharani's Science College for women, Bangalore. Three plots measuring 3m x 3m were selected in the garden and the field area was labeled, conducted in Randomized Block Design (RBD) with three replications. Cuttings from three years old plantation were selected.

Experimental treatment:

T_1-Control (Nothing was added)
T_2-FYM
T_3-Silkworm litter

Growth parameter:

The growth parameters such as number of branches, number of leaves, leaf area, petiole length, inter nodal distance, length of the shoot and shoot thickness were recorded after one, second and third month of application of the manure

Biochemical analysis:

Preparation of leaf extract:

The leaf samples were collected after one month, two months and three months of plantation. 8-10 leaves were collected in a random manner from the plants in each of the three plots. 10g of leaves of each plot were weighed separately. The weighed leaves were cut into small pieces and were homogenized in a mortar and pestle. Acetone chilled at 4-5^{0}c was added to the homogenate, and this was filtered using Whatman No. 1 filter paper. The filtrate was dried in shade and was then stored in packets at 4-5^{0}c and until further use for biochemical analysis.

Estimation of Protein:

The method of Lowry et al, (1951) was followed for the estimation of protein. OD values were measured at 660 nm. Bovine serum albumin (200µg/ml) was used as the standard.

Estimation of Total Sugars:

Total sugars were estimated by employing Anthrone colour reaction (Plummer, 1987). One ml of sample was added to 4 ml of Anthrone reagent. The mixture was boiled over a boiling water bath for 10 minutes and immediately cooled by taking 1 ml of distilled water in place of sample. Optical density was measured at 620 nm using a photoelectric colorimeter.

Estimation of Reducing Sugar:

The estimation of reducing sugars was done as described in Plummer, 1987. OD was measured at 540 nm. Glucose (500 µg/ml) was used as a standard.

RESULT:

Application of FYM and silkworm litter on the growth parameters of mulberry are detailed below (Table-1).

Morphological characters:

Results indicated that performance of T_2 on the branch number is more (24.0) a month after planting compared to application of T_3 (19.0) and control (19.0) plants. Number of branches increased after the second (25.0) and third (26.0) month showed better values than T_3(20.0) and T_1 (20.0). T_1 plants exhibited intermodal distance (5.0cm) compared toT_2 (6.0cm) and T_3 (6.0cm) after three months of planting. Gradual increase in length observed in FYM (4.3cm) and T_3(4.1cm) on the third month with comparative decrease in petiole length in T_1 (3.6cm) was noticed. Number of leaves considerably increased in plants grown in T_3 treated soil (37.6) compared to T_2 (295.5) and T_1 (275.0). Leaf is an important parameter and values exponentially increased in T_3 (319.3cm^2) compared toT_2 (295.5cm^2) and T_1 (275.0cm^2). Highest shoot length (197.3cm) and thickness of shoot (4.0cm) in T_3 showed appreciable values compared to T_2(186.6cm & 3.7cm) and T_1(191.0cm & 3.6cm) respectively after three months of planting. Physical, chemical and biological properties depends on the soil health condition and organic manures play a vital role in facilitating water holding capacity in sandy soils, increasing nutrient supply power of alkaline soil by reducing its pH and promote microbial activity to make the soil fertile. The well decomposed FYM approximately contains 0.5% N, 0.2% P_2O_5 and 0.5% K_2O (Sakthivel, 2014). The manures derived from animal wastes found to be more economical than commercial fertilizers for plant nutrients. The Seri waste compost contains approximately 2.00-2.24% N, 0.93-1.00% P and 1.5-1.8% K besides Zn, Fe, Mn and Cu as micronutrients (Singhal et al., 2001). The application of compost manure produced out of sericulture waste including silkworm litter is highly beneficial for mulberry cultivation and is much effective than conventional use of farmyard manure (Sangeetha et al., 2012). Plants show better growth silkworm litter treatment due to the availability of macronutrients after decomposition. Silkworm is also found to be beneficial when compared to FYM and analysis of the litter revealed higher composition of NPK, sodium and carbon (Sonwalkar, 1991). Silkworm waste found to enhance the beneficial micro flora like bacteria, fungi, actinomycetes etc. resulting enhancement in the mineralization and decomposition of soil available nutrient (Faruque et al, 2017).

Table-1: Effect on growth of mulberry plant by FYM and Silkworm litter after One, Two and Three month of application.

Growth parameter	Control			FYM			Silkworm Litter		
	One month	Two month	Three month	One month	Two month	Three month	One month	Two month	Three month
Avg. No. of branches	19	18	20	24	25	26	19	18	20
Avg. Internodal distance (cm)	3.75	5.56	5	3.13	5.3	6	3.62	5.5	6
Avg. petiole length(cm)	2.75	3.48	3.6	2.62	3.68	4.3	2.62	3.9	4.1
Avg. No. of leaves/shoot	10	22.75	36	7.5	26	34.6	8.5	27.25	37.6
Avg. leaf area(sq.cm)	91	264.3	275	80	287	295.5	97.25	253.5	319.3
Avg. length of the shoot(cm)	32.75	132.25	191	26.5	151.25	186.6	25.5	144.25	197.3
Avg. Shoot thickness (cm)			3.6			3.7			4.0

Phytochemistry:

Protein content (Table-2) in plants grown in T_3 exhibited increased protein concentration from first month onwards in the range 0.50mg/g > 0.144mg/g >0.182mg/g till the end of third month. It is comparatively better when compared plants grown in T_1 and T_2 and values with leaves containing less protein (0.124mg/g and 0.144mg/g respectively) at the end of third month. Carbohydrate concentration in the T_2 and T_3 has not changed considerably in its three months period and T_2 showed almost similar values in all the months (0.66mg/g, 0.63mg/g and 0.66mg/g) compared to T_3 indicated better values (0.70mg/g, 0.64mg/g and 0.68mg/g).T_1 performance was inferior than T_2 and T_3.The concentration of reducing sugar is appreciable in control (0.41mg/g, 0.41mg/g and 0.44mg/g) compared to T_2 (0.36mg/g=0.36mg/g >0.40mg/g) and T_3 (0.39mg/g >0.42mg/g=0.42mg/g). Shinde et al (2014) revealed that quality and productivity based on plant variety, its nutrients and climatic conditions. Quality of leaves plays important role in conversion into insect biomass and this in turn affects the economic traits of cocoon (Das et al., 2001; Kumar and Vadamalai, 2010).

Table-2: Concentration of protein, total carbohydrates and reducing sugar (mg/g) in Mulberry leaf obtained from plants By FYM and Silkworm litter after One, Two and Three-months of application.

Biochemical analysis	Control			FYM			Silkworm Litter		
	One month	Two month	Three month	One month	Two month	Three month	One month	Two month	Three month
Concentration of Protein (mg/g)	19	18	20	24	25	26	19	18	20
Concentration of Total Carbohydrates (mg/g)	3.75	5.56	5	3.13	5.3	6	3.62	5.5	6
Concentration of Reducing Sugar (mg/g)	2.75	3.48	3.6	2.62	3.68	4.3	2.62	3.9	4.1

CONCLUSION:

Sustainability of silkworm depends on the quality and biochemical profile of the leaves. Balanced nutrition of leaves is inevitable to harvest better quality cocoons. Perennial plant like mulberry could survive on all kinds of soil structure but to produce nutritionally superior leaves, plants must be grown in the soil supplemented with organic fertilizers like farm yard manure and silkworm litter. These fertilizers are better replacement for chemical fertilizers and soil sickness could be avoided. Application of organic fertilizer makes the soil nutritionally rich with available macro and micronutrients. Silkworm litter- waste generated during rearing from the rearing trays found to contain appreciable quantity of Nitrogen which is required for fast growth of mulberry since the plant is pruned regularly to avail good shape and increasing the yield of plants. Soil supplemented with litter perform better morphologically with increased protein and carbohydrate compared to plants grown in FYM supplemented soil.

REFERENCES:

1. Chowdhary, PC; Das,PK; AsisnGhosh; Mishra,RK and Datta,RK,1993. Recycling technology of Sericultural waste as compost. Indian silk.28-29.
2. Dandin,SB; Jayaswal,J; Giridhar,K., 2003. Handbook of Sericulture Technologies, CSB. Bangalore. India.
3. Das,BC ; Sahu,PK; Sengupta,T; Misra,AK; Saratchandra,B and Sen,SK, 2001.Genetic variability in some physiological traits in mulberry. Indian J. Plant. Physiol. 6:162-165.
4. Faruque Ahmed; Rafia Sultana; Oli Ahmed and Toufiq Iqbal,MD, 2017.Seriwaste compost enhances mulberry leaf yield and quality in Bangladesh. American Journal of Plant Nutrition and Fertilization Technology. 7:1-10.
5. Kumar,R and Vadamalai,E,2010.Rearing Performance of Eri Silkworm Philosamia ricini in Monsoon Season of Uttar Pradesh. Asian J. Exp. Biol. Sci. 1:303-310.
6. Lowry, H.O., Rosenbrough, N.J., Farr, A.L. and Randall, R.J. 1951. Protein measurement with the Folin Phenol reagent. *J. Biol .Chem.* 176: 363-388.
7. Miyashita Y. (1986) A Report on mulberry Cultivation and Training Methods Suitable to Bivoltine Rearing in Karnataka Central Silk Board, pp.1-7.
8. Plummer, D.T. 1987. An Introduction to Practical Bio-chemistry. 3rd Edition,London: 159&179.
9. Shankar MA; Nagaraju PA and Rangaswamy BT, 1999. Response of mulberry to application of micronutritional and their impact on cocoon production and grainage parameters. The proceeding of the XVIIth International Sericulture Commission Congress, Cairo-Egypt, 12-16 October.
10. Singhal,S; Dhar,BKA; Bindroo,PM; Tripathi,SMH; Qadri and Ahsan,MM, 2001. Medicinal Utilities of mulberry and Non-Mulberry Food Plants of the Silkworm: Recent Progress in Medicinal Plants. Research Periodicals and Book Publishing House, Texas.
11. Sangeetha,R; Mahalingam,CA and Priyadharshini,2012. Effect of Silkworm Litter-Pupal Waste (SLPW) compost on mulberry leaf yield. eJ. Acad. Res. Rev.,Vol.5.
12. Sonwlker,TN, 1991. Handbook of Silk Technology. Wiley Eastern Limited, New Delhi.
13. Shinde,KS; Avhad,SB; Hiware,CJ, 2014. Impact of spacing's and fertilizer's on the production of M5 Mulberry variety. Int. J. Interdiscio. Multidiscip. Stud. 1:344-348.