Impact of INM on Selected Mulberry and Silkworm Traits

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Abstract: *The Study was carried out during the years 2016 -2018 under bore well irrigated condition at Doddamudugere village, Talavady area to study the effect of Integrated Nutrient Management (INM) in Mulberry and it is effect on Physico-Chemico properties of Silkworm, V-1 Mulberry variety planted at 3' * 3' spacing. Two INM Combination were tested against recommended dose and control, data recorded with three different time interval, Leaf quality assessed via fed to Silkworm. Significantly increased plant growth parameters were recorded in Treatment - T3, Replication – R3 (time gap) such as Plant height (171.1cm), Number of shoots plant $^{-1}$ (9.7) Number of leaves plant $^{-1}$ (368.2) and leaf yield plant $^{-1}$ (1680.3 g) over T1, T2, control, under INM combined with 3 MT Vermi-compost ac $^{-1}$ yr $^{-1}$ with 12 liters of Panchagavya@3% level ac $^{-1}$ yr $^{-1}$ Bivoltine CSR_2 X CSR_4 , Larvae fed with Treatment T3,R3, showed significantly higher in physic-chemico properties of Silkworm, such as Cocoon weight (2g), Shell weight(0.51g), Shell ratio(25.5%) and larval weight (4.4g), pupal weight (1.52g) observed high in T3,R2 than PM * CSR_2 X CSR_4. In this experiment, both plant growth parameters and bioassay showed superiority of INM practiced over control and recommended package of practices.*

Keywords: Inorganic fertilizers, Vermicompost, Poshan, Panchagavya, Mulberry, *Bombyx mori* L.

1. Introduction

Sericulture is a rural development as it enhances the socio-economic status of the farmers in the rural areas and is a labour intensive industry. Sustainability of sericulture depend on quality of raw silk, quality of silk production depend on Mulberry leaves, Diseases free laying and improved technologies of cultivation, rearing. V-1 Mulberry variety (Victory-1) is the most popular genotype which is extensively cultivated in southern parts of India, leaf yield recorded in V-1 is 60 MT/ha/yr. The *Bombyx mori* is an important economic sericigenous insect which feed mainly on mulberry leaf and convert protein into silk protein. The silkworm hybrids of Bivoltine CSR_2 X CSR_4 and cross breed PM X CSR_2 completely rewrite the history of sericulture in southern parts of India.

The bulk of Silk produced in India is from Cross breed cocoons, natural silk faces demand than artificial silk, besides indigenous demand, there is a huge export demand and Indian Silk is popular all over the world (Dandin,1998). Quality of Mulberry leaf fed to silkworms is the most important factor that influences successful cocoon production, cocoon yield increasing by using inorganic fertilizers but continuous supplementation of chemical fertilizers to mulberry is hazardous to environment and soil (Bose and Manjumder,1999).In effect, complementing inorganic fertilizers with Farm yard manure (FYM), Vermicompost, Intercrop is a cost effective means to achieve the desired end by overcoming the problems of soil infertility and poor leaves production in sericulture. The Nutritional composition of mulberry leaf depends on variety, environment and agronomical practices (Datta, 1992). Consumption of quality and quantity of mulberry leaf influence on silkworm growth and duration (Murugan and George, 1992)

Rearing performance of bivoltine hybrids on V-1 and M5 Mulberry varieties, reported Venkatesha and Rayar (2003).Quality of silk production differ from one silkworm

race to another race when fed with same mulberry variety (Hassanein *et al.,* 1972). Application of recommended doses of inorganic and organic fertilizers was found to be one of the limiting factors. Non availability of FYM, Vermicompost, farmers use less quantity of organic manure, it is leads soil infertility. However, Integrated Nutrient Management (INM), farming approach application of chemical fertilizers along with organic fertilizers, green manuring and bio fertilizers are found to be maintaining steady crop production for a longer time (Nambiar and Abrol, 1992; Anilkumar and John, 1999).

Experiment conducted to know the effect of Integrated nutrient application with time interval on Mulberry plant growth and Physico-chemico parameters of silkworm compared with control, Chemical fertilizers.

2. Materials and Methods

The study was conducted consecutive of two years during 2016-2017 and 2017-2018 at Doddamudugere village, Talavady area, Tamil Nadu under bore well / underground irrigated condition, two years old cultivated field selected to conduct research and PM X CSR_2 , CSR_2 X CSR_4 laying collected from National Silkworm Seed Organization (NSSO), Mysore, Poshan buy from Central Sericultural Research and Training Institute (CSR & TI), Mysore. PM X CSR_2, CSR_2 X CSR_4, breed rearing in India for the commercial purpose. Different treatments of nutrient inputs combinations were tested against the control with minimum inputs.

Control (Fertilizers free)
T1: 60 N: 20 P: 20 K kg/ac/yr
T2: 30 N: 10 P: 10 K kg/ac/yr + 3MT Vermicompost + one liter Poshan foliar spray @ 7ml per liter /ac/yr
T3: 3 MT Vermicompost + 12 liters Panchagavya @ 3% level /ac/yr.

V-1 Mulberry variety is a high yielding variety being popularized in India, planted at 3' X 3' spacing. PM X CSR$_2$ (Kolar Gold) cross breed of multivoltine and bivoltine, CSR$_2$ X CSR$_4$ is pure bivoltine breed selected to record Physico- chemical parameters by larvae fed with four different treated plant leaves and were reared following standard methodology (Krishnaswamy,1978).V-1 mulberry leaves used to feed the silkworm twice in a day, data were recorded on mulberry plant height, number of shoots per plant, number of leaves per plant and leaf yield per plant with few Physico-chemico parameters of silkworm like Larval weight, Cocoon weight, Pupal weight, Shell weight and Shell ratio, data recorded after six months interval of fertilizers application as three replication, each replication has 6 months time gap.

Preparation of Panchagavya
Panchagavya, an organic product has the potential to play the role of promoting growth and providing immunity in plant system. Fresh cow dung: 7 kg, Cow Urine: 3 lit, Cow milk: 2 lit, Curd: 2 lit, Cow ghee: 1 kg, Sugarcane juice: 3 lit, Coconut water: 3 lit, Banana paste: 12 fruits, water: 10 liter.

Put all the ingredients in Plastic drum, Stired in thirty times clock-wise and thirty times anti clock wise (twice daily), The container kept under shade and covered with a wire mesh to prevent houseflies from layings eggs. The panchagavya stock solution ready after 18-20 days. For first one year **Panchagavya used** as foliar spray at 3 % level, three liter panchagavya in 100 liter of water, (300ml / 10 liter capacity tank) .

A multi-nutrient formulation namely Poshan used as foliar spray contains all the necessary nutrients in a balanced and readily available form for the healthy growth of mulberry, thereby providing complete nutritional requirements of the leaf and in turn to the silkworms. A Single spray is recommended for correcting the deficiencies, dilute one liter of Poshan in 140 liters of water (@ 7ml /L). Spray on mulberry foliage 25 to 30 days after pruning or leaf picking, till the leaves are drenched. Poshan buy from Central Sericultural Research and Training Institute (CSR & TI), Mysore.

The experiment was conducted in Randomized complete block design, the data was analyzed using One-way analysis (ANOVA) to test the significance effect of INM on shrub and tree mulberry leaf nutrients.

3. Result and Discussion

Two years data recorded after six month interval of nutrients application on different plant growth attributing characteristics of mulberry and revealed that mulberry plant growth parameters was significantly differed with INM treatment imposed in the experiments Treatment T3, R3 showed significantly higher in plant height (171.1cm), number of shoots/plant (9.7), number of leaves/plant (368.2) and leaf yield/plant (1680.3g) than the other treatments, replication. While compared with other treatments T3, showed higher value in all the plant growth parameters viz., plant height (156.6cm), (170.1cm), (171.1), number of shoots per plant (7.7),(9.1), (9.7), number of leaves per plant (220), (282.2), (368.2) and leaf yield per plant ((881.2g), (1070.2g), (1680.3g) than other treatments (Table:1). Data recorded after six months interval of nutrient application as three replication (i.e., after application of fertilizers with time gap 6,12 and 18 months, 6 month gap per replication) followed by treatment T3 showed higher plant growth parameters in all replication.

Low plant growth parameters were recorded in treatment Control with three replication, plant height (112.6cm)(130.4cm) (130.4), number of shoots per plant (4.6),(4.6), (4.9), number of leaves per plant (107.2) (183.1), (201.2) and leaf yield per plant (251.3g) (568.8g), (692.1g) than other treatments.

Table 1: Shows Influence of INM on few Mulberry growth parameters

Treatment	R1(after 36 months of INM Application)				(after 12 months of INM Application)				(after 18 months of INM Application)			
	Plant height (cm)	No. of shoots / plant	No. of leaves / plant	Leaf yield / plant (g)	Plant height (cm)	No. of shoots / plant	No. of leaves / plant	Leaf yield / plant (g)	Plant height (cm)	No. of shoots / plant	No. of leaves / plant	Leaf yield / plant (g)
Control	112.6 ±12.11	4.6 ±0.96	107.2 ±11.2	251.3 ±26.1	130.4 ±14.52	4.6 ±0.96	183.1 ±19.21	568.8 ±57.4	130.4 ±14.52	4.9 ±0.97	201.2 ±21.2	692.1 ±70.14
T1	140. 2±15.24	5.5 ±1.1	159.0 ±16.47	493.1 ±51.10	147.1 ±14.56	6.2 ±1.61	235.2 ±24.12	710.1 ±72.64	152.4 ±16.00	6.9 ±1.65	268.7 ±27.45	912.3 ±92.68
T2	148.8 ±15.26	7.2 ±1.42	198.1 ±20.41	810.7 ±81.22	159.7 ±17.21	8.8 ±1.82	250.1 ±26.01	1048.8 ±105.66	164.2 ±17.3	9.3 ±1.84	309.6 ±31.62	1320.8 ±192.4
T3	156.6 ±16.24	7.7 ±1.44	220.0 ±23.2	881.2 ±89.12	170.0 ±18.26	9.1 ±1.84	282.2 ±29.21	1070.2 ±108.97	171.1 ±18.5	9.1 ±1.87	368.2 ±37.64	1680.3 ±212.2
SE±	1.88	1.81	9.08	9.28	2.22	1.85	9.91	9.28	2.5	2.41	10.4	11.2
CV (%)	3.21	6.88	7.11	9.11	2.28	5.49	8.00	10	4	7.3	8.22	9.28

SE± = Standard error, ± = Standard deviation , CV= Coefficient variation

Table 2: Shows Influence of INM on few Economic parameters of Silkworm *Bombyx mori* L.

		CSR$_2$ * CSR$_4$					PM * CSR$_2$				
		Larval Weight (g)	Cocoon weight(g)	Pupal weight (g)	Shell weight (g)	Shell ratio (%)	Larval Weight (g)	Cocoon weight(g)	Pupal weight (g)	Shell weight (g)	Shell ratio (%)
R1	Control	2.4±0.31	0.71±0.61	0.62±0.41	0.09±0.04	12.67±3.8	2.1±0.42	0.53±0.21	0.44±0.12	0.09±0.25	16.98±2.4
	T1	2.9±0.42	0.72±0.63	0.60±0.36	0.12±0.07	16.66±4.2	2.6±0.48	0.61±0.13	0.52±0.18	0.09±0.14	14.75±2.1
	T2	3.3±0.3	1.1±0.12	0.9±0.12	0.20±0.23	18.18±5.2	2.9±0.42	0.87±0.18	0.73±0.51	0.14±0.11	16.09±3.2
	T3	3.3±0.10	1.3±0.11	1.05±0.17	0.25±0.17	19.23±6.4	2.9±0.45	0.95±0.12	0.78±0.42	0.17±0.11	17.89±4.1
R2	Control	2.6 ±0.18	0.74±0.14	0.58±0.18	0.12±0.32	16.21±5.0	2.3±0.48	0.16±0.11	0.52±0.33	0.09±0.21	14.75±4.56
	T1	2.8±0.42	1.2±0.20	0.98±0.35	0.22±0.27	18.33±5.1	2.3±0.41	0.83±0.22	0.69±0.51	0.14±0.12	16.86±5.01
	T2	3.5±0.51	1.52±0.37	1.16±0.31	0.36±0.58	23.68±5.8	3.2±0.55	1.2±0.17	0.98±0.20	0.22±0.18	18.33±5.2
	T3	4.4±0.58	2.0±0.41	1.52±0.12	0.48±0.24	24±5.1	3.7±0.51	1.31±0.13	1.05±0.12	0.26±0.21	19.84±5.40
R3	Control	2.9 ±0.42	0.82 ±0.50	0.68± 0.17	0.14 ±0.61	17.07± 8.81	2.7 ±0.42	0.70 ±0.05	0.58 ±0.18	0.12 ±0.11	16.90± 4.18
	T1	3.2 ±0.46	1.46± 0.23	1.15±0.2	0.31 ±0.24	21.23± 5.91	2.7 ±0.42	0.95 ±0.49	0.78 ±0.24	0.17 ±0.11	17.89± 4.11
	T2	3.8 ±0.41	1.8± 0.33	1.35 ±0.31	0.44 ±0.32	24.44± 6.14	3.2 ±0.53	1.38± 0.62	1.16 ±0.33	0.26 ±0.12	18.84 ±4.83
	T3	4.1 ±0.55	2 ±0.41	1.49 ±0.12	0.51 ±0.24	25.5 ±6.39	3.6 ±0.56	1.46 ±0.25	1.16 ±0.51	0.30 ±0.22	20.54 ±5.32

R = Replication (Time interval), ± = SD (Standard Deviation), T= treatment

Economic parameters of silkworm

Silkworm *Bombyx mori* L. rearing conducted with two races like PM * CSR$_2$ and CSR$_2$* CSR$_4$ larvae fed with four different treated garden mulberry leaves with three replication.

Analysis data revealed that the weight of 20 mature larvae was significantly higher in CSR$_2$* CSR$_4$ fed with T3, R2 (4.4g) than other treatments, replication and PM * CSR$_2$.

The Single cocoon weight (g), Shell weight (g) and Shell ratio (%) recorded significantly higher in CSR$_2$* CSR$_4$ fed with T3, R3 (2), (0.51), (25.5) than the other treatments, replication and PM * CSR$_2$. The Pupal weight (1.52g) recorded higher in CSR$_2$* CSR$_4$ fed with T3, R2 than T1, T2, control, R1, R3 and PM * CSR$_2$. When compared economic parameters of PM * CSR$_2$ with replication and treatments, T3, R3 showed higher in larval weight (3.6g) Single cocoon weight (1.46g), Pupal weight (1.16g) Shell weight (0.30g) and Shell ratio (20.54%), than R1,R2, T1,T2 and control. PM * CSR$_2$ Larvae fed with treatment Control, R1 showed low economic parameters than CSR$_2$* CSR$_4$ R2, R3,T1, T2, and T3.(Table:2)

Leaves quality different due to variety, irrigation and manuring (Narayanan *et al*.,1966).The silkworm *Bombyx mori*. L being a monophagous insect, therefore the growth and development of silkworm depend on quality and quantity of leaves, silkworm genotype also contributes to the growth and development of silkworm interacting with environment. The present finding of the study on the performance of PM * CSR$_2$ and CSR$_2$* CSR$_4$ larvae fed with V-1 mulberry leaves under treated field. CSR$_2$* CSR$_4$ larvae fed with treatment T3, R3 showed higher economic parameters than others.

4. Conclusion

The CSR$_2$* CSR$_4$ breed larvae fed with treatment T3, R3 clearly showed higher economic parameters than others. Treatment T3 significantly showed higher plant growth and economic parameters than T1,T2 and control. Replication R3 showed higher plant growth and economic parameters than R1, R2. In present study data better result observed on both mulberry plant growth and economic traits in treatment T3, R3.

Application of organic fertilizers without application of chemical fertilizers T3 showed higher value in plant and silkworm economic traits followed by T2 that is minimum quantity of chemical fertilizers application also better than application of chemical fertilizers. In today world application of completely organic fertilizers is not possible but we can reduce the application of chemical fertilizers by using Integrated Nutrient Management and it is helps to gradually reduce environment pollution, Soil deficiency and to increase soil health, crop productivity.

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