Research Article

EFFECT OF INM PRACTICES ON NUTRIENT STATUS OF MULBERRY CULTIVATED AS BUSH AND TREE UNDER IRRIGATED CONDITION

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ABSTRACT

An experiment was conducted during 2016-18 to study the impact of Integrated nutrient Management practices on existing bush type (3'x3') and tree type (10'x10') V-1 variety grown under irrigated condition at Doddamudugere village, Talavady, Erode district, Tamil Nadu. Two INM Combinations were tested against recommended dose and control, data recorded for three years. Leaf quality was also assessed through bioassay rearing of Silkworm. Treatment T4 of tree mulberry recorded significantly highest composition of macronutrients such as Nitrogen (5.24%), Phosphorus (1.63%) and Potash (4.54%) during the third year of experiment followed by T3-tree mulberry Nitrogen (4.98%), Phosphorus (1.17%) and Potash (3.68%) compared to other treatments in bush and tree mulberry cultivation irrespective of the years. Similar observations were recorded in case of secondary and micronutrients viz., Ca (3.82%), Mg (0.94%), S (2.84%) and Fe (163.67 mg kg $^{-1}$), Zn (72.24 mg kg $^{-1}$), Mn (52.29 mg kg $^{-1}$), Cu (5.05 mg kg $^{-1}$) and B (47.93 mg kg $^{-1}$) in T4 tree mulberry followed by T3 with Ca (3.76%), Mg (0.87%), S (1.91%) and Fe (148.11mg kg $^{-1}$), Zn (59.97 mg kg $^{-1}$), Mn (49.38 mg kg $^{-1}$), Cu (4.88 mg kg $^{-1}$), B (45.64 mg kg^{-1}) also. All the eleven mulberry nutrients were recorded highest in tree plant leaf T4, 3rd year compare to 1st and ^{2nd} year and other treatments. Silkworm rearing data recorded indicated highest single shell weight (0.51g) and shell ratio (25.5%) in T4 tree mulberry followed by T3 tree mulberry (0.490 g : 24.5%) respectively.

INTRODUCTION

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 Farmyard manure (FYM), vermicompost is a cost effective means to achieve the desired end by overcoming the problems of soil infertility and poor leaves production in sericulture. 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 leads to 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). Production of quality cocoon depend on silkworm fed with nutritionally superior leaves which result in improved silk production (Seki and Oshikane, 1959). Nutrient management is prime importance, leaf quality depend on fertility management such as macro and micronutrients. Macronutrient has major impact and its deficiency causes 85-88% (N & P), Calcium 57% and secondary nutrients and iron (45.7%), micronutrients also has major impact on leaf yield reduction 52.6-53.2% (Shankar, 1997). In the above context present study was conducted to know the effect of Integrated Nutrient Management (INM) on mulberry cultivated as shrub and tree, its leaf quality and impact on silkworm.

MATERIALS AND METHODS

The study was conducted for three years from 2016-2019 at Doddamudugere village, Talavady area, Tamil Nadu in an established V-1 mulberry bush and tree type garden under irrigated condition in Randomized Block Design. The treatments were imposed for every pruning.Bioassay study was conducted at the time of leaf harvest with single bivoltine hybrid CSR_2 X CSR_4 following standard

methodology (Krishnaswamy, 1978). The treatment details are as given below.

T1: 100 % RDF (140 N: 56 P: 56 K kg/ac/yr)
T2: 70 N: 28 P: 28 K kg/ac/yr (50% RDF) + 3MT Vermicompost
T3: 35 N: 14 P: 14 K kg/ac/yr (25% RDF) + 3MT Vermicompost + Poshan foliar spray@ 7ml/ lt
T4: 3 MT Vermicompost + 12 liters Panchagavya @ 3% level /ac/yr.

Fertilizers were given as Ammonium Sulphate (Nitrogen-N), Single super phosphate (Phosphorus-P), Murate of Potash (Potash-K).

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 kept under shade, covered with a wire mesh to prevent houseflies from layings eggs.. Stirred for thirty times clock-wise and anti clock wise (twice daily). Panchagavya stock solution is ready after 18-20 days and it is used as foliar spray at 3 % level.

Poshan - A multi-nutrient formulation of CSRTI), Mysuru 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 at 25 to 30 days after pruning or leaf picking.

At the end of 1st and 2nd year of INM application mulberry leaves of both shrub and tree were collected from experimental plots to analyze nutrients (N, P, K, Ca, Mg, S, Fe, Zn, Mn, B, Cu. Plant nutrient analysis was done at Soil Laboratory, Dept.of Agriculture, Chamarajanagar, Karnataka, India. The leaf nutrients were analyzed following standard procedures viz., Nitrogen (Kjeldahl's method), Phosphorus (Vanadomolybdo phosphoric yellow colour method- 460nm), Potassium (Flame photometer method) as proposed by (Jackson, 1973). Sulphur by Black (1965) turbidometric method at 440nm and micronutrients such as Zn, Cu, Mn, Fe were analyzed by Atomic Absorption Spectrophotometer using DTPA extract method (Lindsay and Norwell, 1978), Boron by Azomethine-H reagent method (Howe *et al.*, 1996), Ca and Mg analyzed by titrating against standard versanate solution using murexide and EBT indicators, where magnesium estimated by taking difference of calcium and calcium plus magnesium (Jackson, 1973).

Statistical analysis

The experimental data was analyzed using One-way analysis (ANOVA) to test the significance effect of INM on shrub and tree mulberry leaf nutrients, while difference among the treatments was tested applying least significance difference test $P<0.05$.

RESULTS AND DISCUSSION

The availability of plant nutrients in V-1 mulberry variety as shrub and tree plant with four different treatments of INM showed distinctive results. The result showed highly significant at (P<0.05), variation in macro and micronutrients in mulberry leaf. The highest content of macronutrients such as Nitrogen, Phosphorus and Potash recorded in 3rdyear, T4, tree plant leaf (5.24%), (1.63%) and (4.54%), followed by T3, 3rd year, tree plant leaf (4.98%), (1.17%) and (3.68%) compared to other treatments, shrub and other two years (Table 1).

Table 1. Impact of INM on macronutrients in mulberry foliage grown as bush and tree

	T	1st Year			2nd Year			3rd Year		
		N	P	K	N	P	K	N	P	K
@	T1	0.42	0.07	0.51	0.66	0.23	0.91	1.42	0.21	0.94
	T2	2.54	0.18	0.83	3.58	0.37	1.83	3.91	0.55	2.61
	T3	2.04	0.14	0.67	3.42	0.48	1.71	4.65	0.68	2.97
	T4	2.01	0.11	0.62	3.16	0.32	1.71	4.89	0.73	4.33
*	T1	0.22	0.04	0.27	0.51	0.17	0.72	1.87	0.49	1.22
	T2	1.07	0.16	0.51	3.52	0.26	1.67	2.01	0.77	2.87
	T3	1.51	0.09	0.44	3.42	0.43	1.51	4.98	1.17	3.68
	T4	1.09	0.06	0.39	3.16	0.25	1.49	5.24	1.63	4.54
±		0.32	0.66	0.02	0.14	0.29	0.02	0.28	0.18	0.18
%		0.012	0.031	0.048	0.30	0.015	0.041	0.063	0.031	0.044

Symbols indication: @ = Bush plant, * = Tree plant, T =Treatment, ± =S.Em. ±, % = CD @ 0.05% (critical difference)

Secondary and micronutrients found high in 3rdyear, T4, tree leaf, nutrients viz., Ca (3.82%), Mg (0.94%), S (2.84%) (Table-2) and Fe (163.67 mg kg $^{-1}$), Zn (72.24 mg kg $^{-1}$), Mn (52.29 mg kg $^{-1}$), Cu (5.05 mg kg $^{-1}$), B (47.93 mg kg $^{-1}$)

followed by T3, 3rd year, tree leaf showed highest content of secondary and micronutrients viz., Ca (3.76%), Mg (0.87%), S (1.91%) and Fe (148.11mg kg $^{-1}$), Zn (59.97 mg kg $^{-1}$), Mn (49.38 mg kg $^{-1}$), Cu(4.88 mg kg $^{-1}$), B (45.64 mg kg $^{-1}$) , followed by 3rd year (Table-3), T4 shrub leaf recorded highest in nutrients content such as N (4.89%), P(0.73%), K(4.33%), Ca(3.55%), Mg(0.85%), S (1.86%) and Fe (137.01 mg kg $^{-1}$), Zn (44.67 mg kg $^{-1}$), Mn (47.13 mg kg $^{-1}$), Cu (4.81 mg kg $^{-1}$), B (47.07 mg kg $^{-1}$). All the eleven mulberry nutrients recorded highest in tree plant leaf T4, 3rd year compared to 1st and 2nd year and other treatments. When compared year wise, crop nutrients content were high in 3rd year in both shrub and tree leaf than other treatments.

Table 2. Impact of INM on Secondary nutrients in mulberry foliage grown as bush and tree

	T	1st Year			2nd Year			3rd Year		
		Ca	Mg	S	Ca	Mg	S	Ca	Mg	S
@	T1	0.63	0.18	0.31	1.13	0.48	0.55	1.47	0.41	0.55
	T2	0.97	0.42	0.47	2.01	0.72	0.82	2.11	0.53	0.71
	T3	0.86	0.68	0.38	2.67	0.78	0.88	3.36	0.78	1.01
	T4	0.67	0.56	0.32	2.91	0.68	0.96	3.55	0.85	1.86
*	T1	0.41	0.11	0.23	0.77	0.32	0.41	1.85	0.57	0.68
	T2	0.66	0.27	0.29	0.96	0.38	0.53	2.22	0.73	0.97
	T3	0.43	0.46	0.25	0.79	0.37	0.44	3.76	0.87	1.91
	T4	0.41	0.38	0.20	0.76	0.29	0.41	3.82	0.94	2.84
±		0.19	0.11	0.03	0.38	0.22	0.19	0.19	0.11	0.14
%		0.016	0.062	0.02	0.032	0.041	0.028	0.021	0.012	0.013

Symbols indication : @ = Bush plant, * = Tree plant, T =Treatment, ± = S.Em. ±, % = CD@0.05%

Table 3. Impact of INM on micro-nutrients in mulberry foliage grown as bush and tree

	T	1st Year					2nd Year					3rd Year				
		Fe	Zn	Mn	Cu	B	Fe	Zn	Mn	Cu	B	Fe	Zn	Mn	Cu	B
@	T1	61.21	20.11	30.11	1.81	16.06	81.01	21.01	22.14	1.87	19.06	72.07	18.09	20.10	1.87	17.18
	T2	70.02	26.22	40.68	3.30	19.22	96.66	32.07	40.62	3.81	26.03	84.12	32.00	40.04	4.19	29.06
	T3	69.09	23.12	40.08	4.12	26.22	110.01	37	41.07	4.77	32.12	135.11	44.04	46.28	4.72	42.62
	T4	65.11	23.01	30.08	4.01	21.91	98.29	35.11	38.81	4.02	30.00	137.01	44.67	47.13	4.81	45.64
*	T1	53.16	19	17.03	1.01	12.59	69.13	21.01	20.11	1.58	18.38	81.12	26.62	23.15	2.02	18.22
	T2	66.68	22.19	26.16	2.69	26.28	71.00	34.03	33.34	2.91	22.67	91.02	42.37	42.02	4.36	29.06
	T3	66.01	20.16	22.11	3.55	26.93	79.02	32.01	37.07	3.09	26.93	148.11	59.97	49.38	4.88	47.07
	T4	63.14	19.93	22.08	2.61	24.21	68.16	31.07	32.09	3.01	25.11	163.67	72.24	52.29	5.05	47.93
±		8.12	2.01	3.12	0.34	0.72	9.18	3.11	4.02	0.61	0.88	5.12	1.01	2.08	0.26	0.43
%		8.18	3.33	0.098	1.41	3.08	7.16	2.19	0.72	2.02	4.16	8.18	3.01	0.84	1.08	1.89

Symbols indication : @ = Bush plant, * = Tree plant, T =Treatment, ± =S.Em. ±, % = CD @ 0.05%

Table 4. Impact of INM packages on Silkworm rearing fed with leaves cultivated as bush and tree foliage

T	Larvae fed with bush mulberry leaf					Larvae fed with tree mulberry leaf				
	LW (g)	CW (g)	PW (g)	SW (g)	SR (%)	LW (g)	CW (g)	PW (g)	SW (g)	SR (%)
T1	2.6	0.74	0.58	0.12	16.21	3.8	1.21	0.97	0.24	19.83
T2	3.2	1.2	0.98	0.22	18.33	3.2	0.87	0.72	0.15	17.24
T3	3.5	1.52	1.16	0.36	23.68	4.4	2.0	1.57	0.49	24.5
T4	3.8	1.8	1.38	0.43	23.88	4.4	2.0	1.49	0.51	25.5
±	0.12	0.18	0.11	0.08	1.55	0.15	0.11	0.15	0.09	2.22
%	0.04	0.02	0.06	0.01	1.23	0.07	0.04	0.01	0.06	1.64

T=Treatment, LW= Larval Weight (g), CW= Cocoon Weight (g), PW= Pupal Weight (g), SW= Shell Weight (g), SR= Shell Ratio (%), ± =S.Em.±, % = CD@0.05%

Bio-assay

The silkworm rearing parameters were recorded significantly high in larvae fed with T4, tree leaf such as shell weight (0.51g) and shell ratio (25.5%) followed by larvae fed with T3, tree leaf shell weight (0.49g) and shell ratio (24.5%). Highest larval weight (4.4g) and cocoon weight (2.0g) recorded in larvae fed with both T3, T4 tree leaf. Pupal weight (1.57g) was high in larvae fed with T3 tree leaf.

The positive impact of micronutrients on economic parameters of silkworm *Bombyx mori* L. such as cocoon weight, shell weight and shell ratio has been well doucumented with reference to nutritional role of several mineral salts (Chakraborti and Medda, 1978), similar result observed with respect to cocoon weight, shell weight and shell ratio.

The importance of boron and manganese in silkworm nutrition was also observed by Lokanath *et al.* (1984). Economic parameters of silkworm perform better due to nutritive values of leaves, these results were also in conformity of leaf nutrients (Bose *et al*. 1994).Highest composition and required amount of leaf nutrients showed positive correlation with larval, cocoon, shell weight and shell ratio. The improvement in the plant nutrients viz., Fe, Zn, Mn and Cu, there by quality of mulberry leaves by application of Seriboost may be attributed to it is micronutrient content and to the fact that each micronutrients plays significant role in physiological and biochemical process of mulberry (Gowda *et al.,* 2000).

CONCLUSION

Integrated nutrient management shows positive effect gradually on mulberry and silkworm traits, 3rd year onwards of application. T4 (Vermicompost and Jeevamurutham) showed high in mulberry leaf nutrient composition and silkworm physico-chemico traits followed by T3 (NPK + Vermicompost +Poshan). Silkworm fed with mulberry tree leaves showed better result in Larval weight, cocoon weight, shell weight and shell ratio compare to larvae fed with shrub leaves also macro and micro nutrients in mulberry foliage high in tree leaves than shrub. Mulberry tree cultivation and maintenance of tree plant is easy and it is required less input than shrub plant. Need further study about this to develop the mulberry tree plantation.

REFERENCES

Anilkumar, A.S. and P.S. John. 1999. Integrated nutrient management for sustainable mulberry production in humid tropic. In: Moriculture in Tropics Vol. 1. Proc. Natl. Sem. In tropical Seric., USA, GKVK, Bangalore., pp.53-57.

Black, C. A. 1965. Methods of Soil Analysis Part – I. Physical and mineralogical properties. Agronomy Monograph No. 9. American Society of Agronomy, Inc. Madison, Wisconsin, USA, pp. 18-25.

Bose, P.C. and S.K. Majumder. 1999. Nitrogen fertilizers recommended of mulberry (Morus alba L.) based on the Mitscherlich-Bray concept. Sericologia, **35**(2): 331-336.

Bose ,P.C., N.R. Singhvi and R.K. Dutta. 1994. Effect of micronutrients on yield and yield attributes of mulberry (*Morus alba* L.). *Indian Journal Agron.*, 39:97-99.

Chakraborti, M. K. and A.K. Medda. 1978. Effect of potassium iodide on silkworms *(Bombyx mori* L.) Nistari race. Science Culture, **44**: 231-233.

Datta, R. K. 1992. Influence of mulberry varities and seasons on the economic traits of popular hybrids of silkworm, Bombyx mori L. fed with different mulberry varieties. *Environment and Ecology.,* **13**(2): 263-268.

Gowda, R., P. Sundar and B.V. Aghu. 2000. Foliar spray of Seriboost on mulberry and its impact on cocoon production. Proceeding of the National Seminar on tropical sericulture, Bangalore, **2**:163-167.

Hassanein, M.H., M.F. Sharaway and A.T. Elgarha. 1972. Food assimilation and the out put of silk in the different races of the silkworm Bombyx mori L. *Bull. Soc. Entomol. Egypt.,* **56**: 333-337.

Howe, L. and M.R. Wagner. 1996. The effect of paper mill waste water irrigation and gypsum soil amendments on sodium accumulation by cottonwood and soil. Agric. Water Mang., 31: 295-306.

Jackson, M. L. 1973. Soil Chemical Analysis. Prentice Hall of India Private Limited, 498P.

Jackson, M.L., 1973. Soil chemical analyses. Prentice Hall of India Pvt. Ltd, New Delhi, pp 485.

Krishnaswami, S. 1978. New Technology of Silkworm rearing. CSR& TI Bulletin No.2, CSB, Bangalore, 1-23.

Kjeldahl, J.1983. A new method for the estimation of nitrogen in organic compounds. *Journal of Analytical Chemistry,* **22**: 336-382.

Lindsay, W. L. and W.A. Norvel. 1978. Development of DTPA soil test for Zn, Fe, Mn and Cu. Soil Sci. Soc. Am. J., **42**: 421-428.

Lokanath, R., K. Shivashankar and Kasivishwanathan. 1984. Effect of foliar application of magnesium and micronutrients to mulberry on quality and production of cocoon. Indian journal of sericulture., **25**(1):40-41.

Murugan, K. and A. George. 1992. Feeding and nutritional influence on the growth and reproduction of of Daphnis nerii L. *J. Insect physio.,* **38**: 961-968.

Nambiar, K.M and I.P. Abrol. 1992. Long term fertilizers experiments in India an overview. Fertilizer News, **34**: 11-26.

Seki, K. and K. Oshikane. 1959. Res. Rept. Fac. Text. Seric., Shinshu Univ.,China

Shankar, M. A. 1997. Hand book of mulberry nutrition. Multiplex, Bangalore, pp.121.

Sehgal, I.L., R.K. Sanena and R.M. Pojali. 1990. Degraded soils, Their mapping through soil surveys. In: Technologies for wast land development. I.B. Abrol

and V.V. Dhruvanarayana (Eds), ICAR publication, P.1-20.

Venkatesha, M., S.G. Rayar. 2003. Evaluation of bivoltine hybrids of silkworm, Bombyx mori L. on V-1 and M_5 mulberry varieties under Dharwad conditions. *Indian Journal of Sericulture*, **42**(2): 183-185.

Google search- http://vikaspedia.in/agriculture/agri-inputs/bio-inputs/bioinputs for nutrient management / panchagavya.

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