Plant Archives Vol. 24, Special Issue (VS), 2024 pp.54-57 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org

DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2024.v24.specialissue.010

EFFECT OF SECONDARY NUTRIENTS COMBINATION SM_5 ON *TERMINALIA ARJUNA*: A FIELD EVALUATION

Susmita Das*, Jitendra Singh, Aparna K., S. Giri[2], Sunil Kumar Misro[3] and N.B. Chowdary

Central Tasar Research & Training Institute,

Piska Nagri, Ranchi – 835 303, Jharkhand, India (**Email*: sdas1202@gmail.com)

[2]Regional Tasar Research Station, Dumka, Jharkhand.

[3]Regional Tasar Research Station, Jagdalpur, Chhattisgarh.

*Corresponding Author: sdas1202@gmail.com

ABSTRACT

The quantity and quality of silk produced is directly dependent on the leaf quality, which influences the healthy growth of silkworm larvae and thereby affects the cocoon production. The ultimate objective to yield more quality leaves rests with the nutrients available in the soil, climatic conditions and input application. So far the recommended dose of NPK and FYM were in practice. However, Secondary nutrients are also important to plants as the primary nutrients. Results of experiment conducted at CTRTI farm indicated that secondary nutrients have promotary effect on *Terminalia arjuna* by improving the quality and yield of leaves as well as the commercial characters of cocoons reared on it. Among different combinations of secondary nutrients tried, combination SM_5 [Foliar application of Magnesium sulphate (2%, w/v) and basal application of Calcium carbonate (3 quintal / ha)] was found the best in crop improvement in leaf yield and cocoon characters. It improves the quality and yield of leaves and also commercial characters of the cocoons produced resulting into improvement in production and productivity. On application of this combination, leaf yield increased by 27.45% as compared to the control at institute level. Performance was evaluated at different climatic conditions though Regional Research Stations and Research Extension Centers as well as at farmer's field. The combination of secondary nutrients SM_5 recorded an increase at 30.86 % at farmers' level confirming the effectiveness of the combination.

Keywords: *Antheraea mylitta*, bio assay, chemo assay Secondary nutrients combinations, tasar crops, *Terminalia arjuna*.

Introduction

Secondary nutrients are as important to plants as major nutrients (Pasricha and Sarkar, 2002). Deterioration in soil fertility is often observed in crops / cropping system, even with adequate use of NPK fertilizers. Decrease in quantity and quality of leaf per unit area will lead to decreased quantity and quality cocoon production. The yield is influenced by macro and micronutrients. Several studies have been carried out to improve the quantity and quality of leaves of tasar food plants through application of major and micronutrients (Sinha *et al.*, 1999, 2002, & 2006). Besides foliar spray of micro-nutrients have also been reported to enhance the leaf yield in mulberry, Bose *et al.* (1995) and Singhvi *et al.* (1996), Dutta *et al.* (2009). The increase in leaf yield lead to increased cocoon production per hectare at reduced cost (Sinha *et al.*, 2002). Sinha *et al.* (2006) studied the effect of individual micronutrient on the growth and leaf yield of *Terminalia arjuna.* Soils of tasar producing areas are generally acidic. Secondary nutrients are the key nutrients responsible for increasing productivity in acidic soils (Sarkar and Singh, 2003). To evaluate the efficacy of the secodary nutrients, combination SM_5 was tried at different locations under field conditions.

Material and Methods

The experiment with ten different combinations of secondary nutrients was first conducted at experimental field of Central Tasar Research & Training Institute, Nagri, Ranchi on *T. arjuna* plants with 1.2 m x 1.2 m spacing under rain fed condition. Out of which the best performing combination SM_5 was selected for field trial. The nutrient status with regard to secondary nutrients of the field was studied which is given below:

Name of secondary nutrients	Status in soil
Available Calcium	2.90 Cmol (P^+) kg^{-1}
Available Magnesium	0.95 Cmol (P^+) kg^{-1}
Available Sulphur	8.70 ppm

SM_5 has two components i.e., foliar application of $MgSO_4$ (2 %, w/v) & basal application of $CaCO_3$ (45 g/plant or, 3 q ha^{-1}). Basal application of Calcium carbonate was done in single dose in the month of June. Magnesium Sulphate was applied foliarly on *T. arjuna* plants in three split doses starting from month of May with an interval of 15 days. Routine cultural operations were followed and same dose of NPK / FYM were applied to both the treated and controlled plants. The effect of the treatment was studied through leaf yield determination, bio assay and chemo assay.

Bioassay was conducted through rearing of *Antheraea mylitta* D. following the standard rearing package of CTR&TI Jolly *et al.* (1974). Disease free layings were brushed and reared in three replications. For Chemo assay, Simple Random Sampling method was followed for collecting the leaf samples excluding too tender and over mature leaves from each treatment in three replications. All the biochemical constituents of leaves were determined on oven dry basis. Moisture, total mineral, total carbohydrate and crude fibre were estimated by the method of AOAC (1955). Kjeldahl's method as described by Vogel (1978) was followed for the determination of total nitrogen. Crude protein was calculated by multiplying the estimated value of nitrogen content by 6.25. The trials of SM_5 were conducted on the economic plantation of RTRS Jagadalpur, RTRS Bhandara, Research extension Centre (REC) Hatgamharia and at farmers' fields at REC, Kapistha following the same package. The trial was done following the Randomized Block Design. The spray was done before 45 days of brushing of tasar silkworm. The leaf yield was taken on complete harvesting of the treated and control plants.

Results and Discussion

The effect of application of SM_5 at RTRS, REC and farmers' field level has been shown in Table-1 which indicated an overall improvement in leaf yield, cocoon yield and cocoon characters. Since soil of different areas vary in nutrients level, effectiveness of SM_5 varies from place to place. With increase in leaf yield production, the corresponding increase in rearing capacity per unit area will also increase thus increasing the productivity. The leaf yield and cocoon yield under treated and control lots at Institute, RTRS, REC and farmers, level has been shown in Table -2 whereas Table-3 shows the commercial characters of the cocoons under treated and control lots. It is evident from the table that on application of SM_5 i.e., foliar application of Magnesium sulphate, (2%, w/v) and basal application of Calcium carbonate (3 q ha^{-1}), there has been increase in leaf yield of *T. arjuna* plants as well as commercial characters of the cocoons with respect to control at all the locations under trial. The increase in leaf yield due to application of Magnesium sulphate and Calcium carbonate may be attributed to the fact that Magnesium sulphate is involved in the formation of Chlorophyll and activation of enzymes (Gunther, 1981 and Tandon, 2002). Calcium carbonate provides Calcium to the soil in available form to plants. Calcium is extremely important mineral in plant nutrition. It increases the uptake of nutrient and is required for the growth of the meristematic tissues and for the functioning of the root tip. It also maintains the shape of the cells. Our findings corroborates with the findings of Sarkar and Singh (2003) who also reported that basal application of 2- 4 q ha^{-1} of Calcium carbonate increased the yield of Soya bean to the tune of 26.70%. Application of secondary nutrients combination SM_5 improves commercial characters of the cocoon reared on treated leaves. Cocoon weight, shell weight and silk ratio percent increased by 14.78%, 24.36% and 1.33% at Institute level and 14.12% 15.65% & 1.40% at farmers' level respectively as compared with control. Findings of Shankar *et al.* (1994) are similar to our findings. They reported that secondary nutrients play an important role in silkworm larval growth, cocoon weight and silk quality. Bose *et al.* (1995) reported that mineral contents stimulate the metabolic activities in silkworm resulting in quantitative improvement of cocoon and silk. Gunther (1981) concluded that about 300 enzyme reactions are influenced by Mg ions. When Magnesium is passed on to the silkworms, it accelerates the growth of silkworms through orientation of physiological activities. Moreover, Sulphur is known to have an important role in the synthesis of amino acids, proteins and vitamins. This may be the reason for improvement in commercial characters of cocoons due to the application of Magnesium sulphate. Further, results of Viswanath and Krishnamurthy (1982) is similar to our findings who have reported that silkworm larvae fed with Mg sprayed leaves resulted in better cocoon yield and cocoon weight. Results of Loknath and

Shivshankar (1986) also support our findings. They observed that when leaves fortified with Magnesium (1.25 kg/ha) were fed to mulberry silkworms, it favourably influenced the cocoon yield and shell quality.

Chemo assay of the treated leaves collected from institute and farmers' level shows that application of secondary nutrients improves the moisture content, nitrogen% & consequently crude protein% and total mineral content indicating quality improvement in the leaves (Table-4). The increase in chemical constituents may be due to the beneficial role of secondary nutrients in plant metabolism. Magnesium activates enzymes and Sulphur is involved in the formation of amino acids essential for protein synthesis (Pasricha and Sarkar, 2002). Calcium is an important mineral for plant nutrition. It enhances the uptake of nitrogen in the form of nitrates and helps in protein synthesis (Das and Chaudhary, 2007). Improvement in quality of food plants leads to increased survival of silkworms leading to increased cocoon yield /dfl.

T-test of the treatments against their respective controls for leaf yield, cocoon yield and cocoonn characters at farm and farmers' level shows that for all the characters the treated lots are significant at 1% and 5% level except for cocoon wt. and shell wt. at RTRS Bhandara and REC Hatgamharia. Thus it is inferred that combination SM_5 brings improvement in quantity and quality leaf production of tasar food plant *T. arjuna* as well as improvement in commercial characters of the cocoons of *A. mylitta* D reared on it which is confirmed by its trial at different places.

Table 1 : Percentage improvement in leaf yield, Cocoon yield and Cocoon characters on application of SM_5 at Farms and Farmers' field

Centres	Leaf Yield	Cocoon / dfl	Cocoon Wt.	Shell Wt.	S.R.%
CTR&TI Ranchi	27.45	11.11	14.78	24.36	8.33
RTRS Jagadalpur	110.41	8.33	8.49	13.09	3.54
RTRS Bhandara	4.30	8.37	1.24	2.63	2.03
REC Hatgamharia	29.13	28.69	3.05	5.01	2.01
Farmers level (Kapistha)	30.86	27.77	14.12	15.65	1.40

Table 2 : Effect of SM_5 on leaf yield and cocoon yield at Farms and Farmer' field

Centres	Leaf Yield (Kg/ha)			Cocoon/dfl		
	Treatment	Control	T-test	Treatment	Control	T-test
CTR&TI Ranchi	7674	6021	8.942**	90.00	81.00	8.914**
RTRS Jagadalpur	22722	10799	46.957**	52.00	48.00	4.243**
RTRS Bhandara	30948	29760	2.601*	32.37	29.87	2.546*
REC Hatgamharia	17970	13920	6.375**	71.56	55.60	11.547**
Farmers level (Kapistha)	20930	15988	17.240**	14.00	11.00	3.963**

Table 3 : Effect of SM_5 on Cocoon characters at Farms and Farmer' field

Centres	Cocoon Wt. (g)			Shell Wt. (g)		
	Treatment	Control	T-test	Treatment	Control	T-test
CTR&TI Ranchi	11.65	10.15	8.057**	1.94	1.56	4.597**
RTRS Jagadalpur	13.04	12.02	4.221**	2.16	1.91	2.665*
RTRS Bhandara	8.18	8.08	0.576	0.78	0.76	0.378
REC Hatgamharia	12.31	11.95	1.817	1.61	1.54	1.116
Farmers level (Kapistha)	11.00	9.77	5.433**	1.70	1.47	3.420**

** Significant at 1% level, * Significant at 5% level

Table 4 : Percentage Improvement in leaf quality on application of SM_5 at Institute and Farmers' field.

Parameters	Moisture (%)	Crude protein (%)	Crude Fibre (%)	Total mineral (%)
CTR&TI	4.96	16.45	6.25	11.83
Hatgamaria REC	3.40	7.50	5.60	9.00
Farmers level (Kapistha)	6.87	5.70	6.40	6.00

References

Association of Official Agricultural Chemists (AOAC). (1955). Official methods of analysis, 8th edition, Washington, 99, 373, 118-119, 368.

Bose, P.C. Singhvi, N.R. and Datta, R.K. (1995). Effect of micronutrients on the biochemical parameters of mulberry (*Morus alba* L.) leaf. *Sericologia,* 35(1): 65-69.

Das, S. and Chaudhary, S.K. (2007). A book of Tasar Culture – *Principles and Practices*, Central Tasar Research and Training Institute, Ranchi, 1: 81-91.

Dutta, R.N., Jayappa, T. Rajanna, K.L., Sindagi, S.S., Philomena, K.L. and Dandin, S.B. (2007). Boron - A potential micronutrient for seed crop mulberry cultivation in micronutrient deficient soil. 18th All Congress of Zoology. Lucknow

Gunther, T.H. (1981). Biochemistry and pathobiochemistry of magnesium. Magnesium BULL-3: H. LA: 91-101.

Jolly, M.S., Sen, S.K. and Ahsan, M.M. (1974). A book of Tasar culture, Ambika Publishers, Bombay: 134 -148.

Pasricha, N.S. and Sarkar, A.K. (2002). Fundamentals of soil science. Indian society of soil science, Indian Agricultural Research Institute, New Delhi: 381-389.

Loknath, R. And Shivshankar, K. (1986). Effect of foliar application of micronutrients and magnesium on the growth, yield and quality of mulberry (Morus alba Linn.). *Indian J. Seric.*, **35(1):** 1-5.

Sarkar, A.K. and Singh, S. (2003). Crop response of secondary and micronutrients in acidic soils of India. Fertilizer News, 48(4): 47-54.

Shankar, M.A., Shivshankar, K. and Devaiah, M.C. (1994). Effect of feeding mulberry leaves deficient in secondary nutrients on larval growth, development, cocoon weight and silk quality. *Sericologia***, 34:** 511-518.

Singhvi, N.R., Bose, P.C., Reddy, M. Munirathnam, Sinha A. K., Subbaswamy, M.R., Himantharaj, M.T. and Dutta, R.K. (1996). Effect of micronutrients on growth and quality of mulberry leaf. *Bull. Sericult. Res***., 7:** 11-14.

Sinha, U.S.P., Isa Md., Srivastava D.P., Sinha A.K. and Brahmachari, B.N. (1999). Effect of different combinations of NPK fertilizers on the yield and nutritive value of *Terminalia arjuna*. Sericologia, **39(2):** 291-298.

Sinha, U.S.P., Isa Md., Sinha, A.K. and Brahmachari, B.N. (2002). Effect of different combinations of NPK fertilizers on the yield and nutritive value of *Terminalia tomentosa*. Sericologia, **42(2):** 241-247.

Sinha, U.S.P., Sinha, A.K., Banerjee, N.D., Prasad, J., Chaudhary, S.K. and Suryanarayana, N. (2006). Effect of micronutrients on the growth and leaf yield of *Terminalia arjuna*. Sericologia*,* **46(1):**127-132.

Tandon, H.L.S. (2002). Fertilizers Guide, Fertilizer Development and Consultation Organization, New Delhi: 6p.

Viswanath, A.P. and Krishnamurthy, K. (1982). Effect of foliar spray of micro-nutrients on the larval development and cocoon characters of silkworm, *Bombyx mori* L. *Indian J. Seric.*, **21-22,** 1-6.

Vogel, A.I. (1978). A textbook of quantitative inorganic analysis including elementary instrumental analysis, 4th edition, Longman Group Ltd., London, 926p.