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EFFICACY OF MICRONUTRIENTS AND MICROBES (LEAF SURFACE MICROFLORA) ON TASAR SILKWORM CROP IN BIOSPHERE OF BASTAR (CHHATTISGARH)

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Traditional farmers of tasar culture adopt their own system based on their indigenous knowledge for maintenance of tasar host plants and silkworm rearing. As the silkworm rearing is totally left on vagaries of nature like temperature, humidity, rainfall, wind etc. and exposed to parasite, predators and diseases, no care is taken in traditional method to improve the quality of leaf of food plant resulting in larval susceptible to diseases followed by low productivity of cocoons. Micronutrients to raise leaf production and microbes (Leaf Surface Microflora) to control bacterial and viral diseases were tested individually for three years and collectively for one year. Both the technologies were developed at CTR&TI, Ranchi, Jharkhand (India). The performance of micronutrients and microbes are equally good in significantly improving the crop yield over control. Efficacy of these technologies were different for different parameters, however, their cumulative effect was more than their individual performance. Leaf yield was enhanced upto 600-1000 kilograms per hectare per crop with the enhancement to the tune of 7 to 20%. Hence, the integration of these technologies facilitates crop stability and associated profit.

Key words : Micronutrients, microbes, efficacy, integration, technologies, crop stability.

INTRODUCTION

Chhattisgarh is the second largest producer of tasar silk next to Jharkhand (India). Tasar culture is a traditional occupation in the state which provides gainful employment and remunerative supplementary income to approximately 50,000 people. Bastar division of Chhattisgarh is known for the production of wild as well as domesticated varieties of tasar cocoons. Due to increasing demand of good quality tasar silk, it is essential to increase the production/productivity of tasar food plant in order to strengthen the production of non-mulberry sector from economic point of view. Hence, an attempt has been made to find out the efficacy of foliar spray of micronutrients and leaf surface microbes for improvement of tasar silk worm crops and leaf yield of food plants at own farm and farmers level.

MATERIALS AND METHODS

Technologies of foliar spray of micronutrients and Leaf surface Microbes (LSM) developed at Central Tasar Research and Training Institute, Ranchi were adopted to find out its efficacy on tasar food plants and silkworm rearing under the agro-climatic conditions of Bastar, India. The experiment was conducted at own farm (Belguda forest) of Regional Tasar Research Station, Jagdalpur, and farmers level in Satlawand Bastar (Chhattisgarh). Rearing of chawki worms were conducted under nylon net and late age rearing on forest plantation of *Terminalia arjuna* adopting prophylactic measures against

silkworm diseases and pests as suggested in Integrated Package of Rearing (IPR) by Mathur *et al.*(1996).

Foliar spray of micronutrients was done on the tasar food plants one month prior to commencement of rearing. A packet of micronutrient mixture consisting of Manganese sulphate (MnSO4) 4.6 kg., Zinc sulphate ($ZnSO_4$) 1.090 kg., Borax ($Na_2B_4O_7$) 0.5 kg., Ferrous sulphate ($FeSO_4$) 0.25 kg, Cupric sulphate ($CuSO_4$) 0.200 kg and Ammonium heptamolybdate [$(NH_4)_6Mo_7O_{24}$] 3.6 gm were dissolved in 50 lit of water. This solution was treated as stock solution. Foliar spray was done with one liter of stock solution mixed in 19 liters of water in bright sunny day for early absorption of the mixture.

To prepare the leaf surface microbes solution the ampoules containing microbes received from the CTR&TI, Ranchi was diluted in soil water according to the ratio mentioned in ampoules itself. Red soil (4-5 kg) was mixed in 10-12 ltrs of water in a bucket and left for overnight. Without disturbing the soil sediment, the supernatant was collected for dilution of microbes. This diluted microbes solution was sprayed on the food plants having silkworms in the early instar 24 hrs after I and II moult. Care was always taken to use fresh soil water for dilution and spraying was done within 12 hrs.

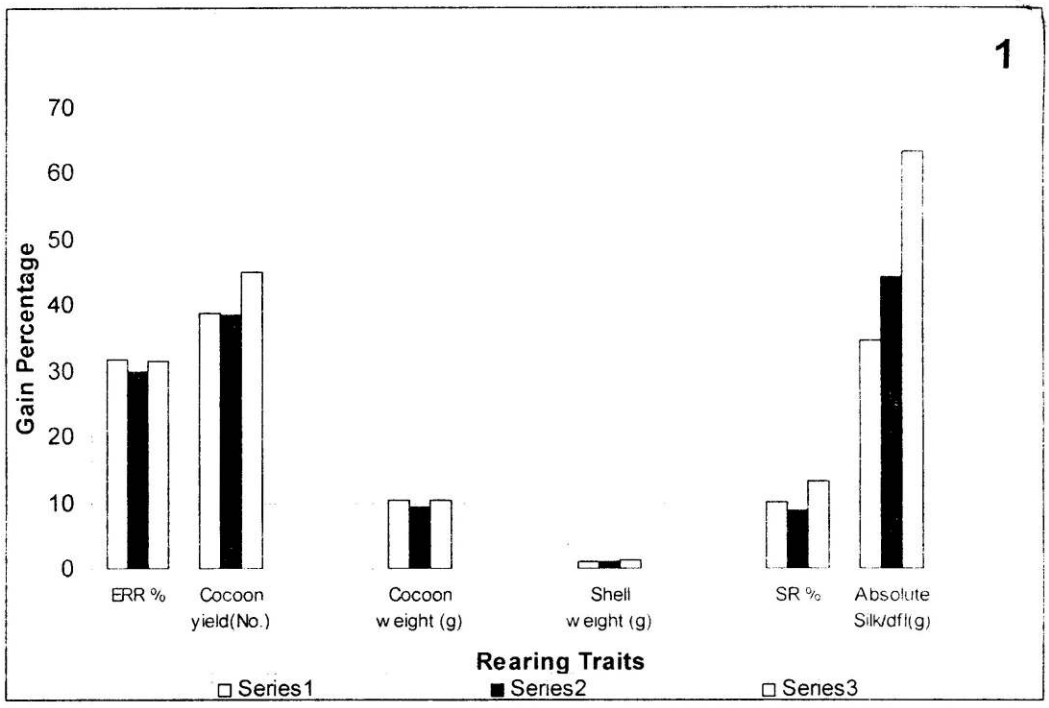
Chawki rearing was conducted in chawki garden maintained with inputs of FYM 2 Kg/plant and NPK while late age rearing was conducted on food plants maintained with the input of NPK 100 : 50 : 50. Nylon net of 40'x 30'x10' size recommended by CTR&TI, Ranchi was used for chawki rearing.

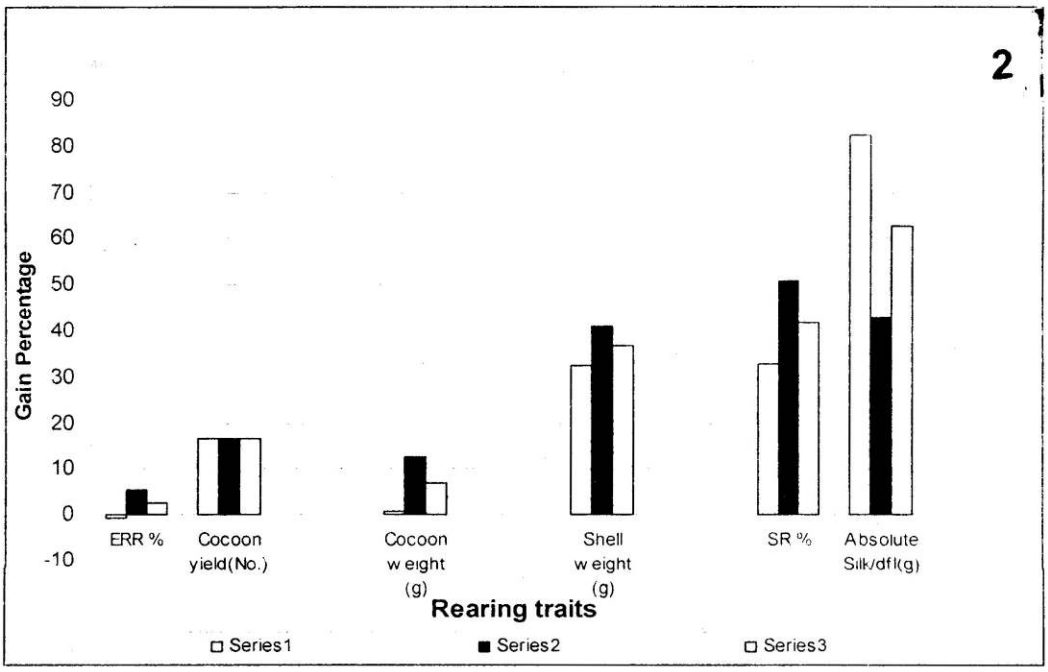
Rearings were conducted with the dfls of Daba ecoracre having 200 fecundity, separately for both technologies during 1st and 2nd crops of 2001-02 to 2003-04 and in 2004-05, both the technologies were tested together to see the efficacy on production and productivity of tasar host plants and silk. Five farmers were adopted maintaining 3 replications for each crop in Bastar and 3 replications maintained at own farm level of RTRS, Jagdalpur.

RESULTS AND DISCUSSION

Impact of micronutrients on tasar food plant *Terminatia arjuna* and silkworm rearing presented in Table I indicated a significant improvement over control at own farm and farmers level in respect of leaf yield (Kg/Ha/Crop), 22.74% and 12.83%; ERR %, 12.83 & 18.34; cocoon yield (Nos.), 16.66% & 18.09% ; cocoon weight (gm), 1.06 & 2.51%; shell weight (gm), 4.55 & 7.67%; silk ratio, 3.49 & 4.98% and absolute silk yield, 21.89 & 20.98%, respectively. Tasar silkworm gets energy from leaves of its food plants. The quality of leaves has got direct bearing on the health, growth and survival of tasar silkworm (Sinha *et al.,* 1986). The contents of proteins and carbohydrates of the leaves of food plants have greatly supplemented with the micronutrients and increased leaf yield to the tune of 600-1000 kg per hectare per crop in all the years with 12.83 to 22.74% gain over control. These micronutrients help the silkworms for its larval growth, cocoon yield and silk production. Hence, feeding leaves treated with micronutrients stimulates the metabolic activities of silkworm resulting in improvement of larval and cocoon characters. (Govindan *et al.*, 1987; Mane & Patil, 1998; Patil *et al.*, 2000)

Effect of leaf surface microbes on silkworm rearing indicates a significant gain over control at own farm and farmer level in respect of ERR % 17.46 & 15.71% ; Cocoon





Figs. 1-2 : 1. Impact of micronutrients and microbes in Bastar (Chattisgarh) India: **2.** Cumulative performance of micronutrients and microbes on silkworm rearing and crop yield in Bastar (Chattisgarh).

Table I : Effect of Micronutrients on *T. arjuna* plantation and tasar silkworm rearing in Bastar (Chhattisgarh) (Mean value of 6 crops in 3 years)

Parameter	RTRS Level			Farmers Level		
	Treatment	Control	Gain %	Treatment	Control	Gain %
Leaf Yield (Kg/Ha/crop)	2861.38±573.82	2318.91±339.91	22.74	4058.66±998.48	3434.66±972.18	12.83
ERR %	35.73±11.17	31.85±10.76	12.83	27.84±6.83	23.53±5.53	18.34
Cocoon yield/ dfl (Nos.)	41.32±13.20	35.70±12.20	16.66	36.02±10.11	30.50±7.72	18.09
Cocoon weight (gm)	9.85±2.25	9.75±2.18	1.06	10.86±2.49	10.45±2.31	2.51
Shell weight (gm)	1.00±0.28	0.96±0.29	4.55	1.10±0.36	0.98±0.31	7.67
Silk Ratio (%)	10.09±1.43	9.78±1.58	3.49	10.00±1.66	9.27±1.06	4.98
Absolute Silk Yield /dfl (gm)	42.02±20.66	34.81±17.95	21.89	27.27±26.00	20.34±18.72	20.98

Table II : Effects of Leaf Surface Microbes on tasar silkworm rearing in Bastar (Chhattisgarh) (Mean value of 2 crops)

Parameter	RTRS Level			Farmers Level		
	Treatment	Control	Gain %	Treatment	Control	Gain %
ERR %	36.73±11.61	31.38±8.52	17.46	23.14±20.66	20.00±18.35	15.71
Cocoon yield/ dfl (Nos.)	50.95±16.99	43.18±14.02	19.51	26.33±22.27	22.67±19.55	16.18
Cocoon weight (gm)	11.09±2.46	10.54±2.16	5.34	7.41±6.01	7.01±5.68	5.68
Shell weight (gm)	1.19±0.33	1.01±0.30	20.21	0.78±0.64	0.67±0.56	16.82
Silk Ratio (%)	10.67±1.72	9.53±0.99	12.62	7.03±5.54	6.31±4.94	11.41
Absolute Silk Yield /dfl (gm)	58.16±18.88	43.34±15.42	45.03	30.26±25.77	22.67±20.28	33.47

Table III : Effect of micronutrients and microbes on *T. arjuna* plantation and silkworm (Chhattisgarh) (Mean value of 2 crops).

Parameter	RTRS Level			Farmers Level		
	Treatment	Control	Gain %	Treatment	Control	Gain %
ERR %	33.31±8.47	26.45±8.13	27.02	29.87±8.27	22.84±8.10	32.69
Cocoon yield/ dfl (Nos.)	47.58±10.49	37.72±10.30	27.10	42.65±10.39	32.50±10.61	33.12
Cocoon weight (gm)	10.45±0.02	10.68±0.33	-2.10	10.41±0.08	10.24±0.26	1.77
Shell weight (gm)	1.40±0.08	1.36±0.02	2.88	1.39±0.09	1.33±0.04	4.00
Silk Ratio (%)	13.39±0.73	12.71±0.52	5.26	13.30±0.97	13.01±0.73	2.18
Absolute Silk Yield /dfl (gm)	66.87±18.29	51.28±14.60	30.61	59.55±18.31	43.48±15.45	38.23

Table IV : Comparative performances of micronutrients and leaf surface microbes on Tasar Silkworm rearing.

Parameter	Micronutrients					Microbes					Micronutrients & Microbes				
	R	F	M	C	G	R	F	M	C	G	R	F	M	C	G
ERR %	35.73 ±11.17	27.84 ±6.83	31.79 ±16.13	27.69 ±8.14	**12.89**	36.73 ±11.61	23.14 ±20.66	29.93 ±16.13	25.69 ±13.43	**14.18**	33.31 ±8.47	29.87 ±8.27	31.59 ±8.37	24.65 ±8.11	**21.98**
Cocoon yield/ dfl (Nos.)	41.32 ±13.20	36.02 ±10.11	38.67 ±11.65	33.10 ±9.96	**14.40**	50.95 ±16.99	26.33 ±22.27	38.64 ±19.63	32.93 ±16.78	**14.79**	47.58 ±10.49	42.65 ±10.39	45.12 ±10.44	35.11 ±10.45	**22.19**
Cocoon weight (gm)	9.85 ±2.25	10.86 ±2.49	10.36 ±2.37	10.10 ±2.24	**2.48**	11.09 ±2.46	7.41 ±6.01	9.25 ±4.23	8.77 ±3.92	**5.12**	10.45 ±0.02	10.41 ±0.08	10.43 ±0.05	10.46 ±0.29	**-0.24**
Shell weight (gm)	1.00 ±0.28	1.10 ±0.36	1.05 ±0.32	0.97 ±0.30	**7.51**	1.19 ±0.33	0.78 ±0.64	0.98 ±0.48	0.84 ±0.43	**14.55**	1.40 ±0.08	1.39 ±0.09	1.39 ±0.08	1.34 ±0.03	**3.36**
Silk Ratio (%)	10.09 ±1.43	10.00 ±1.66	10.04 ±1.54	9.52 ±1.32	**5.15**	10.67 ±1.72	7.03 ±5.54	8.85 ±3.63	7.92 ±2.96	**10.51**	13.39 ±0.73	13.30 ±0.97	13.34 ±0.85	12.86 ±0.62	**3.60**
Absolute Silk Yield /dfl (gm)	42.02 ±20.66	27.27 ±26.00	34.64 ±23.33	27.58 ±18.33	**20.40**	58.16 ±18.88	30.26 ±25.77	44.21 ±22.32	33.00 ±17.85	**25.34**	66.87 ±18.29	59.55 ±18.31	63.21 ±18.3	47.38 ±15.02	**25.05**

R : RTRS; F : Farmers; M : Mean; C : Control; G : Gain; ± : Standard Deviation.

Table V : Impact of Micronutrients and Microbes together compared with individual treatment of Micronutrients and Microbes (Mean values).

Parameter	Micro-nutrients	Microbes	Micronutrients + Microbes	Gain % over		
				Micro-nutrients	Microbes	Average
ERR %	31.79	29.93	31.59	-0.62	5.52	2.45
Cocoon yield/ dfl (Nos.)	38.67	38.64	45.12	16.68	16.76	16.72
Cocoon weight (gm)`1	10.36	9.25	10.43	0.74	12.84	6.79
Shell weight (gm)	1.05	0.98	1.39	32.57	41.24	36.91
Silk Ratio %)	10.04	8.85	13.34	32.88	50.79	41.83
Absolute Silk Yield /dfl gm)	34.64	44.21	63.21	82.46	42.99	62.73

yield 1dfl (nos.) 19.5 & 16.18; cocoon weight (gm) 5.34 & 5.68; shell weight (gm) 20.21 & 16.82; Silk ratio (%) 12.62 & 11.41 and Absolute Silk Yield 45.05 & 33.47%, respectively (Table II). Application of leaf surface microflora or microbes on the food plant alongwith II and III instar larvae in all the crops controls bacterial and viral diseases due to its antagonistic property which inactivates the pathogens to a great extent in controlling disease severity (Roy *et al.*, 2000)

Cumulative effect of micronutrients and microbes on rearing performance indicated as significant improvement over control at own farm and farmers level in respect of ERR % 27.02 & 32.69% ; cocoon yield 27.10 & 33.12; cocoon weight 2.1 & 1.77; Shell weight 2.88 & 4.00; Silk ratio 5.26 & 2.18 and absolute silk yield 30.61 & 38.23, respectively.(Table III).

The comparative performance of micronutrients, microbes and both together on tasar silkworm rearing has been presented in Table IV. The data revealed that there was significant difference in gain % over control in almost all the parameters except cocoon weight in different treatments. Treatment with micronutrients, microbes and both together (Table V) indicated that there was significant improvement in almost all the parameters considered when the treatment was done in integration of both micronutrients and microbes. Hence, the efficacy of micronutrients & microbes when applied together for rearing of tasar silkworm had a very significant role on production and productivity of cocoon/silk production over their individual treatments at farmer's level in Bastar (Chhattisgarh).

The present study indicated that adoption of foliar spray of micronutrient and leaf surface microflora technologies resulted in higher cocoon yield with better cocoon quality. However, the consolidation of there technologies facilitate crop stability and associated profit. These technologies are recommended for large scale adoption by the farmers to boost of tasar silk production and improving the socio-economic status of farm house hold in Chhattisgarh.

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REFERENCES

GOVINDAN, R., MAGADUM, S.B., MAGADUM, B.G. & KRISHNA, V. 1987. Effect of supplementing potassium iodide and copper sulphate on the economic traits of eri silkworm. *Mysore J. of Agricultural Sciences*. **21**: 23-62.

MANE, J.K & PATIL, G.M. 1998. Fortification of castor leaves with minerals to increase economic traits of eri silkworm *Samia cynthia ricini. Science and Culture.* Jan-Feb., 1998.

MATHUR, S.K., SINHA, B.R.R.P. & SINHA, S.S. 1996. Package for tasar chawki rearing. *Indian Silk.* **35**(6&7) : 23-26.

PATIL, G.M., KULKARNI, K.A., PATIL, R.K. & JAYAPRAKASHRAO, MANE. 2000. Effect of different inorganic compounds on the economic traits of eri silkworm *Samia Cynthia ricini* Boised. *The 3rd Int. Conf. on Wild Silkmoth*-1998. **5** :150-152.

ROY, D.K., BANSAL, A.K., SAXENA, N.N. & SINHA, B.R.R.P. 2000. Biological control of tasar silkworm diseases with leaf surface antagonistic bacteria. *The 3rd Int. Conf. on Wild Silkmoth-1998.* **5** : 43-46.

SINHA, A.K., CHAUDHARY, B.K., BRAMHACHARI, B.N. & SENGUPTA, K. 1986. Foliar constituents of the food plants of temperate tasar silkworm *Antheraea proylei. Ind. J. Seri.* **25**(1) : 42-43.