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Effect of Integrated Nutrient Management on Biochemical Parameters and Nutrient Content on the Leaf of Food Plant of Tropical Tasar Silkworm (*Antheraea mylitta* Drury)

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ABSTRACT

A field experiment was conducted at Central Tasar Training and Research Institute to study the effect of Integrated Nutrient Management in food plant of Tasar silkworm on biochemical parameters and nutrient content of leaf. There was twenty treatment each with three replications. Results revealed that application of INM treatments have significantly influence the biochemical parameters and nutrient content of leaf. Highest total N was recorded 1.65% in T_9 which was applied with 50% RDF+ Phosphorus Solubilizing Bacteria followed by T_{19} (1.63%). Highest total P was observed in T_4 (0.97%) over the control and total K was recorded highest in T_7 (1.8%) followed by T_8 (1.74%). The crude protein was recorded highest in T_9 (10.3324%) followed by T_{19} (10.157%) and total carbohydrate recorded highest in T_4 (222.5 mg/g) followed by T_{20} (182.9mg/g). The study indicates that INM practices significantly influenced the different parameters.

***Key words*:** Carbohydrate, Crude protein, Nutrient, Phosphorus solubilizing bacteria, Silkworm

Balanced nutrition of the plant directly influences the quality and quantity of production of cocoon by silkworm *Antheraea mylitta* Drury [1]. Presently, India occupies the second position in the globe in silk production after china, Tasar silk which is being produced by the genus Antheraea (Lepidoptera: Saturniidae) which comprises 35 species [2], out of which three species are exploited for wild silk production i.e., *A. mylitta* (Tropical Tasar Silkworm), *A. proylei* (Temperate Tasar Silkworm) and *A. assama* (Muga silkworm). Besides these other wild silk moth species used commercially in India are Eri silkworm, *Samia ricini*. Except Eri silkworm rest are grown naturally in the forest region [3]. Mulberry accounted for 70.46% (25,239 MT), Tasar 8.76% (3,136MT), Eri 20.11% (7,204MT) and Muga 0.67% (241 MT) of the total raw silk production of 35,820MT [4].

Aboriginals residing in the central India plateau mainly in the states of Jharkhand, Bihar, Chhattisgarh, Madhya Pradesh, Orissa and West Bengal extending Uttar Pradesh, Andhra Pradesh and Maharashtra practices this old age tradition of Tasar culture [5] i.e., rearing of tasar silkworm and other activities of silk production. Tropical tasar is produced by the larvae of yellow orange moth known as Antheraea mylitta Drury is one of the most important wild silkworms found in India [6]. If the nutrient and chemicals present in the leaves are less than the silkworm will not grow properly [7] and will hamper the production of cocoon leading to a great loss in the yield. The nutrient present in the leaf plays important role in the proper growth of the silkworm and make resistant to various diseases, the silkworms that are underfed and do not get proper nutrition become more prone to various diseases [8]. The silkworm larvae take nutrients from the leaf they fed to build up body, sustain life and to spin cocoon [9]. The present investigation was undertaken to study the effect of Integrated Nutrient Management on Biochemical composition and Nutrient content in the leaf of Food plant of Tropical Tasar Silkworm (*Antheraea mylitta* Drury).

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MATERIALS AND METHODS

The present work was carried out in the field of Central Tasar Research and Training Institute, Nagri, Ranchi. The treatments were replicated three times (Table 1) and laid out in randomized complete block design.

Table 1 Treatment details

Treatments	Treatment detail
T_1	Absolute Control
T_2	Control with recommended dose fertilizer (RDF)

T_3	50% RDF through fertilizer + 50% through vermicompost
T_4	75% RDF through fertilizer + 25% through vermicompost
T_5	100% RDF through fertilizer + 2% through vermicompost
T_6	50% RDF + Azotobacter
T_7	75% RDF + Azotobacter
T_8	100% RDF + Azotobacter
T_9	50% RDF + Phosphorus solubilizing bacteria (PSB)
T_{10}	75% RDF + PSB
T_{11}	100% RDF + PSB
T_{12}	T_3 + Azotobacter
T_{13}	T_4 + Azotobacter
T_{14}	T_5 + Azotobacter
T_{15}	T_3 + PSB
T_{16}	T_4 + PSB
T_{17}	T_5 + PSB
T_{18}	T_3 + Azotobacter + PSB
T_{19}	T_4 + Azotobacter + PSB
T_{20}	T_5 + Azotobacter +PSB

Sample collection and processing

Leaf sample were collected from each treatments and were dried and milled to fine powder for further use.

Evaluation of biochemical parameters and nutrients content of food plant of tropical tasar silkworm

Total Nitrogen Content

Per cent of total nitrogen in the leaf sample was determined by Kjeldhal's Method using digestion mixture consisting of 2.5g potassium sulphate and 0.5g copper sulphate [10].

Processing of plant sample for other nutrient determination

Plant sample were digested using di-acid mixture consisting HNO_3 and $HClO_4$ in the ratio 9:4 and digested at temperature of 200ºC.

Total phosphorus content

Total phosphorus content was determined by Vando-Molybdate phosphoric acid yellow color method at 730nm [11].

Total potassium content

It was estimated by using Flame-Photometer from the extract obtained by digestion with di-acid mixture [12].

Total carbohydrate content

The total carbohydrate content was determined following the Anthrone Method [13].

Crude protein content of leaf

The crude protein content of leaf was determined by multiplying total N-content by the converting factor 6.25 [14-15].

Statistical analysis

Statistical analysis was carried out using ANOVA and SPSS 20.0 and Duncan's Multiple Range Test (DMRT) was used to determine significance of the difference between individuals means [16].

RESULTS AND DISCUSSION

Data depicted in (Table 2) reveals that application of vermicompost along with recommended dose of fertilizer and biofertilizer significantly influenced the nutrient content of leaf. There was significant increase in the total N, P and K content of leaf. The total N was found maximum in T_9 (1.65%) followed by T_{19}(1.63%) over the control. The increase in the N may be due to release of N from both the Organic forms, Chemical fertilizer [17] and due to the effect of N_2 fixing bacteria which fixes free molecular atmospheric nitrogen and make soil nutrient available by secreting chelating substances (Organic acid) which solubilize sparingly soluble inorganic compounds making available to plant [18-19].

Table 2 Nutrient content of leaves after INM practices

Treatments	Nitrogen %	Phosphorus %	Potassium %
T_1	0.34	0.05	1.1
T_2	0.36	0.09	1.26
T_3	1.42	0.18	1.32
T_4	1.51	0.97	1.44
T_5	0.81	0.15	1.2
T_6	1.26	0.16	1.36
T_7	1.04	0.29	1.8
T_8	1.37	0.211	1.74
T_9	1.65	0.174	1.66
T_{10}	1.32	0.11	1.1
T_{11}	1.57	0.18	1.58
T_{12}	1.01	0.154	1.34
T_{13}	0.95	0.14	1.58
T_{14}	1.01	0.184	1.7
T_{15}	1.26	0.213	1.28
T_{16}	1.20	0.19	1.4
T_{17}	1.40	0.18	1.42
T_{18}	1.14	0.21	1.7
T_{19}	1.63	0.27	1.02
T_{20}	1.40	0.12	1.6
Mean	1.1825	0.2113	1.43
S.Em±	0.0466	0.0237	0.02968
Range	0.3286-1.697	0.0492-0.9845	1.0024-1.8594
CD (95.0%)	0.09329	0.04752	0.0594

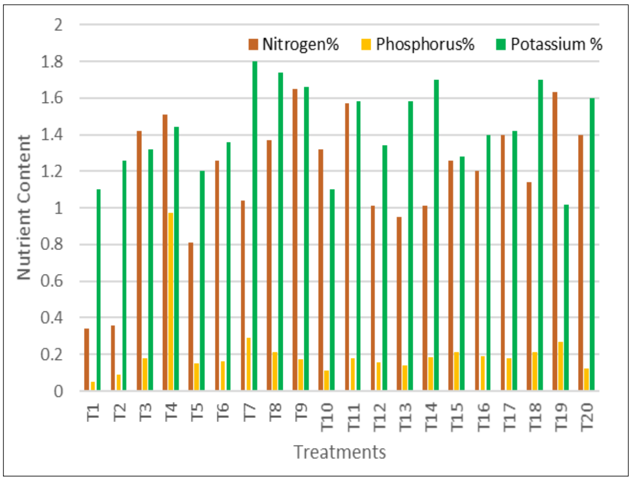
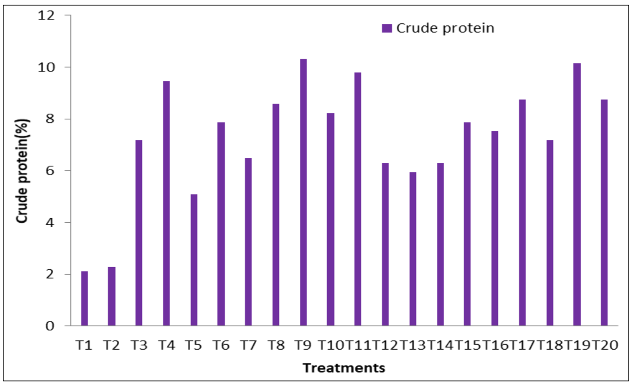


Fig 1 Influence of INM practices on nutrient content

Significant difference was observed in total phosphorus content, highest phosphorus content was recorded in T_4 (0.97%) followed by T_7 (0.29%) and T_{19} (0.27%). The increase in P content is due to enhanced dissolution of P by production of organic acid by decomposition of organic matter [17] and solubilization of unavailable phosphate in soil by phosphate in soil by phosphate solubilizing bacteria making it available to plant for uptake [20]. The total potassium content of leaf was significantly influenced by INM practices maximum K content was observed in T_7 (1.8%) followed by T_8 (1.74%) due to the release of K from organic manure which releases organic acids that promote the release of mineral bound insoluble K [17].

Table 3 Crude protein (%) and total carbohydrate (mg/g) content of leaf

Treatments	Crude protein (%)		Total carbohydrate (mg/g)	
	Mean	Rank	Mean	Rank
T_1	2.102^{j}	20	61.8^{l}	20
T_2	2.276^{j}	19	76.3^{k}	19
T_3	7.180^{g}	12	146.2^{ef}	7
T_4	9.4567^{cd}	4	222.5^{a}	1
T_5	5.078^{i}	18	182.5^{b}	3
T_6	7.88^{f}	8	94.7^{j}	17
T_7	6.4796^{h}	14	97.7^{j}	16
T_8	8.5811^{e}	7	116.9^{h}	11
T_9	10.3324^{a}	1	111.7^{hi}	12
T_{10}	8.23087^{f}	10	134^{g}	9
T_{11}	9.807^{bc}	3	154.8^{d}	5
T_{12}	6.305^{h}	15	110.5^{i}	14
T_{13}	5.954^{h}	17	148^{e}	6
T_{14}	6.3045^{h}	16	111.5^{hi}	13
T_{15}	7.881^{f}	9	117.9^{h}	10
T_{16}	7.53^{f}	11	140.3^{f}	8
T_{17}	8.756^{de}	6	108.2^{i}	15
T_{18}	7.180^{g}	13	78.9^{k}	18
T_{19}	10.157^{ab}	2	164.5^{c}	4
T_{20}	8.756^{de}	5	182.9^{b}	2
Mean	7.311		128.09	
S.Em±	0.2883		5.126	
Range	2.0769 - 10.507		61.586 - 228.34	
CD (95.0%)	0.5769		10.258	



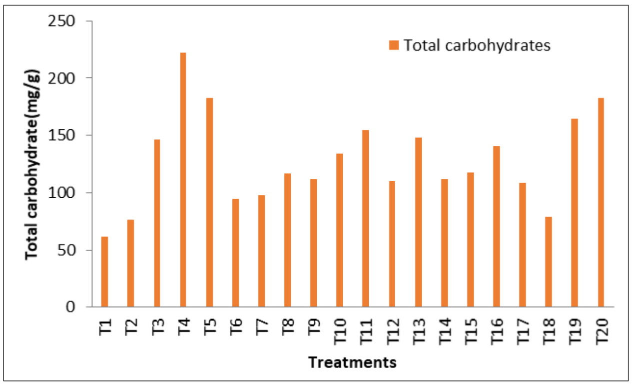


Fig 2 Influence of INM practices on crude protein (%) and total carbohydrate (mg/g)

The highest protein content was recorded in T_9 (10.3324%) was followed by T_{19} (10.157%). The increase in protein content are attributed by integrated effect of vermicompost, recommended dose of fertilizer and biofertilizer by increasing the availability of nutrient for plant growth against the adverse conditions which maximize the biological yield and quality [21]. Increase in the protein content is due to bi-mineral fertilization. The results was in agreement with those by [22-24]. 70% of protein content of raw silk namely Fibroin and Sericin are directly biosynthesized from the leaf protein and 30% from the body tissue and haemolymph protein of the silkworm [25-27]. Protein content in leaf had direct bearing on larvae growth (Silk gland development and cocoon character) (Table 3).

Carbohydrate content in leaf is closely related to the health of silkworm. Leaf with high sugar content have good rearing result. 75% RDF through fertilizer + 25% through vermicompost had the maximum carbohydrate content (222.5 mg/g) followed by T_{20} (182.9 mg/g) increase. Increase in total protein, carbohydrate, total nitrogen and total phosphorus were also reported by [28]. Leaf with more protein, sugar, carbohydrate and less minerals and crude fiber content are best for silkworm nutrition [29] (Table 3).

CONCLUSION

The application of integrated nutrient management have significant effect on the biochemical parameters and nutrient content of Leaf. The results suggest that application of vermicomposting along with RDF and Biofertilizer could be a superior recommendation for biochemical parameters and nutrient content of leaf as well as for maintain soil health over the sole use of chemical fertilizer which deteriorate the soil health.

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Conflict of interest

There is no conflict of interest among the authors.

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