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EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON THE PARAMETERS OF TASAR SILK COCOON PRODUCTION ON ASAN PLANTATION

Soma Karmakar[1*], A.K. Srivastava[1], T. Pandiaraj[2] and Jyostna Tirkey[3]

[1*]Department of Botany, Ranchi University, Ranchi, India-834008

[2]College of Agriculture Campus (Narendra Deva University of Agricultural Technology, Kumarganj, Ayodhya), Azamgarh, U.P., India-276207

[3]Director (Retd.) CMER & TI, Jorhat, Assam, India-785700

*Corresponding author Email: smarten436@gmail.com

ABSTRACT

A field experiment was carried out at Central Tasar Research & Training Institute, Nagri, Ranchi. To study the effect of integrated nutrient management (INM) on Cocoon parameters. The treatments consist of different levels of nutrient management in an integrated manner with either organic manure or biofertilizer or a combined manner imposed with three replications in RBD design. The results revealed a significant effect shown on the various cocoon parameters. A higher Single cocoon weight (19.604 g), Shell weight (2.854 g), Shell ratio (15.45%), Silk filament length (1248.15) and Denier (10.82)were observed as compared to control.

***Keywords* :** Biofertilizer, Cocoon, Denier , Organic manure and Silk filamentl

Introduction

Silkworm, *Antheraea mylitta* Drury is a polyphagous insect that feeds on three primary and dozens of secondary food plants (Sreenivas and Shamitha, 2017). It is known as" Wild silk" because it breeds on local trees like Sal, Arjun and Sajabut does not breed on mulberry trees (Vigneswaran *et al*., 2015). Since 4000 years ago silk has played an important role in the economic life of man. During the lean period of the year, it's an ideal sideline activity to earn income. Natural silk has reigned supreme as the "Queen of Textiles", due to its some of the qualities like texture, luster, tensile qualities, comfort, adaptability to all climatic conditions and its ability to take up dyes making it an unequaled textile material (Baby Joseph and Justin Raj, 2012). The growth and development of tasar silkworm larvae and the economic characteristics of cocoons are directly proportional to the nutritional content of leaves (Srivastava *et al*., 2017). The quality of leaves depends on soil fertility and the supply of essential nutrients from the soil in a balanced manner (Subbaswamy *et al.,* 2004). Food quality greatly influences larval growth, the weight of cocoons, silk yield and physical-mechanical properties of silk thread (Samokhvalova *et al*., 1972). Silks are fibrous proteins, insects spun them into fibers (Vollrath, 1999). In the cocoon filament silk protein is an essential constituent (Kamatsu, 1975). The use of less quantity of organic manure leads to the ill health of the soil and thus lowers the quality of leaves and cocoons (Nambiar and Abrol, 1992; Kumar and John, 1999). The weight of the cocoons is directly correlated to the protein content of the leaves for normal silk production during the 5th in star of the caterpillar. However, an integrated nutrient management system is an alternative approach to reducing the use of chemical fertilizer and combined use of chemical fertilizers with organic materials such as animal manures, crop residues, green manure, composts and biofertilizer is found to maintain steady crop production for a longer time (Sujathamma *et al*., 2014). The application of organic manures improves the soil physical, chemical and biological properties (Kerenhap *et al*., 2007). The availability and uptake of nutrients to plants are affected by the use of chemical fertilizer for a prolonged period (Subbaswamy *et al.*, 1994). Thus, the present work was carried out to study the Effect of Integrated Nutrient Management on the parameters of Tasar silk Cocoon production.

Materials and Methods

The present work was carried out in the field of Central Tasar Research & Training Institute (CTR & TI), Ranchi on the Asan plant (*Terminalia tomentosa*). The treatments consist of the different nutrient management with manures, biofertilizers and a combined both in an integrated fashion along with chemical fertilizers (Table 1). The experiment was designed in Complete Randomized Block Design (CRBD) with three replications.

Table 1 : Treatments followed in the experimental site in CTR & TI., Ranchi

Treatments	Treatments
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

Cocoon Parameters

The following parameters of cocoon characters were measured as per the methods of (Mahesh, 2004).

Single cocoon weight

The weight of a single cocoon was recorded from each treatment after being spun by a silkworm. It was expressed in g per cocoon.

Single shell weight

The shell's weight was observed after removing the pupae and last larval skin and expressed in g.

Shell ratio (%)

The shell ratio percentage was calculated by using the following formula.

$$\text{Shell ratio } \% = \frac{\text{Weight of cocoon shell(g)}}{\text{Weight of whole cocoon(g)}} \times 100$$

Post Cocoon Parameters

Single cocoon filament length

About ten cocoons were randomly selected from each replication from different treatments and were reeled on epprouvette to find the filament length of the cocoon and expressed in meter. Single cocoon filament length was computed by using the following formula

$$L(m)=R\times1.125$$

Where,

L= Total Cocoon filament length (m)

R= Number of revolutions recorded by epprouvette

1.125- Circumference of epprouvette in meters

Denier

The raw silk filaments reeled with epprouvette were dried in the oven at 70ºC and denier was determined by using the formula

$$\text{Denier} = \frac{\text{Weight of single cocoon filament (g)}}{\text{Weight of single cocoon filament (m)}} \times 9000$$

Statistical Analysis

The effects of the treatments on the measured parameters were evaluated using descriptive ANOVA and SPSS 20.0. When F-values were significant, the least significant difference (LSD) was used to compare means. In all cases, differences were deemed to be significant if $P\leq0.05$ and comparisons were performed with Duncan's Multiple Range Test (DMRT) to identify the significant critical differences (Gomez and Gomez, 1984).

Results and Discussion

Cocoon Characters

The commercial characters of cocoons of *Antheraea mylitta* Drury, *viz.,* single cocoon weight (g), single shell weight (g), shell ratio (%), silk filament length (m) and Denier were measured at experimental sites CTR&TI., Ranchi.

The cocoon weight of the samples ranged from 8.24 to 19.60 g cocoon^{-1} with an average of 15.00 g cocoon^{-1}. Cocoon spun by the silkworms fed with Asan leaves raised using 50% RDF through fertilizer + 50% through vermicompost + PSB (T_{15}) registered significantly higher single cocoon weight (19.60 g cocoon^{-1}) and it was on par with T_{14} (18.93 g cocoon^{-1}). The treatment T_{16} (18.029 g cocoon^{-1}), T_{17} (18.528 g cocoon^{-1}) and T_{19} (18.47 g cocoon^{-1}) were observed as next to higher and found on par with each other. In contrast, lower cocoon weight was measured with T_1 (8.24 g cocoon^{-1}) treatment (Fig 1).The single shell weight widely ranged from 0.90 to 2.85 g cocoon^{-1} with an average of 1.79 g cocoon^{-1}. The T_{19} treatment was applied with 75% RDF through fertilizer + 25% through vermicompost + *Azotobacter* + PSB had significantly increased shell weight of cocoon by 2.85 g cocoon^{-1} followed by T15 and T14 as 2.217 and 2.123 g cocoon^{-1}, respectively. The treatments such as T_{16} (1.984 g cocoon^{-1}), T_{18} (1.979 g cocoon^{-1}), T_{17} (1.978 g cocoon^{-1}), T_{20} (1.928 g cocoon^{-1}) and T_{13} (1.914 g cocoon^{-1}) were recorded statistically similar shell weight of cocoon and not differed each other. The less weight of the cocoon shell (0.896 g) was observed with the T_1 treatment. Different INM practices treated significantly increased the shell ratio of tasar cocoons (Fig. 1). The shell ratio of tasar cocoon samples ranged from 10.50 to 15.45% with a mean value of 11.95%. During the investigation, a significantly higher shell ratio percentage (15.45%) was registered when silkworms were reared on the leaves as raised by the application of 75% RDF through fertilizer + 25 % through vermicompost + *Azotobacter* + PSB (T_{19}). A lower shell ratio was observed with T_{12} (10.50%) i.e. 50% RDF through fertilizer + 50 % through vermicompost (Fig 2).The cocoon filament length ranged from 318.32 to 1248.15 m with a mean of 759.99 m. The silk filament length of tasar cocoon (1248.15 m) was significantly increased by T_{19} (75%RDF + 25% through vermicompost + *Azotobacte*r + PSB) followed by T_{15} (1092.13 m), T_{14} (1079.32 m); while shorter filament length (318.32 m) was observed from T_1 treatment (Fig. 2).The denier of silk filament for the cocoon samples ranged from 5.55 to 10.82 with a mean of 10.11. The INM treatment of T_9 showed a significant and higher denier (10.82) than other treatments. However, it was statistically on par with treatments such as T_4 (10.79), T_{18} (10.76), T_{20} (10.74), T_{16} (10.59), T_{19} (10.54), T_{17} (10.50), T_{13} (10.47), T_7 (10.46) and T_{11} (10.43). In this study, a lower denier was found to be observed with the T_{14} (8.55) treatment (Fig. 3). The application of organic manure, inorganic fertilizer and biofertilizer fixes atmospheric N, supplies P, and synthesis other nutrients, vitamins, amino acids, hormones, etc., which help to enhance the growth, metabolism and physiological activity of the host plants which results in improvement of leaf quality led to improved silkworm growth and cocoon characters (Ram Rao *et al*., 2007). An increase in nitrogen significantly influences cocoon production and has a profound influence on larval, cocoon and shell weights, shell percentage and cocoon yield as nitrogen promotesthe protein content of the leaf (Narayanswamy *et al.,* 2006). INM practices strongly influence the improvement of cocoon weight, shell weight and shell ratio (Thangamalar *et al.*, 2018, Mathan and Ramesh, 2016). The combined application of organic manure, inorganic fertilizer and biofertilizer mitigate the deficiency of many secondary and micronutrient organically produced leaves and supplements the nutritional requirement of silkworms by producing a nutritionally balanced leaf (Arulmozhi and Sakthivel, 2018).

Table 1 : Commercial cocoon characters of *Antheraea mylitta* Drury [single cocoon weight (g cocoon^{-1}), single shell weight (g cocoon^{-1}), shell ratio (%), silk filament length (m cocoon^{-1}) and Denier] as influenced by various INM practices at CTR&TI., Ranchi.

Treatments	Cocoon weight	Shell weight	Shell ratio	Silk filament length	Denier
T1	8.24^{m}	0.90	10.87^{efg}	318.32^{m}	9.30^{d}
T2	9.48^{l}	1.31	13.81^{c}	485.97^{l}	10.05^{bc}
T3	9.67^{l}	1.38	14.30^{bc}	595.19^{ij}	10.01^{bc}
T4	14.49^{hi}	1.67	11.52^{de}	615.73^{i}	10.79^{a}
T5	12.21^{k}	1.78	14.56^{b}	795.76^{fg}	10.37^{bc}
T6	13.45^{j}	1.82	13.55^{c}	974.32^{c}	8.85^{d}
T7	14.33^{i}	1.70	11.82^{de}	675.35^{h}	10.46^{ab}
T8	10.36^{l}	1.47	12.23^{d}	556.39^{k}	9.27^{cd}
T9	15.26^{h}	1.68	10.99^{efg}	635.79^{i}	10.82^{a}
T10	16.17^{g}	1.80	11.13^{ef}	801.15^{fg}	10.18^{bc}
T11	15.40^{h}	1.63	10.57^{g}	601.27^{i}	10.43^{ab}
T12	15.22^{hi}	1.60	10.50^{g}	535^{k}	10.14^{bc}
T13	17.29^{fg}	1.91	11.07^{efg}	865.12^{de}	10.47^{ab}
T14	18.93^{ab}	2.12	11.21^{efg}	1079.32^{b}	8.55^{d}
T15	19.60^{a}	2.22	11.31^{efg}	1092.13^{b}	9.28^{d}
T16	18.03^{cde}	1.98	11.00^{efg}	887.39^{d}	10.59^{ab}
T17	18.53^{bcd}	1.98	10.67^{fg}	827.12^{efg}	10.50^{ab}
T18	17.54^{def}	1.98	11.28^{ef}	826^{efg}	10.76^{ab}
T19	18.47^{bcd}	2.85	15.45^{a}	1248.15^{a}	10.54^{ab}
T20	17.38^{ef}	1.93	11.09^{efg}	784.32^{g}	10.74^{ab}
Mean	***15.00***	***1.79***	***11.95***	***759.99***	***10.11***
Range	***8.24-19.60***	***0.90-2.85***	***10.50-15.45***	***318.32-1248.15-***	***8.55-10.82***
SEm.±	***0.19***	***0.03***	***0.17***	***13.55***	***0.15***
LSD (P=0.05)	***0.55***	***0.09***	***0.49***	***3.94***	***0.43***

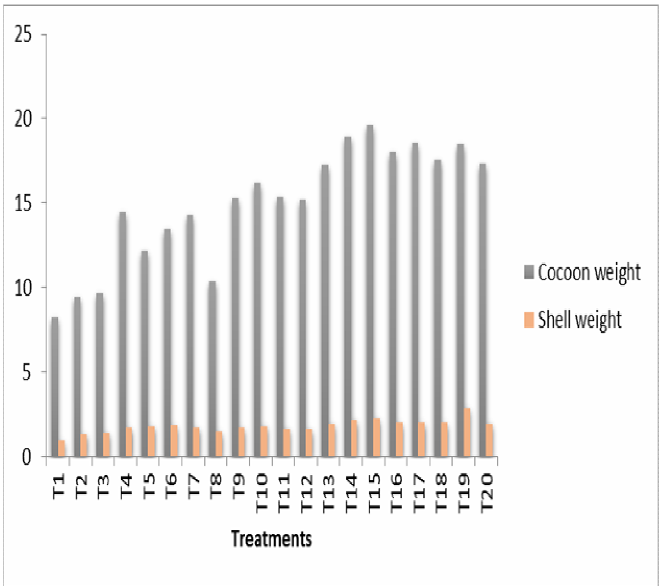

Fig. 1 : Cocoon weight (g) and Shell weight of tasar silkworm as reared at *T. tomentosa* as influenced by various INM practices at CTR&TI., Ranchi

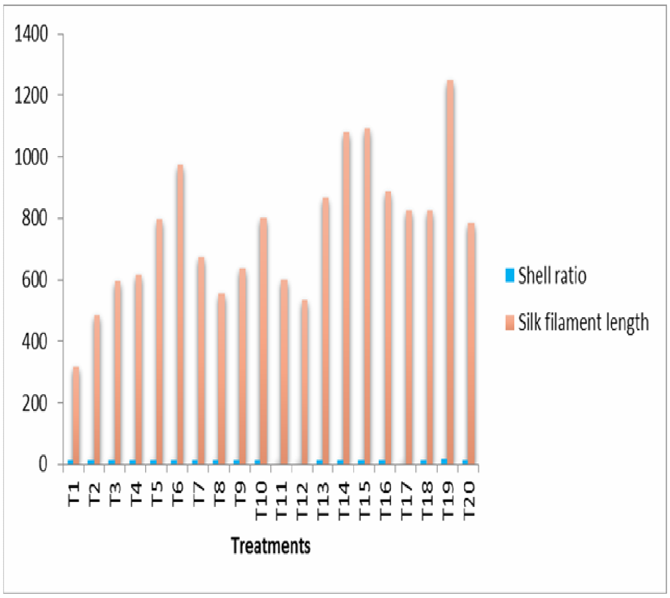

Fig. 2 : Cocoon Shell ratio (%) and Silk filament length of tasar silkworm as reared at *T. tomentosa* as influenced by various INM practices at CTR&TI., Ranchi

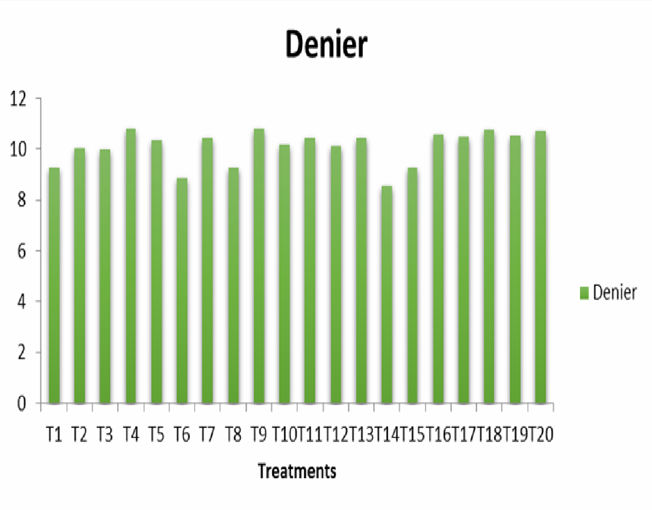

Fig. 3 : Denier of tasar silkworm as reared at *T. tomentosa* as influenced by various INM practices at CTR&TI., Ranchi

Conclusion

The current study inferred that the application of integrated nutrient management had a significant effect on the various cocoon parameters like single cocoon weight, single shell weight, shell ratio, silk filament length and denier as compared to the application of chemical fertilizers. Hence, the finding of the present investigation will be of immense importance to sericulture farmers for sustainable production of quality cocoons.

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