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# INTEGRATED ORGANIC BASED NITROGEN MANAGEMENT APPROACH IN MULBERRY ON LARVAL TRAITS OF SILKWORM (*BOMBYX MORI* L.)

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**ABSTRACT**
The integrated organic based nitrogen management on $S_{36}$ and $M_5$ mulberry varieties showed influence on larval parameters of PM and $CSR_2$ pure breeds. The results revealed that, among the various treatments, larvae of PM and $CSR_2$ fed on mulberry leaves raised through the application of biofertilizers @ 10 kg/ha each of *Azospirillum brasilense* + *Aspergillus awamori* + 20 per cent recommended nitrogen each through compost, vermicompost, green manure, castor oil cake and 20 per cent N and recommended dose of P and K through inorganic fertilizers exhibited significantly higher values in respect of grownup larval weight (1.824 and 3.911 g), effective rate of rearing (96.81 and 96.38 %) and cocoon yield (43.59 and 70.29 kg / 100 DFLs) and lower values in respect of disease incidence (2.89 and 3.32 %), chawki duration (246.38 and 232.75 h), fifth instar larval duration (173.73 and 165.90 h), total moulting duration (100.65 and 105.67 h) and total larval duration (651.79 and 615.75 h).

**KEYWORDS:** Mulberry varieties, silkworm breeds, organic manures and inorganic fertilizers.

## INTRODUCTION

Among the numerous factors that influence the productivity in sericulture, silkworm seed is of prime importance. As it is known that, the quality silkworm seed is the backbone of the sericulture industry, which plays a decisive role in the success of commercial cocoon crop. Thus, silk industry sustains on the strength of silkworm seed quality, crop performance and productivity at Basic seed farms and seed areas. The timely supply of required quantity of quality disease free layings (dfls) to the sericulturists is one of the responsibilities for achieving stable cocoon production. So, to generate good quality seed cocoons

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## MATERIAL AND METHODS

A field experiment was carried out during 2005-07 at Main Research Station, Hebbal, University of Agricultural Sciences, Bangalore in irrigated $S_{36}$ and $M_5$ mulberry gardens with spacing of 60×60 cm. The experiment was laid out in a Randomized Complete Block Design (RCBD) with 6 treatments of 3 replications each. The mulberry cultivation practices were followed as per Dandin *et al.* (2003). The treatments were as follows,

**Treatment details**

$T_1$: 50 per cent recommended N through castor oil cake + 50 per cent recommended N and recommended dose of P and K through inorganic fertilizers.

$T_2$: 50 per cent recommended N through vermicompost + 50 per cent recommended N and recommended dose of P and K through inorganic fertilizers.

$T_3$: Biofertilizers @ 10 kg/ha each of *Azospirillum brasilense*+ *Aspergillus awamori* + 25 per cent recommended N each through compost, green manure (*Glyricidia maculata*), castor oil cake , vermicompost with recommended dose of P and K through inorganic fertilizers.

$T_4$: Biofertilizers @ 10 kg/ha each of *Azospirillum brasilense* + *Aspergillus awamori* + 20 per cent recommended nitrogen each through compost, vermicompost, green manure, castor oil cake and 20 per cent N and recommended dose of P and K through inorganic fertilizers.

$T_5$: 20 tonnes FYM / ha / year + 300: 120: 120 NPK kgs / ha / year through chemical fertilizers (control).

$T_6$: Only chemical fertilizers applied @ 300 : 120 : 120 NPK kgs / ha / year.

Recommended 'P' and 'K' fertilizers were applied in the form of Single Super Phosphate and Muriate of Potash, respectively. Organic manures and fertilizers were applied by ring and basin method at a distance of 15 cm from the base of each plant of both $S_{36}$ and $M_5$ mulberry. The recommended dose of 300 kg N / ha / yr was taken as base for supplying 'N' through different organic manures at different levels and recommended dose as per package of practices *i.e.*, 300:120:120 kg NPK / ha / yr as base for the supply of NPK through chemical fertilizers at different levels. After 35 days of pruning, the $S_{36}$ (for youngage silkworm) and $M_5$ mulberry (for lateage silkworm) leaves raised through different kinds of organics were used for rearing the pure breeds *viz*., PM and $CSR_2$. The silkworm rearing was conducted as per the procedure laid by Dandin *et al.* (2003). Finally the data was analyzed statistically by using simple CRD and two way factorial CRD as outlined by Cochran and Cox (2000).

## RESULTS AND DISCUSSION

The observations on larval parameters of Pure Mysore (PM) and $CSR_2$ silkworm breeds as influenced by

integrated organic based nitrogen management of mulberry are presented in Tables 1 to 2.

The grownup larval weight of both PM and $CSR_2$ breeds differed significantly among different treatments (Table 1). The larvae of PM and $CSR_2$ fed on mulberry leaves raised through the application of biofertilizers @ 10 kg/ha each of *Azospirillum brasilense* + *Aspergillus awamori* + 20 per cent recommended nitrogen each through compost, vermicompost, green manure, castor oil cake and 20 per cent N and recommended dose of P and K through inorganic fertilizers ($T_4$) exhibited maximum grownup larval weight (1.824 and 3.911g) followed by $T_5$ (recommended 20 tonnes FYM / ha / year + 300: 120: 120 NPK kgs / ha / year through inorganic fertilizers), ( 1.803 and 3.755g. The increased larval weight might be due to the fact that the application of different sources of organic manures might have influenced the uptake of macro and secondary nutrients, which inturn increased the leaf quality which enhanced the growth and development of silkworms resulting in higher larval weight (Shankar, 1990; Shivaprakash, 1991; Siddappakore, 1992).

The grownup larval volume did not vary significantly among the treatments in both PM and $CSR_2$ breeds (Table 1). However, the larval volume was maximum (7.34 and 12.47 ml / 5 worms) in larvae fed with mulberry leaves from the plot applied with biofertilizers @ 10 kg/ha each of *Azospirillum brasilense* + *Aspergillus awamori* + 20 per cent recommended nitrogen each through compost, vermicompost, green manure, castor oil cake and 20 per cent N and recommended dose of P and K through inorganic fertilizers ($T_4$) followed by recommended 20 tonnes FYM / ha / year + 300: 120: 120 NPK kgs / ha / year through chemical fertilizers ($T_5$), (7.31 and 12.46 ml/5 worms). The findings are clear indicative of the fact that, male and female worms require differential nutrition in order to obtain healthy growth and development of worms. It can be further concluded that female moths require more carbohydrates in order to accumulate adequate energy to distribute among the newly formed eggs.

Significantly maximum ERR and lower disease incidence was observed when the larvae of PM and $CSR_2$ were fed on mulberry leaves obtained with the application of biofertilizers @ 10 kg/ha each of *Azospirillum brasilense* + *Aspergillus awamori* + 20 per cent recommended nitrogen each through compost, vermicompost, green manure, castor oil cake and 20 per cent N and recommended dose of P and K through inorganic fertilizers ($T_4$) (96.81 and 96.38%, 2.89 and 3.32% respectively) followed by recommended 20 tonnes FYM / ha / year + 300: 120: 120 NPK kgs / ha / year through chemical fertilizers ($T_5$) (96.32 and 94.43 %, 3.38 and 5.27 % respectively). Increase in ERR and lower disease incidence might be due to application of different types of organic manures, for nitrogen management in particular, bio-inoculants and chemical fertilizers at recommended dose, might have increased soil fertility and productive potentiality. (Shankar, 1990; Siddappakore, 1992; Ravikumar *et al*., 2005). The above observations are in harmony with the results of Jadhav (1994), who reported maximum ERR and less disease incidence when silkworm fed with mulberry leaves raised with the application of vermicompost @ 5 MT/ha. Likewise, Fathima *et al*. (1996) and Philomena *et al.* (2003) have observed higher ERR in silkworms fed on mulberry leaves which were grown by applying lower dose of inorganic fertilizer with higher dose of organic manures.

Among different treatments, significantly higher cocoon yield in PM and $CSR_2$ was obtained, when fed on the mulberry leaves obtained by the application of biofertilizers @ 10 kg/ha each of *Azospirillum brasilense* + *Aspergillus awamori* + 20 per cent recommended nitrogen each through compost, vermicompost, green manure, castor oil cake and 20 per cent N through inorganic fertilizers with recommended dose of P and K through inorganic fertilizers ($T_4$) (43.59 and 70.29 kg/100 DFLs) followed by recommended 20 tonnes FYM / ha / year + 300: 120: 120 NPK kgs / ha / year through chemical fertilizers ($T_5$) (41.32 and 65.14 kg/100 DFLs). This may be due to increase in the quality of mulberry leaves which might have enhanced palatability and acceptability of leaves, which lead to increased feeding efficiency of silkworm and thereby resulting in good cocoon yield.

Larval duration of silkworm as influenced by feeding mulberry leaf produced through organic based integrated nitrogen management differed significantly (Table 2). The chawki duration varied significantly among the different treatments in both PM and $CSR_2$ breeds. Significantly, shorter chawki duration (246.38 and 232.75 h, respectively), fifth instar duration (173.73 and 165.90h), total moulting duration (100.65 and 105.67 h) and total larval duration (651.79 and 615.75 h) were recorded in PM and $CSR_2$, when reared on mulberry leaves obtained by the application of biofertilizers @ 10 kg/ha each of *Azospirillum brasilense* + *Aspergillus awamori* + 20 per cent recommended nitrogen each through compost, vermicompost, green manure, castor oil cake and 20 per cent N with recommended dose of P and K through inorganic fertilizers ($T_4$), followed by recommended 20 tonnes FYM / ha / year + 300: 120: 120 NPK kgs / ha / year through chemical fertilizers ($T_5$) (251.30 and 237.41 h, 177.20 and 169.22 h, 102.67 and 107.78 h, 664.82 and 628.06 h, respectively). This might be due to the presence of required nutrients supplied through feeding of chawki worms with $S_{36}$ leaf. The increased larval weight might be due to the fact that the application of different types of organic manures might have influenced the uptake of macro and secondary nutrients, which inturn increased the leaf quality. Thus, enhancing the growth and development of silkworms resulting in higher larval weight (Shankar, 1990; Shivaprakash, 1991; Siddappakore, 1992). Shortest larval duration which may be due to fact that, balanced nutritional status of the leaves which enabled the worms to mature early due to the faster metabolic activity (Horie *et al.,* 1967). It is clear that, leaves from FYM with recommended NPK had higher calcium and magnesium content, which might have accelerated the growth of the silkworm. The shorter larval durations corresponding to all the 'N' sources may be attributed to the fact that these leaves might have fulfilled the nutritional requirements of silkworm both qualitatively and quantitatively, thereby contributing for reduction of larval durations compared to other treatments.

## CONCLUSION

The present findings clearly indicated the fact that, it is always better to integrate organic based nitrogen management with fertilizers to supply P and K to mulberry. However, the application of nutrients to the mulberry by more of organic sources recorded healthy growth and development of worms which leads to higher larval weight and shorter larval duration rather going for only inorganic sources of nutrient.

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**TABLE 1:** Larval parameters of silkworm as influenced by feeding mulberry leaves produced through organic based integrated nitrogen management

| Treatments | Chawki duration (h) | | Fifth instar larval duration (h) | | Total moulting duration (h) | | Total larval duration (h) | |
|---|---|---|---|---|---|---|---|---|
| | PM | CSR2 | PM | CSR2 | PM | CSR2 | PM | CSR2 |
| $T_1$ | 261.16 | 246.72 | 184.15 | 175.85 | 106.69 | 112.01 | 690.90 | 652.69 |
| $T_2$ | 258.69 | 244.39 | 182.41 | 174.19 | 105.69 | 110.95 | 684.38 | 646.53 |
| $T_3$ | 256.23 | 242.06 | 180.68 | 172.54 | 104.68 | 109.90 | 677.86 | 640.38 |
| $T_4$ | 246.38 | 232.75 | 173.73 | 165.90 | 100.65 | 105.67 | 651.79 | 615.75 |
| $T_5$ | 251.30 | 237.41 | 177.20 | 169.22 | 102.67 | 107.78 | 664.82 | 628.06 |
| $T_6$ | 263.62 | 249.05 | 185.89 | 177.51 | 107.70 | 113.07 | 697.41 | 658.85 |
| F - test | * | * | * | * | * | * | * | * |
| SEm ± | 0.795 | 0.857 | 0.802 | 0.793 | 0.800 | 1.202 | 2.103 | 2.267 |
| CD at 5% | 2.380 | 2.565 | 2.400 | 2.380 | 2.390 | 3.599 | 6.296 | 6.787 |

* : Significant at 5%
NS : Non- Significant
Figures in the parentheses are angular transformed values.

| Treatments | Grownup larval weight (g) | | Grownup larval volume (ml/5 worms) | | Effective rate of rearing (%) | | Disease incidence (%) | | Cocoon yield (kg / 100 DFLs) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | PM | CSR2 | PM | CSR2 | PM | CSR2 | PM | CSR2 | PM | CSR2 |
| $T_1$ | 1.626 | 3.520 | 7.24 | 12.44 | 94.89 (73.10) | 91.57 (76.91) | 4.82 (12.66) | 8.13 (16.56) | 33.90 | 55.89 |
| $T_2$ | 1.703 | 3.598 | 7.30 | 12.45 | 95.34 (74.10) | 92.48 (77.52) | 4.36 (12.03) | 7.22 (15.58) | 35.85 | 59.05 |
| $T_3$ | 1.788 | 3.677 | 7.30 | 12.46 | 95.83 (75.23) | 93.52 (78.19) | 3.87 (11.33) | 6.18 (14.38) | 37.58 | 62.37 |
| $T_4$ | 1.824 | 3.911 | 7.34 | 12.47 | 96.81 (79.02) | 96.38 (79.70) | 2.89 (9.76) | 3.32 (10.47) | 43.59 | 70.29 |
| $T_5$ | 1.803 | 3.755 | 7.31 | 12.46 | 96.32 (76.33) | 94.43 (78.93) | 3.38 (10.57) | 5.27 (13.26) | 41.32 | 65.14 |
| $T_6$ | 1.612 | 3.442 | 7.23 | 12.42 | 94.43 (72.14) | 90.63 (76.33) | 6.15 (14.20) | 9.08 (17.52) | 32.59 | 53.38 |
| F - test | * | * | NS | NS | * | * | * | * | * | * |
| SEm ± | 0.003 | 0.016 | - | - | 0.248 | 0.282 | 0.310 | 0.233 | 0.592 | 0.344 |
| CD at 5% | 0.009 | 0.048 | - | - | 0.742 | 0.696 | 0.928 | 0.696 | 1.845 | 1.071 |

**TABLE 2:** Larval duration of silkworm as influenced by feeding mulberry leaves produced through organic based integrated nitrogen management

* : Significant at 5%
NS : Non- Significant