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# SIGNIFICANCE OF FEEDING MULBERRY LEAF IN DIFFERENT SCHEDULES RAISED THROUGH ORGANIC BASED NUTRIENT MANAGEMENT ON THE BODY WEIGHT OF YOUNG-AGE WORMS

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**ABSTRACT**
Investigations were carried out on young-age worm rearing as influenced by the application of N through organic manures and inorganic fertilizers. Significant differences were exerted with respect to feeding schedules (FS), treatments (T) and interactions (FS × T). Among these $FS_2$ (Chawki worms fed with $S_{36}$ leaf + Late-age worms fed with $M_5$ leaf) and $T_{12}$ Recommended 20 tonnes compost + 300: 120: 120 kg N, P and K / ha / year through fertilizer yielded significantly higher first instar (0.0571 and 0.0615 g/10 larvae), second instar (0.3126 and 0.3210 g/10 larvae), third instar (1.177 and 1.2167 g/10 larvae) and fourth instar larval weights (5.103 and 5.502 g/10 larvae) respectively. Among interactions, $FS_1T_{11}$ (Both chawki + Late-age worms fed with $S_{36}$ leaf Bio-fertilizers 10 kg each of *Azospirillum* + *Aspergillus awamori*/ha/yr + 20 % recommended N through each of Compost, Green manure, Castor oil cake, vermicompost and fertilizer + remaining P, K through fertilizer recorded maximum towards first instar silkworm weight (0.0660 g/10 larvae). $FS_2T_{12}$ (Chawki worms fed with $S_{36}$ leaf + Late-age worms fed with $M_5$ leaf with a combination of Recommended 20 tonnes compost + 300: 120: 120 kg N, P and K / ha / year through fertilizer contributed more towards second, third and fourth instar larval weights (0.3280, 1.2260 and 5.523 g/10 larvaes respectively).

**KEY WORDS:** Feeding schedules, Mulberry, Silkworms, Nutrients, Organic and Inorganic Fertilizers, Silkworm weights.

## INTRODUCTION

The silkworm *Bombyx mori* L. being a monophagous insect, derives almost all the nutrients required for its growth and development from the mulberry leaf itself. Increased production of quality leaves for feeding silkworms through mineral supplimentation play a vital role in the larval development and cocoon characters Horie (1967). However, the inorganic nutrition through application of fertilizers increases the mulberry growth and yield, but does not ensure the quality of leaves. Hence, the nutrient management systems for getting nutritious leaf through organic manures is to be ensured for the better growth and development of plants. Further, there are distinct differences in the quality and quantity requirement of leaves for young and late age worms which is greatly influenced by the varieties and nutritional quality of mulberry leaf used as feed. Therefore, an investigation under taken with a view to study the effect of feeding mulberry leaf in different schedules raised through organic based nutrient management on the body weight of young age worms.

## MATERIALS & METHODS

A research study was under taken at Main Research Station, Hebbal, UAS, Bangalore to work out the influence of feeding mulberry leaf raised through the application of recommended quantity of N through different organic and inorganic sources on late age worm rearing. Silkworm feeding with two different mulberry varieties ($S_{36}$ and $M_5$) in four feeding schedules (FS) viz., $FS_1$ (chawki worms fed with $S_{36}$ leaf + late age worms fed with $S_{36}$ leaf), $FS_2$ (chawki worms fed with $S_{36}$ leaf + late age worms fed with $M_5$ leaf), $FS_3$ (chawki worms fed with $M_5$ leaf + late age worms fed with $S_{36}$ leaf) and $FS_4$ (chawki worms fed with $M_5$ leaf + late age worms fed with $M_5$ leaf) respectively. The leaves of two different mulberry varieties grown under different treatments viz.,

| | | |
|---|---|---|
| **$T_1$** | **:** | 100 % recommended N through Compost |
| **$T_2$** | **:** | 50 % recommended N through Compost + 50 % recommended N and remaining P, K through fertilizer |
| **$T_3$** | **:** | 100 % recommended N through Green manure (*Glyricidia maculata*) |
| **$T_4$** | **:** | 50 % recommended N through Green manure + 50 % recommended N and remaining P, K through Fertilizer |
| **$T_5$** | **:** | 100 % recommended N through Castor oil cake |
| **$T_6$** | **:** | 50 % recommended N through Castor oil cake + 50 % recommended N and remaining P, K through Fertilizer |

| | | |
|---|---|---|
| **$T_7$** | **:** | 35 % recommended N through Compost + 30 % recommended N through Castor oil cake + 35 % recommended N through Green manure |
| **$T_8$** | **:** | 100 % recommended N through Vermicompost |
| **$T_9$** | **:** | 50 % recommended N through Vermicompost + 50 % recommended N and remaining P, K through Fertilizer |
| **$T_{10}$** | **:** | Bio-fertilizers 10 kg each of *Azospirillum* + *Aspergillus awamori*/ha/yr + 25% recommended N through each of Compost, Green manure, Castor oil cake and vermicompost |
| **$T_{11}$** | **:** | Bio-fertilizers 10 kg each of *Azospirillum* + *Aspergillus awamori*/ha/yr + 20 % recommended N through each of Compost, Green manure, Castor oil cake, vermicompost and fertilizer + remaining P, K through fertilizer |
| **$T_{12}$ (control)** | **:** | Recommended 20 tonnes compost + 300: 120: 120 kg N, P and K / ha / year through fertilizer |
| **$T_{13}$ (control)** | **:** | Only fertilizer 300: 120: 120 kg of N, P and K / ha / year |

The experiment was conducted with 13 treatments and 3 replications. In each replication 100 worms were maintained. The $CSR_2$ worms were reared as per package of practices published by Dandin *et al.* (2014). The data was analyzed statistically by using two way factorial RCBD as outlined by Cochron and Cox (2000).

## RESULTS

The results on the mulberry raised through organic based nutrient management fed through different feeding schedules on the growth and young age silkworms are tabulated in tables 1 and 2 and are interpreted in the light of earlier work. Significant differences were observed for first instar silkworm weight, being highest in $T_{11}$ Bio-fertilizers 10 kg each of *Azospirillum* + *Aspergillus awamori*/ha/yr + 20 % recommended N through each of Compost, Green manure, Castor oil cake, vermicompost and fertilizer + remaining P, K through fertilizer (0.0642 g/10 larvae) followed by $T_{10}$ Bio-fertilizers 10 kg each of *Azospirillum* + *Aspergillus awamori*/ha/yr + 25% recommended N through each of Compost, Green manure, Castor oil cake and vermicompost (0.0631 g/10 larvae) and other treatments differed significantly from each other with respect to silkworm weight. Second, third and fourth instar larval weights were significantly maximum in $T_{12}$ Recommended 20 tonnes compost + 300: 120: 120 kg N, P and K / ha / year through fertilizer (0.321, 1.216 and 5.502 g/10 larvae) respectively followed by $T_{11}$ (0.317, 1.201 and 5.489 g/10 larvae respectively) (Table 1 &2). Feeding schedules ($FS_2$) resulted in significantly maximum first instar (0.0571 g/10 larvae), second instar (0.3126 g/10 larvae), third instar (1.1776 g/10 larvae) and fourth instar (5.106 g/10 larvae) larval weight. Hence, feeding of chawki worms with $S_{36}$ leaf and late age worms with $M_5$ leaf has increased the rearing parameters of the silkworm. The increased larval weight recorded in $FS_2$ might be due to the suitability of $S_{36}$ leaf for young-age worm growth.

Among interactions, $FS_1T_{11}$ (Chawki worms + Late-age worms fed with $S_{36}$ leaf along with combination of Bio-fertilizers 10 kg each of *Azospirillum* + *Aspergillus awamori*/ha/yr + 20 % recommended N through each of Compost, Green manure, Castor oil cake, vermicompost and fertilizer + remaining P, K through fertilizer recorded maximum towards first instar silkworm weight (0.0660 g/10 larvae). $FS_2T_{12}$ (Chawki worms fed with $S_{36}$ leaf + Late-age worms fed with $M_5$ leaf with a combination of Recommended 20 tonnes compost + 300: 120: 120 kg N, P and K / ha / year through fertilizer contributed more towards second, third and fourth instar larval weight (0.3280, 1.2260 and 5.523 g/10 larvae respectively).

## DISCUSSION

This increased larval weight may be due to the worm rearing with leaf obtained through the application of compost, other organic manures and bioinoculants, which improved larval weights. The present findings were found to be in conformity with the results of Jadhav *et al*. (2000) and Kherdekar *et al*. (2000), who reported increased larval weights with the application of fertilizers and vermicompost for mulberry garden. Further, the increased larval weight are also due to the improvement in leaf quality through the uptake of macro and secondary nutrients, which in turn has enhanced the growth and development of silkworms, resulting in higher larval weight (Shankar (1990); Siddappakore (1992)).

Thus the increased body weight of the worms might be due to the presence of required nutrients, which are supplied through the feeding of chawki worms with $S_{36}$ leaf and late age worm with $M_5$ leaf. However, there is no such similar work was conducted earlier. The nutritional requirements of the silkworm vary according to their stages of growth and it depends on the nutritional status of mulberry leaves Bose (1991). The study revealed that chawki worms fed with $S_{36}$ leaf and late-age worms fed with $M_5$ leaf ($FS_2$) stood top for getting higher body weight with respect of first, second, third and fourth instar.

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## REFERENCES

Bose, P. C. (1991) Nutrition management for sericulture industry. In "*Non-Traditional Sectors for Fertilizer Use*". (Ed.H.L.S.Tradon), Fertilizer Development and Consultation Organisation, New Delhi, India, pp. 94-105.

Cochran and Cox. (2000) *Experimental Design Procedures for the Behavioural Sciences*, Cole Publishing Company, pp. 319-380.

Dandin, S. B., Jayant Jayaswal and Giridhar, K. (2014) *Handbook of Sericulture Technologies*, CSB, Bangalore, pp.346-373.

Horie, Y., Watanabe, K. and Ito, T. (1967) Nutrition of silkworm (*Bombyx mori*)–XVIII. Quantitative requirements for potassium, phosphorus, magnesium and zinc. *Bull. Seri. Expt. Stn*., **22**: 181-183.

Jadhav, S. N., Patil, G. M. and Giraddi, R. S. (2000) Effect of organic and in-organic manures and their combinations on M-5 mulberry and its impact silkworm productivity. *Karnataka J. Agri. Sci*., **13**: pp. 744-749.

Kherdekar, R. C., Munde, A. T., Neharkar,. P. S., Sonkamable, M. (2000) Effect of fertilizers on foliage yield of mulberry, *Morus alba* L. and economic traits of silkworm, *Bombyx mori* L. *J. Soil. Crops.*, **10**: 221-225.

Shankar, M. A. (1990) Nutritional management of mulberry and effect on silkworm growth, development and silk quality. Ph.D. Thesis, UAS, Bangalore, P. 410.

Siddappakore. (1992) Effect of different sources of organic manures on yield and quality of mulberry in relation to young silkworm rearing. *M.Sc. (Seri.) Thesis*, UAS, Bangalore, P.120.

**TABLE 1:** I$^{st}$ instar and II$^{nd}$ instar silkworm weight (g/10 larvae) as influenced by feeding of leaf obtained by application of N through different sources of organic manures and inorganic fertilizers

| Treatments (T) | I$^{st}$ and II$^{nd}$ instar silkworm weight (g/10 larvae) | | | | | | | | Mean (T) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Feeding Schedules (FS) | | | | | | | | | |
| | $FS_1$ | | $FS_2$ | | $FS_3$ | | $FS_4$ | | | |
| | I instar | II instar | I instar | II instar | I instar | II instar | I instar | II instar | I instar | II instar |
| $T_1$ | 0.0563 | 0.3073 | 0.0563 | 0.3073 | 0.0533 | 0.3053 | 0.0540 | 0.3043 | 0.0550 | 0.3061 |
| $T_2$ | 0.0530 | 0.3083 | 0.0543 | 0.3093 | 0.0500 | 0.3053 | 0.0513 | 0.3053 | 0.0522 | 0.3071 |
| $T_3$ | 0.0523 | 0.3063 | 0.0523 | 0.3053 | 0.0483 | 0.3023 | 0.0490 | 0.3033 | 0.0505 | 0.3043 |
| $T_4$ | 0.0550 | 0.3090 | 0.0553 | 0.3110 | 0.0503 | 0.3053 | 0.0513 | 0.3063 | 0.0530 | 0.3079 |
| $T_5$ | 0.0530 | 0.3063 | 0.0530 | 0.3063 | 0.0493 | 0.3033 | 0.0493 | 0.3023 | 0.0512 | 0.3046 |
| $T_6$ | 0.0603 | 0.3150 | 0.0603 | 0.3130 | 0.0563 | 0.3103 | 0.0583 | 0.3110 | 0.0588 | 0.3123 |
| $T_7$ | 0.0543 | 0.3143 | 0.0550 | 0.3130 | 0.0510 | 0.3073 | 0.0500 | 0.3073 | 0.0526 | 0.3105 |
| $T_8$ | 0.0533 | 0.3133 | 0.0540 | 0.3130 | 0.0500 | 0.3080 | 0.0503 | 0.3083 | 0.0519 | 0.3107 |
| $T_9$ | 0.0593 | 0.3150 | 0.0590 | 0.3170 | 0.0593 | 0.3130 | 0.0603 | 0.3113 | 0.0595 | 0.3141 |
| $T_{10}$ | 0.0640 | 0.3170 | 0.0640 | 0.3190 | 0.0620 | 0.3123 | 0.0623 | 0.3130 | 0.0631 | 0.3153 |
| $T_{11}$ | 0.0660 | 0.3190 | 0.0653 | 0.3220 | 0.0620 | 0.3150 | 0.0633 | 0.3150 | 0.0642 | 0.3178 |
| $T_{12}$ | 0.0620 | 0.3260 | 0.0623 | 0.3280 | 0.0603 | 0.3150 | 0.0613 | 0.3150 | 0.0615 | 0.3210 |
| $T_{13}$ | 0.0503 | 0.2990 | 0.0510 | 0.2990 | 0.0453 | 0.2930 | 0.0463 | 0.2930 | 0.0483 | 0.2960 |
| Mean (S) | 0.0569 | 0.3120 | 0.0571 | 0.3126 | 0.0537 | 0.3074 | 0.0544 | 0.3074 | | |

**TABLE 3:** Effect of different treatments on the population of *Chrysoperla* eggs and grubs in okra

| | Feeding Schedules (FS) | | Treatments (T) | | Interactions (FS × T) | |
|---|---|---|---|---|---|---|
| | I instar | II instar | I instar | II instar | I nstar | II instar |
| F-Test | * | * | * | * | * | * |
| SEm ± | 0.0002 | 0.0001 | 0.0003 | 0.0002 | 0.0005 | 0.0005 |
| CD at 5 % | 0.0004 | 0.0004 | 0.0008 | 0.0007 | 0.0015 | 0.0014 |

Note: FS1 : Chawki worms fed with S36 leaf + Late age worms fed with S36 leaf

FS2 : Chawki worms fed with S36 leaf + Late age worms fed with M5 leaf

FS3 : Chawki worms fed with M5 leaf + Late age worms fed with S36 leaf

FS4: Chawki worms fed with M5 leaf + Late age worms fed with M5 leaf

**TABLE 2:** III[rd] instar and IV[th] instar silkworm weight (g/10 larvae) as influenced by feeding of leaf obtained by application of N through different sources of organic manures and inorganic fertilizers

| Treatments (T) | III[rd] and IV[th] instar silkworm weight (g/10 larvae) | | | | | | | | Mean (T) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Feeding Schedules (FS) | | | | | | | | | |
| | $FS_1$ | | $FS_2$ | | $FS_3$ | | $FS_4$ | | | |
| | III instar | IV instar | III instar | IV instar | III instar | IV instar | III instar | IV instar | III instar | IV instar |
| $T_1$ | 1.1260 | 4.804 | 1.1320 | 4.813 | 1.1190 | 4.807 | 1.1230 | 4.812 | 1.1250 | 4.809 |
| $T_2$ | 1.1380 | 4.820 | 1.1470 | 4.830 | 1.1340 | 4.811 | 1.1350 | 4.814 | 1.1385 | 4.818 |
| $T_3$ | 1.1440 | 4.828 | 1.1447 | 4.844 | 1.1390 | 4.811 | 1.1420 | 4.807 | 1.1424 | 4.822 |
| $T_4$ | 1.1660 | 4.985 | 1.1700 | 4.907 | 1.1490 | 4.983 | 1.1640 | 4.982 | 1.1623 | 4.964 |
| $T_5$ | 1.1747 | 4.905 | 1.1720 | 4.913 | 1.1690 | 4.897 | 1.1760 | 4.899 | 1.1729 | 4.903 |
| $T_6$ | 1.1850 | 5.252 | 1.1920 | 5.264 | 1.1850 | 5.255 | 1.1850 | 5.256 | 1.1868 | 5.256 |
| $T_7$ | 1.1770 | 5.105 | 1.1810 | 5.167 | 1.1810 | 5.106 | 1.1840 | 5.103 | 1.1808 | 5.120 |
| $T_8$ | 1.1810 | 5.116 | 1.1850 | 5.189 | 1.1740 | 5.112 | 1.1760 | 5.111 | 1.1790 | 5.132 |
| $T_9$ | 1.1950 | 5.349 | 1.2010 | 5.372 | 1.1930 | 5.355 | 1.1930 | 5.354 | 1.1955 | 5.357 |
| $T_{10}$ | 1.1960 | 5.356 | 1.2170 | 5.385 | 1.1910 | 5.362 | 1.1950 | 5.360 | 1.1998 | 5.365 |
| $T_{11}$ | 1.2000 | 5.483 | 1.2187 | 5.513 | 1.1920 | 5.482 | 1.1930 | 5.481 | 1.2009 | 5.489 |
| $T_{12}$ | 1.2357 | 5.499 | 1.2260 | 5.523 | 1.2040 | 5.492 | 1.2010 | 5.496 | 1.2167 | 5.502 |
| $T_{13}$ | 1.1070 | 4.643 | 1.1230 | 4.656 | 1.1150 | 4.652 | 1.1150 | 4.649 | 1.1150 | 4.650 |
| Mean (S) | 1.1712 | 5.088 | 1.1776 | 5.106 | 1.1650 | 5.086 | 1.1678 | 5.086 | | |

| | Feeding Schedules (FS) | | Treatments (T) | | Interactions (FS × T) | |
|---|---|---|---|---|---|---|
| | III instar | IV instar | III instar | IV instar | III instar | IV instar |
| F-Test | * | * | * | * | * | * |
| SEm ± | 0.0013 | 0.0001 | 0.0024 | 0.0003 | 0.0048 | 0.0005 |
| CD at 5 % | 0.0037 | 0.0004 | 0.0066 | 0.0007 | 0.0132 | 0.0015 |

Note: $FS_1$ : Chawki worms fed with $S_{36}$ leaf + Late age worms fed with $S_{36}$ leaf

$FS_2$ : Chawki worms fed with $S_{36}$ leaf + Late age worms fed with $M_5$ leaf

$FS_3$ : Chawki worms fed with $M_5$ leaf + Late age worms fed with $S_{36}$ leaf

$FS_4$: Chawki worms fed with $M_5$ leaf + Late age worms fed with $M_5$ leaf