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INVESTIGATION ON THE SOURCES OF ORGANICS FOR MULBERRY AND ITS IMPACT ON QUANTITATIVE TRAITS OF THE SILKWORM, *Bombyx mori* L.

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ABSTRACT
The experiment was conducted to know the efficacy of sources of organic manures (vermicompost, enriched vermicompost, farm yard manure - FYM, coir pith compost, urban solid waste compost and biodigested slurry) on mulberry (V-1 variety) under irrigated condition to meet nitrogen requirement (100%) and its influence was studied on economic performance of PM x CSR-2 silkworm during 2004-05. The study revealed that the batch of silkworms fed on mulberry leaves raised by supplying 100% nitrogen (N) through vermicompost and recommended phosphorus (P) and potassium (K) through chemical fertilizers recorded significantly superior effective rate of rearing, cocoon yield, cocoon weight, shell weight, shell ratio, silk productivity, single cocoon filament length and fibroin contents with least larval duration, disease incidence (muscardine, flacherie and grasserie), denier and sericin contents. Further, enriched vermicompost + recommended P and K and recommended FYM and NPK found next best with respect to the economic traits of silkworm. However, these characters were inferior with the group of silkworms fed on mulberry grown by the application of coir pith compost and recommended P and K. The details are discussed.

KEYWORDS: Organics, Mulberry, *Bombyx mori* L. Economic characters

INTRODUCTION

Mulberry, the sole food plant of silkworm, *Bombyx mori* L. plays vital role in the growth and development of silkworm and inturn the silk production. Leaf quality and quantity not only influence the silkworm growth and development, but also the cocoon production, quantity and quality of raw silk. Nearly 70 per cent of silk protein produced by silkworm is derived directly from proteins of mulberry leaves. According to Miyashita (1986), mulberry leaf contributes to an extent of 38.20 per cent for successful cocoon crop production. Yield and quality of mulberry leaf are influenced by agronomic practices such as spacing, irrigation, fertilizer schedules and pruning practices apart from mulberry variety and environmental conditions viz., season, temperature, humidity, duration of sunshine hours, soil type, etc. Introduction of high yielding mulberry varieties and high intensity cropping system initiated to meet the increased demand for leaf with high nutritive value for feeding the silkworm. This has increased the demand for associated inputs like organic manure and inorganic fertilizers which are costly inputs in addition to irrigation. Some of these practices cause quick exhaustion of soil nutrients, if timely care is not taken to replenish the same. Proper soil management is the pre-requisite for soil health to achieve higher sericultural productivity.

Though fertilizers are obviously linked with countries goal of stepping up of silk productivity per unit area, they along with other agro-chemicals have been used indiscriminately in the present farming system causing a threat to the sustainability of our seri-ecosystem. Having achieved sound results from these inputs earlier, the farmers have resorted to their indiscriminate use, particularly of nitrogenous fertilizers, at the same time neglecting the use of organic manures. Unilateral usage of heavy doses of chemical fertilizers upset the availability of different plant nutrients and resulted in widespread deficiencies in mulberry field including micronutrients (Krishna and Bongale, 2001). Though, modern farming system seems to be good on short-term economics, it may prove devastating on long-term basis. The increased use of chemical inputs may not be amenable for long-term sericultural development, which necessitates investigating alternate production methods. Eco-friendly approach based on accountability, affordability and availability will be a critical factor in meeting basic requirement of sericulture industry. Several recent studies have indicated that yields from organic production are comparable to conventional systems, especially over the long term. Hence, the study was undertaken and the results are reported in this paper.

MATERIALS AND METHODS

A study was conducted to know the efficacy of sources of organic manures (vermicompost, enriched vermicompost, farm yard manure - FYM, coir pith compost, urban solid waste compost and biodigested slurry) on established irrigated V-1 mulberry in the farmers field of Balagere village, Chintamani taluk, Kolar district based on the performance of silkworm. The plots of 5 x 4 m with planting space of 0.9 x 0.9 m with red sandy loam soil were selected for the study. The organic manures were applied to meet 100% nitrogen requirement, while phosphorus and potassium were applied through chemical sources viz., single super phosphate and muriate of potash, respectively @ 340:140:140 NPK kg/ha/year. Soil of the

experimental site was subjected for chemical analysis as per the procedure of Jackson (1973). The pH of the soil was 6.68 and organic carbon, N, P and K contents were 0.52%, 242.75 kg/ha, 22.13 kg/ha and 132.46 kg/ha, respectively. The experiment was laid out in Randomized Complete Block Design with three replications. Silkworm feeding trials were conducted using cross breed (PM x CSR-2) silkworm. The leaves grown under different treatments were fed to silkworm from first day till spinning. Two hundred worms were maintained in each replication in individual treatment by adopting Complete Randomized Design. The package of practices for mulberry production and silkworm rearing were followed as per the methods described by Dandin *et al*. (2003). Observations such as larval parameters (mature larval weight, fifth instar and total larval duration), disease incidence (muscardine, flacherie and grasserie), rearing parameters (effective rate of rearing, cocoon yield and silk productivity), cocoon parameters (cocoon weight, shell weight and shell ratio) and post-cocoon parameters (filament length, denier, fibroin and sericin) were recorded. Further, leaves grown under treatments were analysed to establish the relationship between foliar constituents and economic parameters of silkworm.

Data recorded on silkworm was analysed statistically (Complete Randomized Design) for test of significance using Fisher's method of "Analysis of Variance" as outlined by Sundararaj *et al*. (1972). The level of significance of 'F-test' was tested at 5 per cent. In order to know the relationship between the foliar constituents of mulberry with rearing, cocoon and grainage traits, the correlation co-efficients were worked out at P=0.05 as per the procedure outlined by Snedecor and Cochran (1979).

RESULTS AND DISCUSSION

The results on the influence of varied sources of organics on mulberry and its influence on the performance of silkworm (Tables 1-2) are discussed in the light of earlier works along with correlation co-efficients between foliar constituents of mulberry and economic parameters of silkworm hereunder.

Larval Parameters

Larval traits viz., mature larval weight, fifth instar and total larval durations differed considerably when worms fed on mulberry grown by the application of varied sources of organic manures. Mature larval weight was significantly highest with enriched vermicompost (100% N) + recommended P and K (38.38 g/10), while fifth instar and total larval durations were least with vermicompost (100% N) + recommended P and K (7.17 and 25.13 days). However, these traits were inferior with coir pith compost (100% N) + recommended P and K and FYM (100% N) + recommended P and K. The mature larval weight exhibited significant positive relationship with foliar constituents viz., crude protein, chlorophyll 'a', 'b' and total chlorophyll, nitrogen, phosphorus, calcium, magnesium and sulphur, while the trend was negative between total larval duration with these constituents. The foliar constituents raised under varied sources of organic manures had negative non-significant relationship with disease incidence except for total carbohydrates, which was significant.

Disease Incidence

The incidence of diseases *viz*., muscardine, flacherie and grasserie varied much among the batches of silkworms fed on mulberry raised by the application of different sources of organic manures under irrigated condition. Significantly lowest incidence of muscardine (1.00%), flacherie (2.00%), grasserie (1.25%) and total incidence of disease (4.25%) were noticed with vermicompost (100% N) + recommended P and K. However, the remaining sources of organic manures favoured higher incidence of diseases.

Rearing Parameters

Statistical variations were observed among the sources of organic manures when applied to mulberry in respect of rearing traits. The rearing performance was superior when the group of silkworms fed on mulberry raised by supplementing with vermicompost (100% N) + recommended P and K in respect of ERR (94.00%), cocoon yield (67.06 kg/100DFLs) and silk productivity (4.74 cg/day) over rest of the sources of organic manures. However, all these traits were inferior with coir pith compost (100% N) + recommended P and K (85.48%, 57.63 kg and 3.53 cg, respectively). The foliar constituents of mulberry showed marked positive influence on rearing parameters viz., ERR, cocoon yield and silk productivity except with leaf moisture and total carbohydrates which had non-significant effect on the rearing performance in PM x CSR-2 silkworm.

Feeding silkworms with mulberry raised by applying 50% N through FYM and 50% N through urea, 50% N through green leaf manure and 50% N through urea and 50% N through castor cake + 50% N through urea recorded higher larval weight in all the instars, higher ERR and least disease incidence. However, feeding silkworms with leaf obtained by application of 50% N through FYM and 50% N through urea recorded higher cocoon weight, shell weight and shell ratio in CSR-2 x CSR-4 silkworm breed (Ravikumar, 2003). As reported by Das *et al*. (2002) silkworm rearing using the leaf obtained by application of vermicompost revealed no significant difference in the larval weight while effective rate of rearing by number and by weight, cocoon weight, shell weight and shell percentage were significantly improved suggesting the enhanced leaf quality when vermicompost was used as a manurial source.

Cocoon Parameters

The cocoons spun by the silkworms fed on mulberry obtained by supplying the crop with different sources of organic manures had notable influence on cocoon traits. Significantly highest cocoon weight, shell weight and shell ratio were encountered with vermicompost (100% N) + recommended P and K (1.82g, 0.34g and 18.68%). However, cocoon traits were inferior with coir pith compost (100% N) + recommended P and K (1.72, 0.29 and 16.86%, respectively). The study on correlation between cocoon parameters with foliar constituents of mulberry revealed that majority of the nutrients favoured for improvement of cocoon traits excepting leaf moisture and total carbohydrates. The silkworm rearing with mulberry leaves obtained by application of FYM and vermicompost revealed cocoon yield improvement in vermicompost (61.80 kg / 100DFL's) followed by FYM (54.14 kg/100DFL's). This clearly indicated that the mulberry leaves of vermicmpost applied plots have more

nutrient value than that of other treatments which inturn influences the silkworm cocoon quality (Krishna Rao *et al*., 2005).

Post - Cocoon Parameters

Marked impact was exerted on post – cocoon parameters among the batches of silkworms fed on mulberry raised with the application of varied sources of organic manures. The post – cocoon parameters were significantly more in vermicompost (100% N) + recommended P and K with respect to single cocoon filament length (820.87 m) and fibroin (78.16%) with thin denier (2.13) and sericin (20.64%). On the other hand, these characters were inferior with coir pith compost (100% N) + recommended P and K (815.82 m, 75.46, 2.51 and 23.45%) over the other sources of organic manures. Among the post-cocoon parameters single cocoon filament length in PM x CSR-2 showed significant positive relationship with leaf constituents viz., crude protein, chlorophyll 'a', 'b', nitrogen, phosphorus, potassium, calcium, magnesium and sulphur.

The study inferred that the application of vermicompost to irrigated V-1 mulberry serves as an alternative to chemical source of nitrogen as it enhances the foliar constituents which inturn improves the rearing and cocoon parameters of silkworm.

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TABLE 1: Influence of feeding silkworm (PM x CSR_2) with mulberry raised using different organic manures on larval parameters, disease incidence and rearing parameters

Treatments	Larval parameters			Disease incidence				Rearing parameters		
	Mature larval weight (g/10 larvae)	Fifth instar larval duration (days)	Total larval duration (days)	Muscardine (%)	Flacherie (%)	Grasserie (%)	Total incidence (%)	Effective rate of rearing (%)	Cocoon yield (kg / 100DFLs)	Silk productivity (cg/day)
T_1	39.12	7.17	25.13	1.00 (5.73)	2.00 (8.12)	1.25 (6.42)	4.25 (11.89)	94.00 (75.82)	67.06	4.74
T_2	39.38	7.19	25.16	1.25 (6.41)	2.50 (9.09)	1.50 (7.03)	5.25 (13.24)	93.08 (74.74)	66.04	4.59
T_3	38.23	8.18	26.08	2.50 (9.09)	3.00 (9.97)	2.25 (8.62)	7.75 (16.16)	86.96 (68.81)	60.34	3.79
T_4	36.98	8.21	26.21	1.50 (7.02)	3.25 (10.38)	1.75 (7.59)	6.50 (14.76)	85.48 (67.57)	57.63	3.53
T_5	38.86	8.04	26.12	2.00 (8.12)	3.75 (11.16)	2.00 (8.12)	7.75 (16.15)	88.59 (70.23)	62.16	3.98
T_6	37.97	8.12	25.23	1.60 (7.26)	3.60 (10.93)	2.00 (8.12)	7.20 (15.56)	89.91 (71.47)	60.97	3.45
T_7	38.96	7.20	25.18	1.25 (6.42)	4.00 (11.53)	3.75 (11.16)	9.00 (17.45)	88.25 (69.93)	62.27	4.44
F-test	*	*	*	*	*	*	*	*	*	*
S.Em ±	0.438	0.061	0.039	0.226	0.141	0.178	0.178	0.464	1.646	0.074
C.D. at 5%	1.343	0.187	0.263	0.692	0.431	0.546	0.544	1.421	5.041	0.227

* = Significant

T_1 = Vermicompost (100% N) + Recommended P and K, T_2 = Enriched vermicompost (100% N) + Recommended P and K,

T_3 = FYM (100% N) + Recommended P and K,

T_4 = Coir pith compost (100% N) + Recommended P and K,

T_5 = Urban solid waste compost (100% N) + Recommended P and K,

T_6 = Biodigested slurry (100% N) + Recommended P and K, & T_7 = Recommended FYM and NPK

TABLE 2: Influence of different organic manures applied to mulberry on cocoon and post – cocoon parameters of PM x CSR_2 silkworm

Treatments	Cocoon parameters			Post – cocoon parameters			
	Cocoon weight (g)	Shell weight (g)	Shell ratio (%)	Filament length (m)	Denier	Fibroin (%)	Sericin (%)
T_1	1.82	0.34	18.68 (25.59)	820.87	2.13	78.16 (62.11)	20.64 (27.00)
T_2	1.81	0.33	18.23 (25.22)	819.94	2.14	78.00 (62.01)	20.76 (27.09)
T_3	1.77	0.31	17.51 (24.72)	816.18	2.48	77.18 (61.44)	21.71 (27.76)
T_4	1.72	0.29	16.86 (24.23)	815.82	2.51	75.46 (60.28)	23.45 (28.95)
T_5	1.79	0.32	17.87 (24.99)	816.00	2.38	76.84 (61.21)	22.14 (28.06)
T_6	1.73	0.28	16.18 (23.71)	815.13	2.46	75.98 (60.63)	23.01 (28.65)
T_7	1.80	0.32	17.77 (24.92)	820.16	2.15	74.14 (59.41)	24.74 (29.82)
F-test	*	*	*	*	*	*	*
S.Em ±	0.013	0.009	0.227	0.690	0.083	0.225	0.261
C.D. at 5%	0.039	0.028	0.695	2.113	0.255	0.690	0.799

* = Significant

T_1 = Vermicompost (100% N) + Recommended P and K,

T_2 = Enriched vermicompost (100% N) + Recommended P and K,

T_3 = FYM (100% N) + Recommended P and K, T_4 = Coir pith compost (100% N) + Recommended P and K,

T_5 = Urban solid waste compost (100% N) + Recommended P and K,

T_6 = Biodigested slurry (100% N) + Recommended P and K,

T_7 = Recommended FYM and NPK