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Performance of Selected Feed Additives on Economic Traits of Mulberry Silkworm Hybrid PM × CSR_2 at Farmers Field Condition

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Abstract

A field experiment was conducted to assess the performance of mulberry silkworm hybrid PM × CSR_2 (Kolar gold/Kolar chinna), with standardized feed additives particularly on economic traits. The results revealed that flours of horse gram + grain amaranthus (50 : 50) applied over mulberry shoots during rearing, registered significantly maximum mature larval weight, increased effective rate of rearing, higher cocoon weight, enhanced cocoon yield, fewer number of cocoons per liter, lesser number of defective cocoons and more number of good cocoons at all five villages followed by CFTRI mixture when compared to unsupplemented control.

Key words : Silkworm hybrid, Feed additives, Horse gram, Grain amaranthus, CFTRI mixture.

India is currently the second largest producer of mulberry raw silk recording an annual production of about 18,653 MT of raw silk, of which 16,700 MT is represented by mulberry silk. Tasar, eri and muga silks contribute to the tune of 323, 1514 and 116 MT respectively. This was possible due to development of new technologies in mulberry cultivation. A new productive bivoltine hybrid, CSR_2 × CSR_4 was recently popularized in the field. Though this bivoltine hybrid was well received by the progressive farmers, it was not reared by all farmers. On the contrary, a new multi × bivoltine hybrid, PM × CSR_2 (Kolar gold or Kolar chinna) has become quite popular in the farmers field (1) and the bulk of silk production (about 94%) in India comes from multi × bivoltine hybrids. In view of some limitations like renditta, low cocoon shell weight, low cocoon shell ratio and poor silk quality of the existing cross breed (PM × CSR_2), the Central Sericulture Research and Training Institute (CSRTI), Mysore developed a new multi × bivoltine hybrid, ND_7× CSR_2 (Jayalakshmi) which is quantitatively and qualitatively superior to meet the international market demands of A grade silk (2). To achieve the silk quality and quantity, this hybrid was selected for laboratory experiment where worms were fed with fortified feed additives with Mulberry.

Methods

Fifteen farmers were selected randomly in five villages ; i.e. 3 farmers per village. V_1 mulberry shoots were harvested from irrigated garden and were supplemented with two flour supplements as confirmed in laboratory trial. Bulk silkworm rearing was done up to third moult and worms were separated, practicing feed additive application with daily once feeding schedule. 5 g flour of each feed additive was weighed and placed in plastic measuring cups and were marked to determine measuring levels.

Once a day feed additive application was made through measuring cups ensuring the flours were sieved (150 μ) and dusted on mulberry shoots at 5g / kg of shoots and fed to silkworm hybrid (PM × CSR_2) using plastic sieves, during late age. However, the remaining two feeds per day were normal (unsupplemented). Two mulberry silkworm rearings were conducted during November and January, 2008. Ten DFL's per treatment were maintained with three replication. The rearing was practiced following shoot method of feeding in accordance with standard package (3). The data were analyzed in randomized completely block design as outlined by Cochran and Cox (4).

In laboratory experiment Jayalakshmi hybrid (ND_7×CSR_2) was selected, as literature claimed it was performing best in all quantitative and qualitative traits of silk. Due to non-availability of this hybrid in field trial, as an alternative PM × CSR_2 was selected for field experiment since it was already popular

Table 1. Influence of feed additives on matured larval weight (g) and ERR (%) of mulberry silkworm hybrid PM × CSR_2.

Treatments	Kambala halli # Matured larval weight	ERR	Dodda halli # Matured larval weight	ERR	Kanigana halli # Matured larval weight	ERR	Kumagunta # Matured larval weight	ERR	Byepalli # Matured larval weight	ERR
Horse gram flour + Grain amaranthus flour (50 : 50%)	3.540	92.23	3.520	92.31	3.523	92.45	3.523	92.93	3.536	92.05
CFTRI mixture (100%)	3.280	89.20	3.290	88.42	3.300	88.46	3.296	88.43	3.316	88.35
Unsupplemented control	2.440	85.35	3.093	85.41	3.106	84.69	3.103	85.33	3.116	85.63
F-test	*	*	*	*	*	*	*	*	*	*
SE ±	0.384	0.314	0.0078	0.278	0.0075	0.363	0.0081	0.273	0.0015	0.232
CD at 5%	1.507	1.236	0.0305	1.092	0.0294	1.427	0.0317	1.074	0.0060	0.911

among farmers besides it was the ruling multi × bivoltine hybrid.

The shoot requirement was 250 g per day. Feed additive application after third moult was 2.5 g per day for 100 worms. Each day shoot weight was increased by 50 g. After fourth moult for 100 worms shoot requirement was 500 g per day and feed additives was 5 g/10 g. Each day, shoot weight was increased by 50 g. For 100 dfls, 2.5 kg of feed additives were required for daily once application.

Results and Discussion

So far, no work has been conducted at farmer's field with feed additives. However, some scientists have undertaken field trial for performance of hybrids in different parts of India.

Silkworm hybrid PM × CSR_2 (Kolar gold/Kolar chinna) was experimented for field trial (as it is popular and locally available multi × bivoltine hybrid) in five selected villages viz., Kambala halli, Dodda halli, Kanigana halli, Kumagunta and Byepalli of Srinivasapura taluk, Kolar district in Karnataka State. In each village, three farmer's were chosen for field trial of feed additive combinations of horse gram flour + grain amaranthus flour (50 : 50) and CFTRI mixture, which are highly nutritive and exhibited best results under laboratory trials.

The late age silkworm hybrid, PM_2 × CSR_2 (Kolar gold) reared on mulberry leaves with flour combination of feed additives for daily once feeding schedules, were accepted and exhibited superiority for all

Table 2. Influence of feed additives on cocoon weight (g) and cocoon yield (kg/100 dfls) of mulberry silkworm hybrid PM × CSR_2.

Treatments	Kambala halli # Cocoon weight	Cocoon yield	Dodda halli # Cocoon weight	Cocoon yield	Kanigana halli # Cocoon weight	Cocoon yield	Kumagunta # Cocoon weight	Cocoon yield	Byepalli # Cocoon weight	Cocoon yield
Horse gram flour+ Grain amaranthus flour (50 : 50%)	1.913	91.89	1.910	91.72	1.916	91.78	1.910	91.71	1.913	91.72
CFTRI mixture (100%)	1.753	87.09	1.773	87.38	1.793	86.78	1.790	86.67	1.813	86.79
Unsupplemented control	1.723	74.76	1.720	75.02	1.730	74.77	1.733	74.70	1.733	74.69
F-test	*	*	*	*	*	*	*	*	*	*
SE ±	0.008	0.2057	0.006	0.4916	0.008	0.1543	0.0051	0.1509	0.0082	0.1161
CD at 5%	0.032	0.807	0.0257	1.9301	0.335	0.6056	0.0201	0.5925	0.0322	0.4556

Table 3. Influence of feed additives on number of cocoons per liter, percentage of defective and good cocoons of mulberry silkworm hybrid PM × CSR_2. GCPL : Number of good cocoons per liter, PDC : Percentage of defective cocoons, PGC : Percentage of good cocoons.

Treatments	Kambala halli #			Dodda halli #			Kanigana halli #		
	GCPL	PDC	PGC	GCPL	PDC	PGC	GCPL	PDC	PGC
Horse gram flour + Grain amaranthus flour (50 : 50%)	78.01	6.10	93.88	77.83	5.99	93.99	77.85	4.88	95.10
CFTRI mixture (100%)	82.20	9.77	90.22	81.00	9.99	89.99	81.06	9.55	90.44
Unsupplemented control	84.69	15.66	84.33	84.76	16.55	83.44	85.00	16.10	83.88
F-test	*	*	*	*	*	*	*	*	*
SE ±	0.5575	0.4285	0.4281	0.0422	0.2672	0.2705	0.0612	0.4887	0.4894
CD at 5%	2.1886	1.6822	1.6807	0.1656	1.0489	1.0620	0.2404	1.9187	1.9213

Table 3. Continued.

Treatments	Kumagunta #			Byepalli #		
	GCPL	PDC	PGC	GCPL	PDC	PGC
Horse gram flour + Grain amaranthus flour (50 : 50%)	77.69	5.11	94.88	77.77	5.55	94.55
CFTRI mixture (100%)	81.10	9.77	90.22	81.06	9.77	90.21
Unsupplemented control	84.99	15.88	84.10	86.10	15.44	84.55
F-test	*	*	*	*	*	*
SE ±	0.2901	0.5759	0.5764	0.5593	0.2191	0.1815
CD at 5%	1.1391	2.2610	2.2627	2.1959	0.8602	0.7126

larval and reeling traits than control (unsupplemented). Improved nutrient status of mulberry leaves by these feed additives might have encouraged the larval growth and development. The protein content of experimented mulberry leaves (V_1 variety) was estimated (22.20%). Horse gram+grain amaranthus and CFTRI mixt-ure are rich source of protein, fat, minerals and carbohydrates. The success of cocoon crop mainly depends on three major factors, viz., quality of layings, quality of leaf used and the method of rearing adopted.

The silkworm hybrid reared on mulberry shoots fortified with flours of horse gram + grain amaranthus (50 : 50) registered significantly maximum mature larval weight (3.540; 3.520; 3.523; 3.523; 3.536 g) (Table 1), increased effective rate of rearing (92.23; 92.31; 92.45; 92.93; 92.05%) (Table 1), higher cocoon weight (1.913; 1.910; 1.916; 1.910; 1.913 g) (Table 2), enhanced cocoon yield (91.89; 91.72; 91.78; 91.71; 91.72 kg/100 dfls) (Table 2), fewer number of cocoons per liter (78.01 ; 77.83 ; 77.85 ; 77.69 ; 77.77) (Table 3), lesser number of defective cocoons (6.10; 5.99; 4.88; 5.11; 5.55%) (Table 3) and more number of good cocoons (93.88; 93.99; 95.10; 94.88; 94.55%) (Table 3) at the five villages.

However the next best performance was in CFTRI mixture, in respect of mature larval weight (3.280; 3.290; 3.300; 3.296; 3.316 g) (Table 1), effective rate of rearing (89.20; 88.42; 88.46; 88.43; 88.35%) (Table 1), higher cocoon weight (1.753; 1.773; 1.793; 1.790; 1.813 g) (Table 2), enhanced cocoon yield (87.09; 87.38; 86.78; 86.67; 86.79 kg/100 dfls) (Table 2), few number of cocoons per liter (82.20; 81.00; 81.06; 81.10; 81.06) (Table 3), lesser number of defective cocoons (9.77; 9.99; 9.55; 9.77; 9.77%) (Table 3) and more number of good cocoons (90.22 ; 89.99; 90.44; 90.22; 90.21%) (Table 3), respectively, in the villages of Kambala halli, Dodda halli, Kanigana halli, Kumagunta and Byepalli.

Comparatively lower values were recorded in unsupplemented control in respect of mature larval weight (2.440; 3.093; 3.106; 3.103; 3.116 g) (Table 1), effective rate of rearing (85.35; 85.41; 84.69; 85.33; 85.63%) (Table 1), higher cocoon weight (1.723; 1.720; 1.730; 1.733; 1.733 g) (Table 2), enhanced cocoon yield (74.76; 75.02; 74.77; 74.70; 74.69 kg/100 dfls) (Table 2), fewer number of cocoons per liter (84.69; 84.76; 85.00; 84.99; 86.10) (Table 3), lesser percentage of defective cocoons (15.66; 16.55; 16.10; 15.88; 15.44%) (Table 3) and more percentage of good cocoons (84.33; 83.44; 83.88; 84.10; 84.55%) (Table 3),

respectively in villagers of Kambala halli, Dodda halli, Kanigana halli, Kumagunta and Byepalli, respectively.

The improvement in economic traits of PM × CSR_2 under field trial could be attributed to fortification of mulberry shoots by value addition through supplementation of horse gram + grain Amaranthus (50 : 50) and CFTRI mixture that might have encouraged larvae to feed on fortified leaves. This implies that some of the essential nutrients in the feed supplement viz., proteins, amino acids, carbohydrates, vitamins, sterols and minerals are responsible for good larval growth and perhaps effectively utilized by larvae.

The present findings are in strong agreement with the results of Safdar et al. (5) who assessed serifeed a nutritive feed supplement to the silkworm cross breed PM × NB_4D_2 under different field locations and the findings clearly indicated the effectiveness of serifeed in improving nutritional and physiological status of silkworms. The improvement in cocoon yield, due to feed supplements directly contributed to an additional income to the sericulturists.

Similarly, the study of Sabitha et al. (6) showed that the overall cocoon yield and raw silk production per unit area of mulberry plantation is highly influenced by qualitative and quantitative improvement of mulberry V_1 variety. Also the field study conducted by Prasanna Kumar et al. (7) to evaluate the effect of green leaf—a commercial foliar applicant on the nutritional status of mulberry leaf (V_1) exhibited enhanced the mulberry growth and development, thereby increasing the all economic traits. This may be due to fact that nutritional composition of foliar applicant may have influenced the silk output of *Bombyx mori.*

Application of foliar nutrient at 5 ml/liter of water were treated over mulberry leaf to MH_1 × C-nichi silkworm bybrid was performed best in rainfed sericulture belt areas especially in Chamarajanagar, Mandya and Mysore districts. This genotype can adjust its state in response to transient fluctuations of agroclimatic conditions, there by decreasing the shorter larval duration with high crop stability (8).

In the field study of CSR hybrid by Susheelamma et al. (9) on S_{13} and S_{34} mulberry varieties, good cocoon yield and returns at Chamarajanagar and Kollegal regions of Karnataka and Thalavadi regions of Tamil Nadu were obtained. This may be due to pH of the soil and soil fertility status in mulberry gardens.

The Cauvery hybrid (BL_{67} × CSR_{101}) performed better in Tamil Nadu than other places of Karnataka and Andhra Pradesh especially with regard to cocoon yield. Sericulture in India is chiefly dependent on multivoltine × bivoltine hybrids as large number of farmers thrive on it. This hybrid produces gradable silk when compared to traditional hybrid, PM × NB_4D_2 (10).

Dandin et al. (2) studied the performance of Jayalakshmi hybrid (ND_7 × CSR_2) along with control PM × CSR_2 in laboratory and field conditions. The new hybrid recorded best in all qualitative and quantitative traits. The hybrid is under large scale testing with the farmers of Andhra Pradesh, Karnataka and Tamil Nadu. The hybrid may reach the A grade quality of silk in domestic markets.

India is the second largest producer of mulberry silk, although the area under mulberry was virtually declining and there was a constant growth in raw silk production. Kolar gold (PM × CSR_2) performed higher for all economic traits over other hybrids viz., CSR_2 × CSR_4 and PM × C-nichi in Mandya district of Karnataka. This hybrid was preferred by farmers' and reelers due to advantages over other two hybrids (1).

A study was conducted in Karnataka covering 120 farmers, 30 reelers and 30 licensed seed producers from Bangalore rural, Mandya and Chamarajanagar districts of Karnataka. All these three sectors preferred Kolar gold (PM × CSR_2) for advantages in performance (11—13).

Field study was conducted in 50 villages of Andhra Pradesh district with an objective to assess the over all knowledge and adoption recommended by sericulturists. The main constraint for low/non adoption of recommended sericulture practices by sericulturists were lack of knowledge, lack of finance, traditional practices, lack of technical guidance and scarcity of water (12).

Phyto-ecdysteroid hormone was tested at Regional Sericulture Research Station, Anantpur and with selected farmers at field level. All qualitative and quantitative traits of silkworm were improved 80%

early maturity of silkworms due to availability of nutrient sources were reported (13).

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