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Cassava Leaves Defoliation for *Eri* Silk Worm Rearing and its Impact on Cassava Tuber Yield

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Abstract

Two experiments, one at experimental farm, Department of Horticulture and another experiment at departmental lab in the Department of Sericulture, Assam Agricultural University (AAU), Jorhat, Assam were carried out during 2013-2015. The first experiment was conducted with four varieties of cassava and its' four leaf defoliation levels. In the second experiment, effect of leaf feeding by *eri* silk worm was studied on the four varieties of cassava and the study was conducted for two seasons. In both the experiments significant treatment effects were observed. The tuber yield reduced at defoliated treatments in all the varieties. The result in leaf defoliation level was opposite to tuber yield in the first experiment. The second experiment results revealed that cassava varieties had significant effect on larval growth, cocoon yield and cocoon characters of *eri* silkworm. The larval duration, larval weight, cocoon yield, cocoon weight and pupal weight were found to be better in spring season; while, autumn rearing was registered better for shell ratio percentage of the cocoon. The economic analysis revealed that cassava production was more profitable, when sericulture component was included. There was additional net income of Rs 41895/- from sericulture component.

Key words: Tapioca, trimming, *eri* silk, rearing, economics

Introduction

Eri silk worm is a multivoltine insect completing six to seven generations in a year. *Eri* culture is an age-old tradition and culture of weaker sections of the society particularly in North East (NE) India. It is also practiced in the states of West Bengal, Bihar, Orissa, Jharkhand, Andhra Pradesh, Uttarakhand, Chhattisgarh, Maharashtra, Gujarat, UP *etc*. *Eri* culture though relatively a less remunerative occupation, it has its own advantages. *Eri* silkworms require comparatively minimum care and they are easy to handle. India produced 3,116 MT of eri silk during 2012-2013. North-eastern region of India is a homeland of about a dozen of sericigenous insects. *Eri* silkworm is a polyphagous species, which feeds on host leaves mainly of family Euphorbiaceae, Araliaceae, Apocynaceae and Simaroubaceae. Castor (*Ricinus communis* L.) and Kesseru (*Hetero panaxfragrans* Seem.) are the major food plants of *eri* silkworm. There are several secondary host plants also *viz*., tapioca (*Manihot esculenta*), Barpat (*Ailanthus grandis* Baiu.), Barkesseru (*Ailanthus excels* Roxb), Payam (*Evodia flaxinifolia* Hook.) *etc*. which are used for rearing of *eri* silkworms during the scarcity of primary host plants. Castor is the main food plant of *eri* silk worm which is annual in nature and has the problem of growing a fresh for every six months. Castor leaf is not available throughout the year. The alternate host plants available in the region for continuous *eri* silkworm rearing is essential (Preetirekha Chutia et al., 2014; Chowdhury, 1982). Castor (*Ricinus communis* L.), the primary host plant of *eri* silkworm *(Samia cynthiaricini* Boisduval) is greatly exploited for eri silk production in nontraditional states whereas cassava, the most preferred food plant after castor has also been proved to be suitable for commercial rearing (Sakthivel, 2012). Therefore, *eri* silkworm rearing on tapioca leaves was undertaken in the present study; which was not reported properly from the region earlier.

Cassava (*Manihot esculenta* Crantz), a root crop, is grown as secondary staple in Kerala, Odisha and North Eastern states, whereas in Tamil Nadu and Andhra Pradesh, it is cultivated as raw material for starch and sago industries and as feed for livestock. The state of Maharashtra is slowly developing as a cassava hub for industrial use (Singh et al., 2013). The production of cassava in Assam is yet to take pace due to limited use. The demand is not increasing as a food and only confined to some tribal pockets. Farmers are converting the taioca land for growing other remunerative crops like vegetables. In this context, value addition is important for increased cassava production. The present experiment is therefore aimed to combine the cassava production both for leaf and tuber yield for better utilization of the crop.

Materials and Methods

The field experiment (First experiment) was carried out in RBD at the Experimental Farm (Horticulture), Dept. of Horticulture, Assam Agricultural University, located at Jorhat District, Assam, India. The experiment was undertaken with four cassava varieties maintained in the experimental field under AICRP on Tuber crops namely Sree Vijaya, Sree Jaya, H-97 and Balijan local during two commercial rearing season i.e. Autumn (Oct.-Nov.) and Spring (March-April). The crop was grown as per recommended package of practice followed in Assam. The leaves were harvested in four different levels *viz*. no harvesting (0%=control), 25%, 50% and 75%.

In the second experiment, these harvested leaves were fed to larvae of *eri* silk worm that were reared variety wise separately under laboratory condition with four replications maintaining 250 larvae per replication in each variety. Larvae were fed *ad libitum* providing young leaves to first and second instar,semi-mature leaves to third instar and mature leaves to fourth and fifth instar larvae. The feeds were provided four times in a day except during molting periods. When the larvae attained their maturity, they were transferred to mountages (Chandraki, a bamboo made device) for spinning of cocoons separately from each variety replication wise. Data were recorded for various larval growth parameters *viz*, larval duration, weight of mature larva, effective rate of rearing (Cocoon yield per 100 larvae) and cocoon parameters *viz*, cocoon weight, shell weight, shell ratio percentage and pupal weight.

The data were recorded and statistically analyzed using the statistical software CPCS-1 developed by Panjab Agriculture University, Ludhiana. Finally the economics were calculated on the basis of tuber yield of cassava and *eri* product selling (Shell and pupa) taking consideration of present market demand and price.

Results and Discussion

The Table 1 (First Experiment) revealed that there was significant treatment effect on tuber and leaf yield of cassava. It was interesting to note that except one variety *viz*. Sree Jaya, other varieties responded similarly to tuber and leaf yield. The maximum tuber yield was obtained in 50% defoliation (27.2 t ha^{-1}) in Sree Jaya variety and minimum in 25% leaf defoliation (21.6 t ha^{-1}). In other three varieties i.e. Sree Vijaya, H-97 and Balijan local;the maximum tuber yield was obtained in control treatment(no defoliation) that accounts 31.3t/ha, 28.5 t ha^{-1} and 26.4 t ha^{-1} respectively. The tuber yield recorded minimum in 75% defoliation in var. SreeVijaya (19.1 t ha^{-1}), in 25% in var. Sree Jaya (21.6 t ha^{-1}), in 50% in H-97 (22.4 t ha^{-1}) and Balijan local (21.5 t ha^{-1}) respectively. Similar findings were reported by Sing *et al* (2013).

In the case of leaf yield also there was significant treatment difference. The maximum leaf yield was obtained in the 75% leaf defoliation irrespective of any

Table 1. Effect of leaf defoliation on leaf and tuber yield of cassava

Treatments	Mean tuber yield (t/ha)				Mean leaf yield (fresh wt. t ha^{-1})			
Extent of leaf harvest	Sree Vijaya	Sree Jaya	H-97	Balijan local	Sree Vijaya	Sree Jaya	H-97	Balijan local
0%	31.3	27.0	28.5	26.4	0.0	0.0	0.0	0.0
25%	29.1	21.6	24.5	23.6	1.8	2.1	2.2	1.9
50%	19.8	27.2	22.4	21.5	3.1	3.1	3.6	2.8
75%	19.1	22.3	24.5	23.1	5.7	5.5	5.7	5.1
CD at 0.05	0.85	0.68	0.78	0.89	1.01	0.89	1.00	0.86

Table 2. Effect of cassava varieties on larval growth, cocoon yield and cocoon characters of *eri* silk worm, *Samiaricini* Boisd.

Treatments	Larval duration (days)	Larval weight(g)	Effective rate of rearing*(%)	Cocoon weight(g)	Shell weight(g)	Shell ratio (%)	Pupal weight(g)
VARIETY (V)							
SreeVijaya	23.00	4.93	81.5	3.06	0.40	12.98	2.68
Sree Jaya	23.05	4.84	80.0	2.90	0.37	13.13	2.46
H-97	23.90	4.59	79.3	2.73	0.35	12.91	2.39
Balijan local	22.15	4.74	83.8	2.80	0.36	12.54	2.55
CD at 5%	0.24	0.11	0.30	0.02	0.02	0.13	0.02
SEASON(S)							
Autumn	23.40	4.64	80.13	2.63	0.36	13.78	2.28
Spring	22.65	4.90	82.12	3.12	0.37	12.00	2.76
CD at 5%	0.17	NS	0.21	0.01	NS	0.09	NS
Interaction (V X S)	0.34	0.16	0.42	0.03	0.03	0.18	NS

*Effective rate rearing : Cocoon yield per 100 larvae

variety. These were 5.7, 5.5, 5.7 and 5.1 t ha^{-1} in the varieties SreeVijaya, Sree Jaya, H-97 and Balijan local respectively. Results revealed that cassava varieties had significant effect on larval growth, cocoon yield and cocoon characters of *eri* silkworm (Second experiment; Table 1). Larval duration was recorded significantly shortest when reared with leaves of Balijan local (22.15 days) while it was registered longest on H-97 variety (23.9 days).The maximum larval weight was registered when reared on SreeVijaya leaves (4.93 g). Whereas; it was *at par* in Sree Jaya (4.84 g) and Balijan local (4.74 g) ; while the lowest larval weight was recorded on H-97 (4.59 g). The cocoon yield *i.e*effective rate of rearing, was significantly highest on Balijan local (83.8%) followed by Sree Vijaya (81.5%), Sree Jaya (80.0%) and H-97 (79.3%). With significantly maximum cocoon weight (3.06 g), Shell weight (0.40 g) and pupa weight (2.68 g) the *eri* silkworm performed better in respect of cocoon parameters when reared with SreeVijaya leaves followed by Sree Jaya with highest Shell ratio percentage (12.98%) in the cocoon. Balijan local was next to Sree Jaya in respect of cocoon weight, shell weight and pupal weight while H-97 was next to Sree Jaya in respect of shell ratio percentage.

With significantly shorter larval duration spring season appeared to be better for larval weight, cocoon yield, cocoon weight and pupa weight while autumn rearing was registered better for shell ratio percentage of the cocoon. The interaction effect due to variety and season was significant for all larval growth and cocoon parameters except pupa weight. The present observations are in agreement with the findings of Sakthivel (2016). Chandrasekhar et al. (2013) also reported significant variations in nutritive value of leaves in different genotypes of castor, the primary food plant of *eri* silkworm. Similarly, the influence of variations in nutrient values of mulberry varieties on the silkworm *Bombyx mori* was also documented by Sujathamma and Dandin (2000). The nutritional status in the leaves of food plants which influences the economic characters of silkworm crop depends upon the level of moisture, total protein, total carbohydrates and total minerals.

The table 3 revealed that the economics of cassava production was encouraging, when sericulture component was included. There was additional net income of Rs 41895/- (rupees forty one thousand eight hundred ninety five only) from sericulture component which was cultured for one time only. Similar results were reported by Kawabe(2014) from Combodia.

Conclusion

Thus, it is imperative to conclude that cassava varieties can be effectively used for rearing of *eri* silkworm. Considering larval growth, cocoon yield and cocoon

Table 3. Economics of rearing *eri* silk worm using cassava leaves

Item			Income (₹/ha)	Expenditure (₹/ha)	Net income (₹/ha)	B:C ratio
Tuber yield	24.48 t/ha (Avg,)	Tuber (Whole sale price @ Rs 5/kg	1,22,400.00	65,000.00 Cassava production	57,400	2.33
Cut cocoon yield	31.10 kg/ ha (Avg.)	Cut cocoon (@Rs 450/ kg)	13,995.00(a)	9,600.00(c) Sericulture	41,895.00 (a+b - c)	
Pupa yield	250.00 kg /ha	Pupa(@ Rs 150/kg)	37,500.00(b)			
Grand Total			1,73,895.00	74,600.00	99,295	

N.B.The income is shown from sericulture unit is for only one time culture.

characters, Sree Vijaya and Sree Jaya could be better utilized for production of commercial quality *eri* cocoons followed by Balijan local and H-97 among the varieties tested. Though leaf defoliation reduced the productivity of cassava, finally the *eri* culture could complement cassava production by additional income. The sericulture farmers in NE Region could effectively utilize the tapioca leaves in lean period of production when castor leaves become unavailable. The North Eastern Region of India has ample scope for expansion of cassava cultivation not only for tuber yield but also for leaf production for *eri* silkworm rearing.

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