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EFFECT OF INTERCROPS ON PLANT GROWTH, LAC ENCRUSTATION AND LAC YIELD IN *FLEMINGIA SEMIALATA* ROXB

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ABSTRACT

A field experiment was conducted for three years (2003-04 to 2005-06) to assess performance of vegetable intercrops on shoot length, lac encrustation (broodlac) length and sticklac yield of *Flemingia semialata*. Integration of vegetable crops with *F. semialata* showed significant increase in shoot length for lac insect settlement, lac encrustation length and sticklac yield over sole lac culture at both the planting patterns and vegetable crops schedules. During 2003-04 and 2005-06, the highest increase in sticklac was obtained at paired row planting with vegetable crops Schedule I by 36.38 and 140.85%, respectively, whereas in 2004-05 it was at single row with Schedule II by 62.48% as compared to sole lac culture with same plantation pattern.

Key words: *Flemingia semialata*, Lac encrustation length, Sticklac, Paired row, Single row.

The Indian lac insect *Kerria lacca* (Homoptera: Tachardiidae) is an economic insect producing three versatile natural products *viz.*, resin, wax and dye, having huge commercial value. The insect is being cultured on several host plant species ranging from small bushy type to large species for economic returns in the lac growing regions of the country (Bhattacharya *et al.*, 2004). The significance of *Flemingia semialata* (*Leguminoceae Papilionaceae*), a perennial species was recently identified as a host for commercially important lac insect (Kumar *et al.*, 1997). Since this host is fast growing with high coppicing response, bushy in nature and known for producing best quality of lac resin, this species was promoted for intensive lac cultivation on plantation basis (Singh *et al.*, 2000, Singh 2004 *et al.*, Yadav *et al.*, 2005). As intercropping is a well accepted system for improving productivity and profitability for mutual benefit for main and intercrops. Hence, an experiment was conducted to study the shoot length for settlement of lac insects, lac encrustation and lac yield with intercrops. The black gram was found to be the most compatible intercrop under marginal lands with ber. This crop produced on an average 3.74 q/ha grain yield every year (Ram Newaj *et al.*, 1999). Singh and Vishal Nath (1997) also reported that under semi arid conditions of Pali (Ra-jasthan) 4.36 q/ha mung bean *(Vigna radiate)*, 10.23 q/ha cluster bean and 1.88 q/ha sesame can be produced under ber (cv Seo) based farming system during *kharif*.

A field experiment was conducted during the year 2003-04, 2004-05 and 2005-06 at Indian Institute of Natural Resins and Gums, Namkum, Ranchi, Jharkhand having sub-humid climate. The experimental soil was sandy clay loam in texture and it had pH 5.25. The soil was medium in organic carbon (0.66%), low in available nitrogen (238.33 kg/ha), phosphorus (13.63 kg/ha) and potash (121.55 kg/ha).

The experiment was laid out in randomized block design (RBD) with six treatments including two sole planting (without intercrops) of the host plants and replicated three times. The first schedule of vegetable crops consisted of okra *(Abelmoschus esculentus L.)*, garlic *(Allium sativum Linn.)*, bitter gourd *(Momordica charantia Linn.)* for *kharif*, *rabi* and *zaid* crop seasons respectively. Likewise the second schedule of vegetable crops were ginger *(Zingiber officinalis Rosc.)*, tomato *(Lycopersicon esculentum mill.)* and bottle gourd *(Lagenaria siceraria Mol.)* for the respective seasons. Two system of planting for *semialata* was adopted, normal

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planting at 1 x 1 m uniform spacing (single row) and paired row at 0.5 x 1 m (row to row 0.5 m and plant to plant 1 m) leaving 2 m space in between two paired row, thus, accommodating 10,000 and 8,000 plants per hectare in single and paired rows, respectively. The net plot size was 4 x 4 m for each treatment. *F. semialata* plants were transplanted during monsoon 2002 in well prepared, manured and fertilized pits (45 x 45 x 45 cm) from nursery raised seedlings (30 cm) adopting standard planting procedure laid down for the host (Singh, 2002). Vegetable crops such as okra seeds and ginger clumps were sown at a planting distance of 50 x 25 cm and 30 x 15 cm, respectively in *kharif* season where as tomato seedlings were planted at 50 x 40 cm in standing ginger plot and garlic sown at 15 x 10 cm after harvesting of okra, respectively during *rabi*. Bitter gourd and bottle gourd seeds were sown at 100 x 65 cm and 200 x 100 cm in standing garlic and tomato plots, respectively during January-February in *zaid* season. Manure and fertilizers were applied to each vegetable crop in each season at the doses prescribed for the respective crop on the basis of their plant population. Irrigation was applied to intercrops during *rabi* and *zaid* seasons as and when required. Total shoot length was measured one week prior to the inoculation in each year whereas the thick lac encrustation length, which was utilized generally for broodlac was recorded just before the harvesting of the matured lac crop.

F. semialata plants were first put under lac culture, one year after planting for winter season lac crop (*aghani* 2003-04) with *kusmi* strain of the lac insect, using a uniform rate of broodlac (lac encrustation with gravid female about to produce crawlers) at the rate of 30 g/bush on 25 July 2003. Similarly, for subsequent lac crop seasons 2004-05 and 2005-06, host plants were inoculated on 28 July 2004 and 19 July 2005 with *kusmi* strain of lac insect at the rate of 50 g/bush. Pests (predators and parasitoids) of lac insect were managed by adopting recommended practices (Bhattacharya, 2002). Matured lac crop was harvested on February 26-27, 2004 and on 2nd and 3rd March 2005 and 2006, respectively. Harvesting was carried out by leaving 10 cm stump from the ground level so that sprouts come out and be ready for the next inoculation within six months of harvesting. After harvesting broodlac was selected and prepared by cutting 15 cm in bits, rejected encrusted lac (sparse settled and dead) were scraped with knife to obtain sticklac (scraped lac).

Plant growth: Total shoot length of *F. semialata* varied from year to year. In 2003, the total shoot length per bush was low because of less tillers/sprouts initiation. As the lac crop was harvested in subsequent years, more new tillers/sprouts emerged. Total shoot length of *F. semialata* significantly increased due to intercropping of vegetable crops at Schedule I and Schedule II over sole planting of the host plants at both the planting pattern during all three years (Table 1). Perusal of Table 1 shows that the maximum increase in total shoot length per bush was registered under single row with vegetable crops at Schedule I (5.20 cm) which was at par with all the intercrop treatments in 2003, except, paired row in 2004 (10.98 cm), single (9.89 cm) and paired row (12.54 cm) planting in 2005 with Schedule II. The host plants planted at both the planting patterns with continuous cropping of vegetable inter crops during *kharif*, *rabi* and *zaid* seasons showed significant superiority over sole planting. It appears that intercropping might have resulted in better growth and development of the lac host plants mainly due to manure, fertilizers, irrigation applied to

TABLE 1: Effect of treatments on total shoot length in *semialata*

Treatments	Vegetable crops schedule	Total shoot length (m/bush)		
		2003	2004	2005
Sole *F. semialata* at single row	-	3.13	7.76	8.36
Sole *F. semialata* at paired row	-	2.97	6.56	7.83
F. semialata at single row + Intercrops	Schedule I*	5.20	13.50	15.12
F. semialata at single row + Intercrops	Schedule II@	5.10	12.34	9.89
F. semialata at paired row + Intercrops	Schedule I*	4.90	12.47	13.65
F. semialata at paired row + Intercrops	Schedule II@	4.37	10.98	12.54
LSD (P= 0.05)	-	0.78	2.42	1.66
LSD (P= 0.01)	-	1.10	NS	2.36

* Schedule I: *F. semialata* with okra, garlic and bitter gourd
@ Schedule II: *F. semialata* with ginger, tomato and bottle gourd

intercrops. These results are in conformity with the findings Purkayastha *et al.*, 1981, in which it was reported that the available space within young *Albizia lucida* Benth. and *Moghania macrophylla* (Willd.) O. Ktze might be utilized for growing sweet potato + turmeric as intercrops without any deleterious effect on the host plants.

Lac encrustation: Lac encrustation length per bush (broodlac) of *F. semialata*, measured at harvest was significantly higher under all intercrops system over sole planting at both the planting patterns during 2004-05 and 2005-06. In 2003-04, though there was appreciable increase in length of lac encrustation per bush of *F. semialata* in intercropping system, over sole planting, however, treatments effect was found to be non significant. The lac encrustation length/ bush ranges between 0.41-0.93, 0.97-2.33 and 1.87-4.17 m during 2003-04, 2004-05 and 2005-06, respectively (Table 2). It is evident from Table 2 that increase in lac encrustation length in subsequent years, was mainly due to production of more tillers/ sprout and shoot length after harvesting of lac crops, provided enough available space for lac insects settlement and development. In 2003-04, the higher percentage of lac encrustation was 19.57% at paired row with vegetable crop schedule I whereas in 2003-04, 18.52% at paired row with Schedule II and 29.88% at single row at Schedule II in 2005-06 (Table 3). However, treatment effects were not significant in all the three years of experimentation.

Sticklac yield: Integration of *F. semialata* with vegetable crops during three cropping seasons caused significant increase in winter season *(aghani)* stick lac yield (Table 4). The increase in sticklac yield was higher under paired row planting with vegetable crops in Schedule I during 2003-04 and 2005-06 by 36.38 and 140.85% over control (sole lac culture at paired row) whereas during 2004-05 it was highest at single row planting with Schedule II which was 62.48% higher than that of sole la culture (at single row). This might be owing to the higher shoot length coupled with the encrustation into inter crop system.

TABLE 2: Effect of treatments on lac encrustation length (broodlac) in winter season lac crop *(aghani)* in *semialata*

Treatments	Vegetable crops schedule	Lac encrustation (broodlac) length (m/bush)		
		2003-04	2004-05	2005-06
Sole *F. semialata* at single row	-	0.41	1.10	2.07
Sole *F. semialata* at paired row	-	0.47	0.97	1.87
F. semialata at single row + Intercrops	Schedule I*	0.92	2.31	4.17
F. semialata at single row + Intercrops	Schedule II@	0.81	2.08	2.88
F. semialata at paired row + Intercrops	Schedule I*	0.93	2.33	3.44
F. semialata at paired row + Intercrops	Schedule II@	0.74	1.98	3.37
LSD (P= 0.05)	-	NS	0.42	0.54
LSD (P= 0.01)	-	NS	0.59	0.86

* Schedule I: *F. semialata* with okra, garlic and bitter gourd
@ Schedule II: *F. semialata* with ginger, tomato and bottle gourd

TABLE 3: Effect of different treatments on percent lac encrustation in winter season lac crop (*aghani*) in *semialata*

Treatments	Vegetable crops schedule	Per cent lac encrustation over total shoot length		
		2003-04	2004-05	2005-06
Sole *F. semialata* at single row	-	12.89	14.44	24.57
Sole *F. semialata* at paired row	-	15.82	15.34	23.46
F. semialata at single row + Intercrops	Schedule I*	17.73	17.31	27.65
F. semialata at single row + Intercrops	Schedule II@	16.77	17.11	29.88
F. semialata at paired row + Intercrops	Schedule I*	19.57	18.28	25.52
F. semialata at paired row + Intercrops	Schedule II@	17.20	18.52	26.92
LSD (P= 0.05)	-	NS	NS	NS
LSD (P= 0.01)	-	NS	NS	NS

* Schedule I: *F. semialata* with okra, garlic and bitter gourd
@ Schedule II: *F. semialata* with ginger, tomato and bottle gourd

TABLE 4: Sticklac yield of *semialata* during winter season lac crop as influenced by vegetable crops

Treatments	Vegetable crops schedule	Sticklac yield (q/ha)		
		2003-04	2004-05	2005-06
Sole *F. semialata* at single row	-	12.50	14.10	8.56
Sole *F. semialata* at paired row	-	12.56	14.60	8.15
F. semialata at single row + Intercrops	Schedule I*	13.90	21.80	17.55
F. semialata at single row + Intercrops	Schedule II@	13.29	22.91	17.94
F. semialata at paired row + Intercrops	Schedule I*	17.13	20.66	19.63
F. semialata at paired row + Intercrops	Schedule II@	12.59	19.60	17.82
LSD (P= 0.05)	-	2.02	4.55	4.88
LSD (P= 0.01)	-	2.88	6.47	6.95

* Schedule I: *F. semialata* with okra, garlic and bitter gourd

@ Schedule II: *F. semialata* with ginger, tomato and bottle gourd

Higher yield of sticklac and also of sabai grass (*Eulaliopsis binata*) due to intercropping of vegetable crops and grain legumes, respectively were also reported by Singh *et al.*, (2008) and Mohapatra *et al.*, (2001). Thus based on three year study, it may be concluded that intercropping of vegetable crops with *F. semialata* may be adopted for higher production of sticklac yield.

REFERENCES

Bhattacharya, A. (2002). Management of Pest in Lac Culture. In: Recent Advances in Lac Culture. (K.K. Kumar, R. Ramani and K.K. Sharma eds.), ILRI, Namkum, Ranchi: pp.118-123.

Bhattacharya, A. Jaiswal, A.K., Kumar K.K and Sharma K.K, Santhosh (2004). Management of Lepidopteron Predators of Lac Insect through Habitat Manipulation. In: National Symposium on Lac Industry- Convergence for Resurgence, ILRI, Namkum, Ranchi. pp. 21-22.

Kumar, P., Ghosal S., Srivastava, S.C., Singh B.P. and Jaipuriar S.K. (1997). Record of *Flemingia semialata* Roxb. as a Lac Host. *Journal of Non-Timber Forest Products*. **4** (3-4): 175.

Mohapatra, S., Tripathy, S.K. and Patra A.K. (2001). Effect of Forage Legumes Intercropping on Growth, Yield and Economics of *Sabai grass (Eulaliopsis binata)*. *Indian Journal of Agricultural Sciences*. **71** (1): 14-16.

Purkayastha, B.K., Singh B.P. and Ram Moti (1981). Intercropping of Tuber and Rhizome Crops within Mixed Plantation of Young Lac Hosts, *Albizzia lucida* and *Moghania macrophylla*. *Indian Journal of Agricultural Sciences*. **51** (8): 574-6.

Ram, Newaj, Solanki, K.R. and Shukla, S.K., (1999) Intercropping with Ber *(Ziziphus mauritiana)*: A Sustainable Alternate Land Use System for Marginal Land under Rainfed Conditions. In: International congress on agronomy, environment and food security for 21st century, New Delhi.

Singh, B.P. (2002). Raising of Lac Host Plantation. In: Recent Advances in Lac Culture. (K.K. Kumar, R. Ramani and K.K. Sharma eds.), ILRI, Namkum, Ranchi. pp. 79-85.

Singh, B.P., Mishra Y.D., Kumar K.K., Aggrawal S.C. and Kumar P. (2000). Integration of Lac Cultivation in Agri-horticultural System in Chhotanagpur Region. In: Recent Trends in Horticultural Research. (Central Horticultural Experimental Station, Ranchi): pp. 289-293.

Singh, B.P., Mishra, Y.D. and Kumar P. (2004). Intensive Lac Cultivation for Socio-economic Upliftment of Lac Growers. In: National Symposium on Lac Industry- Convergence for Resurgence, ILRI, Namkum, Ranchi: pp.17-18.

Singh, R.S. and Vishal Nath (1997) Intercropping in *ber*. *Intensive Agriculture*. **34**(11 & 12): 14-17.

Yadav, S.K., Mishra, Y.D., Singh B.P., Kumar P. and Singh R.K. (2005). Kusmi Lac Production on *Flemingia semialata*. ILRI, Namkum, Ranchi. TechBull. No.5.