

Incidence of insect pests and natural enemies under SRI method of rice cultivation

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ABSTRACT

Experiments were conducted during the second crop period of 2006-2007 and 2007-2008 at the Regional Agricultural Research Station, Pattambi Kerala using two rice varieties viz., Jyothi and the hybrid CORH 2 under normal system and system of rice intensification. The pooled result of two seasons revealed that stem borer was significantly lower in SRI (4.82% in Jyothi and 2.35% in CORH 2) during the vegetative phase compared to standard method of cultivation (9.75% in Jyothi and 9.85% in CORH 2), while at the reproductive phase there was no significant difference between the two systems of cultivation. The incidences of whorl maggot and caseworm were lower under SRI system but the incidence of leaf folder was higher in the crop under SRI than the standard system. The occurrence of natural enemies like spiders and larval parasitoids was higher in SRI while damselfly population was lower in SRI system in comparison to the standard system of cultivation.

Key words: system of rice intensification, normal, cultivation, pests, natural enemies

Rice the staple food crop of India, requires 4000-5000 litres of water to produce a kilogram of rice. In recent years, due to increasing water scarcity through out the country, the system of rice intensification (SRI) is gaining momentum. The SRI, a technical innovation from Madagascar (Uphoff, 2003), is a rice farming practice which requires less water but provides better growing conditions in comparison to the traditional practice of flooded rice (Ramaswamy, 2004). This alternative method has shown promise in addressing problems of water scarcity, high energy usage (40 per cent saving) and environmental degradation (Vibhu Nayar and Ravichandran, 2008). Only very few scattered reports are available on the pest scenario in SRI system (Karthikeyan *et al.*, 2007; Ratnasudhakar and Narasimha Reddy, 2007; Padmavathi *et al.*, 2007). The occurrence of insect pests and natural enemies is expected to be different in the flooded rice cultivation system and SRI system. Hence a study was undertaken with a view to investigate and compare the incidence of insect pests and their natural enemies in the SRI and normal system of wetland rice cultivation.

Field experiments in randomized block design were conducted during the second crop season in 2006-2007 and 2007-2008 at the Regional Agricultural Research Station, Kerala Agricultural University, Pattambi using two rice varieties viz., Jyothi and CORH2 (hybrid variety). Each variety was cultivated following the two system viz., the normal method of cultivation and SRI system of cultivation with seven replications for each treatment. The field experiments were undertaken in plot area of 7m x 4m under both the systems. Under conventional method of wet land cultivation 20 days old seedlings 2 seedlings hill⁻¹ 20 x 10 cm spacing with application of fertilizer 70:35:35 twice @ N: P₂O₅:K₂O. Besides this vermicompost @ 150 kg t ha⁻¹ was applied and manual weeding was followed. Under SRI method 10 days old seedlings were transplanted at 25x25 cm spacing and 1 seedling hill⁻¹. Fertilizer was applied once and weeding was carried out with cono weeder.

Observations were recorded on the incidence of insect pests at 15, 30, 45, 60 and 75 days after transplanting on selected 15 hills plot⁻¹ by walking diagonally across the plots. Tiller count was taken for

assessing dead heart (DH) at vegetative stage and white ear head (WEH) at reproductive stage for recording damage by stem borer. Incidence of leaf feeding insects such as whorlmaggot (*Hydrellia philippina* Ferino), leaf folder (*Cnaphalocrocis medinalis* Guenee), blue beetle (*Leptispa pygamaea* Baly) and caseworm (*Paraponyx stagnalis* Zeller) were assessed by counting the number of damaged leaves and total leaves hill⁻¹. Natural enemy population was estimated by making sweep net counts diagonally across each plot and counting the major species of predator viz., spider (*Tetragnatha* sp.), damselflies (*Agriocnemis* sp.), and larval parasitoid (*Temelucha* sp.) per five sweeps per plot.

The results of the pooled analysis on the occurrence of different pests under SRI and normal system of cultivation indicated that the incidence of

yellow stem borer was lower in the SRI system of cultivation with a mean damage of 4.82 and 2.35 per cent dead hearts in Jyothi and CORH 2, respectively as against a higher incidence of 9.75 I in Jyothi and 9.85 (in CORH 2) per cent dead hearts in both the varieties under the normal system of cultivation (Table 1). There was 50.56 and 76.14 per cent reduction of dead hearts caused by stem borer in SRI than the normal system of cultivation. The present finding corroborates with the earlier studies of Padmavathi *et al.* (2007); Ravi *et al.* (2007); Ratnasudhakar and Narasimha Reddy (2007) and Katti *et al.*, (2008). There was no significant difference in the incidence of white ear heads at the reproductive stage under both the systems of cultivation.

The incidence of whorl maggot was found to be lower in Jyothi and CORH 2 with a mean leaf

Table 1. Pest incidence and natural enemy population in wet land and SRI systems during 2006-2007 and 2007-2008 (Pooled Analysis of two seasons)

System of cultivation	Variety	Stem Borer incidence		Whorlmaggot	Blue Beetle	Case worm	Leaf folder
		% DH	% WE	% DL	% DL	% DL	% DL
Wet land System	Jyothi	9.75 (0.31)	9.30 (0.30)	10.10 (0.31)	3.98 (0.17)	5.36 (0.22)	4.56 (0.21)
	CORH2	9.85 (0.31)	11.62 (0.33)	8.92 (0.30)	4.75 (0.18)	10.48 (0.31)	1.52 (0.11)
SRI	Jyothi	4.82 (0.19)	11.78 (0.33)	5.80 (0.23)	3.22 (0.15)	1.00 (0.07)	5.87 (0.21)
	CORH2	2.35 (0.17)	12.75 (0.34)	6.20 (0.23)	3.98 (0.17)	0.91 (0.06)	8.70 (0.28)
CD (P=0.05)		0.04	NS	0.04	NS	0.10	0.07
SEm±		1.86	0.73	1.04	0.31	2.27	1.50

*Figures in parentheses are arcsine transformed values, DH- dead heart, WE- white earhead, DL- damaged leaf

Table 2. Natural enemy population in two systems of rice cultivation during 2006-2007 and 2007-2008 (Pooled Analysis of two seasons)

System of cultivation	Variety	Damselfly (<i>Agriocnemis</i> sp.)	Spider (<i>Tetragnatha</i> sp.)	Larval Parasitoids (<i>Temelucha</i> sp.)	Grain Yield (t ha ⁻¹)
Wet land System	Jyothi	6.77 (0.35)	3.96 (0.26)	4.74 (0.53)	5.14
	CORH2	15.05 (0.50)	3.25 (0.21)	3.92 (0.34)	3.55
SRI	Jyothi	3.25 (0.16)	3.91 (0.26)	5.40 (0.71)	5.03
	CORH2	1.02 (0.13)	6.54 (0.40)	6.95 (0.81)	4.63
CD (P=0.05)		0.05	0.03	0.15	NS
SEm±		3.08	0.73	0.64	3.63

*Figures in parentheses are arcsine transformed values

damage of 5.80 and 6.20 per cent, respectively under SRI as compared to a higher level of damage (10.10% in Jyothi and 8.92% in CORH 2) under normal system of cultivation (Table 1). There was 42.57 and 30.50 per cent reduction in whorl maggot damage in Jyothi and CORH 2, respectively under SRI system of cultivation over the normal system of cultivation. Whorl maggot incidence under SRI system was also earlier reported (Ravi *et al.*, 2007, Karthikeyan *et al.*, 2007. and Katti *et al.*, 2008). There was no significant difference in the incidence of blue beetle in both the varieties under both the systems of cultivation (Table 1). A lower incidence of case worm was observed in both the rice varieties under SRI cultivation, than under the normal system of cultivation (Table 1) and 81.34 and 91.32 per cent reduction of leaf damage due to caseworm in Jyothi and CORH 2, respectively under the SRI method was observed. The reduced incidence of caseworm under SRI system of cultivation might have been due to the alternate drying and wetting of rice fields making it unfavourable for caseworm.

The incidence of leaf folder was higher under SRI system in comparison to the normal system of cultivation in both the varieties. The extent of leaf damage was 5.87% in Jyothi and 8.70 % in CORH 2 under SRI in comparison to normal methods of cultivation (Table 1) showing 22.32 and 82.53 per cent increase in leaf folder incidence in SRI over normal system of cultivation. This finding is in confirmation with the earlier reports (Padmavathi *et al.*, 2007; Ravi *et al.*, 2007; Ratnasudhakar and Narasimha Reddy, 2007; Karthikeyan *et al.*, 2008; Katti *et al.*, 2008; Sumathi *et al.*, 2008) on higher leaf folder incidence under SRI system.

The studies on the occurrence of natural enemies in both the systems of cultivation indicated a higher population of spider (*Tetragnatha* sp.) and *Temelucha* sp. and a lower population of damselfly *Agriocnemis* sp. under SRI system than the normal system of cultivate. The mean number of spiders in wet land system was 3.96 and 3.25 in Jyothi and CORH 2, respectively while under SRI it was 3.91 and 6.54 in Jyothi and CORH 2, respectively (Table 2). But in case of damselflies, the mean number was 6.77 in Jyothi and 15.05 in CORH 2 under wet land system while it was less, under SRI system indicating reduction of damselfly population under SRI system over the

wetland system. The reason for the reduction of damselfly populations could be due to low hopper population (the preferred prey of damselflies) in the SRI system. This is in consonance with Karthikeyan *et al.* (2007) who reported a lower population of damselflies in SRI system.

In both the systems of rice cultivation, Jyothi recorded higher grain yield than the hybrid CORH2. However, there was no significant difference in grain yield between the two systems of cultivation.

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