Effect of system of rice cultivation on insect pest incidence in Palakkad District of Kerala

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ABSTRACT

Experiments were conducted during the three cropping periods involving twenty farmers in Kongad, a major rice growing area in Palakkad district of Kerala, India during 2008-2011 using a rice variety Ponmani under two System of Rice Intensification method of cultivation (SRI) and normal system of rice cultivation. The incidence of yellow stem borer, *Scirpophaga incertulas* Walker was significantly lower in vegetative phase (Dead heart) and reproductive phase (white ear) by 57.85 % and 53.73 % under SRI system in comparison to normal cultivation method. The incidence of other foliage pests like whorl maggot (*Hydrellia philippina* Ferino) and blue beetle (*Leptispa pygmaea* Baly) were also lower in SRI system (31.76 and 3.45 % compared to normal system). The incidence of leaf folder (*Cnaphlocrocis medinalis* Guenee) another foliage pest in rice was high in SRI system (38.29 % higher over the conventional land system). The grain yield and straw yield was higher in SRI system with 18.52 and 13.35 % respectively over the conventional system. The Cost benefit ratio between the SRI and normal system was 1:2.89 and 1:2.12.

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Key words: System of Rice Intensification, normal system of cultivation, yellow stem borer, leafolder, whorlmaggot, blue beetle, C:B ratio.

INTRODUCTION

Rice is probably the world's most genetically diverse crop, which thrives well under varying ecosystems starting from rain fed upland (dry systems) to rain fed lowland (wet system) and deep water situations. It requires 4000-5000 litres of water to produce 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 by Dr. Laulanie introduced from Madagascar (Uphoff, 2003), is a rice farming practice which requires less water but provides better growing conditions for rice plants in comparison to the traditional practice of flooded rice cultivation (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). Earlier reports indicated that rice plants grown under SRI method are more resistant to pests and diseases (Gasparillo, 2002; Gani, 2004). 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 investigating and comparing the incidence of insect pests in the SRI and normal system of wetland rice cultivation.

MATERIALS AND METHODS

The field experiments in Randomized Block Design were conducted during the 2008-2011 periods at farmers fields involving twenty farmers of Kongad of Palakkad district of Kerala using a popular rice variety Ponmani during the second crop season (September – January). The variety was cultivated under the two system *viz.*, the normal system of cultivation (Wet land) and SRI system of cultivation (New System).The establishment of rice plant under the wet land and SRI system is shown in plate A. The plants under the new system have larger root biomass in comparison to plants under the wet land system as in plate B. The details of criteria adopted for each of the systems of cultivation are presented in Table 1.

Observations were recorded on the incidence of insect pests at 15, 30, 45, 60 and 75 days after transplanting on randomly selected 15 hills per plot by walking diagonally across the plots. Tiller count was taken for assessing yellow stem borer (*Scripophaga incertulas* Walker) that causes dead heart damage at vegetative stage and white ear damage at reproductive stage as in plate C and D. Incidence of leaf feeding insects such as whorlmaggot (*Hydrellia philippina* Ferino), blue beetle (*Leptispa pygamea* Baly) and leaffolder (*Cnaphalocrocis medinalis* Guenee) as in plate E, F and G were assessed by counting the number of damaged leaves among the total leaves per hill. The cost of cultivation and profit details of both the system were collected from the farmers for working out the cost benefit ratio. The grain and straw yield were also collected from both the systems. The data thus collected were subjected to statistical analysis by Randomized Block Design (RBD) and standard deviation was worked out for original means.

Table 1. Details of the criteria adopted under different systems of rice cultivation

Production Factor	**Normal System**	**SRI System**
Area	7mx 4m	7mx 4m
Seedling age	20-25 days	8-11 days
Spacing	20x10 cm	25x25 cm
Seedlings / hill	Two	One
Fertilizers (N:P:K kg/ha)	70:35:35	90:45:45
Organic Fertilizers	Vermicompost @ 150 Kg/ha	Vermicompost @ 150 Kg/ha
Irrigation	Flooding	Alternate wetting & drying
Weeding	Manual Weeding	Weeding using Cono weeder

RESULTS AND DISCUSSION

The results of the first year 2008-2009 involving twenty farmers in Kongad of Palakkad district showed that the cost of cultivation was low in the SRI system against the normal system. The gross income and net income were Rs.87, 819 and 59,643 against Rs.63, 290 and 33,877 showing higher advantage in the new system over the conventional system as in table 2.

Table 2. Average mean cultivation details of farmers under both the systems during the year 2008-2009

Year	System of cultivation	Cost of Cultivation (Rs.)	Gross Income (Rs.)	Net Income (Rs.)
2008-2009	SRI	28,182	87,819	59,643
	Wetland	29,465	63,290	33,877
	SEm±	907.22	17,344.6	18,219.3
2009-2010	SRI	36,365	59,461	23,096
	Wetland	33,826	50,085	16,366
	SEm±	1795.34	6629.83	4758.83
2010-2011	SRI	35,907	87,131	49,626
	Wetland	38,153	79,181	40,919
	SEm±	1588.16	5621.50	6156.78

The pest incidence in the first year study (2008-2009) was also relatively low in the new system with 1.99 per cent dead heart and 2.34 per cent white ear, while it was 4.36 and 5.83 per cent in the conventional system as in Table 3. The incidence of whorl maggot was also low with 2.98 per cent damaged leaves in the new system when compared to 4.47 per cent in the wet land system. The incidence of leaffolder was high in the new system at 35 and 45 days after transplanting while it was only 2.43 and 2.61 per cent in the conventional system as in table 3. The net grain yield and straw yield were also high in the new system in comparison to in the conventional system. The cost benefit ratio was 1:3.10 in the SRI system while it was 1: 2.13 in the wet land system as in Table 5.

The second year (2009-2010) study showed similar results with the cost of cultivation of Rs.36, 365 (gross income of Rs.59, 461 and net income of Rs.23, 096) in the new system while conventional system showed cost of cultivation of Rs.33, 826 (gross income of Rs. 50,085 and net income of Rs. 16,366) as in table 2. The study on pest incidence in the second year (2009-2010) depicted similar trend with less incidence of stem borer with 0.89 per cent (dead heart), 1.79 per cent (white ear) and 2.26 per cent (whorlmaggot) against 2.48, 4.58 and 3.20 per cent in the conventional system. The

Table 3. Pest incidence in wet land and SRI systems during 2008-2009 in twenty farmers of Kongad during the first year (Pooled Analysis)

System of cultivation	Stem Borer incidence		Whorlmaggot		Blue Beetle		Leaffolder	
	% DH	% WE	% DL	% DL	% DL	% DL	% DL	% DL
SRI System	1.99	2.34	2.98	2.14	2.22	2.09	4.54	4.55
Wet land System	4.36	5.83	4.63	4.47	2.34	1.67	2.43	2.61
P=0.05%	2.93	1.40	2.48	1.75	NS	NS	1.77	1.50
SEm±	1.67	2.47	1.17	1.65	0.08	0.30	1.36	1.37

* DH: Dead Heart, WE: White ear, DL: Damaged leaves

damage of blue beetle didn't vary significantly in both the system but the leaf folder damage was higher in the new system than in conventional system as in table 4. The grain yield showed no significant difference with 4749 and 4025 kg per ha between the two system. The straw yield and cost benefit ratio's were higher in the SRI system over the conventional system Table 5.

During the year 2010-11, the cost of cultivation in SRI was Rs.35, 907 while it was Rs.38, 153 in the wet land system as in table 6. The pest scenario in the two systems showed 0.42 per cent dead heart and 2.57 per cent stem borer in the SRI system while it was 0.98 per cent (dead heart) and 4.04 per cent (white ear) in the wet land system. The foliage incidence like whorlmaggot and blue beetle were not significant between the two systems. The incidence of leaf folder was higher in the new system with 1.51 per cent damaged leaves while it was only 1.28 per cent in the conventional system as in table 4. The grain yield and straw yield with cost benefit ratio of 1:2.47 in the new system while it was 5128 kg/ha and 4097 kg/ha in the wet land system with cost benefit ratio of 1:2.09 as table 5.

The studies over the period of three years in the farmers field of Kongad of Palakkad district of Kerala showed that the average mean tillers were high in SRI system while it was low in the conventional systems. The present findings corroborates to earlier finding by Mahendrakumar *et al.* (2008) who reported the plants under the SRI system produces increased yield due to their more productive tillers per unit area with chlorophyll values, total biomass and harvest index. The average cost of cultivation over the three periods of years was Rs. 33985 in the new system where it was Rs. 33,815 in the conventional system. The cost of cultivation is on par during the period of study and it may be due to fewer incidences of pest and diseases in both the systems respectively. Similar report was earlier made by Anjukam *et al.* (2008) that the SRI system is more profitable to conventional system due to low cost of nursery, less irrigation and less plant protection chemicals.

The incidence of pests in the two systems of rice cultivation showed that the average mean incidence of yellow stem borer at vegetative stage (dead heart) was 1.10 per cent in SRI system against 2.61 per cent in wet land system showing 57.85 per cent lower damage of stem borer in the new system over the conventional system. Similar reports of other workers *viz.*, Padmavathi *et al.* (2007), Ravi *et al.* (2007), Ratnasudhakar and Narasimha Reddy (2007) showed that incidence of yellow stem borer was lower in the SRI system than the wet land system. The mean per cent incidence of the stem borer at reproductive stage (white ear) was 2.23 per cent in SRI against 4.82 per cent in wet land system showing 53.73 per cent reduction of white ear over conventional system. Similar reports were made by Karthikeyan *et al.* (2007, 2008), Ratnasudhakar and Narasimha Reddy (2007).

The mean incidence of whorlmaggot was found to be lower in the new system with 2.02 per cent against 2.96 per cent in the conventional system

Table 4. Pest incidence in wet land and SRI systems during 2009-2011 in twenty farmers of Kongad during the second year (Pooled Analysis).

Year	System of cultivation	Stem Borer incidence		Whorlmaggot		Blue Beetle		Leaffolder	
		% DH	% WE	% DL	% DL	% DL	% DL	% DL	% DL
2009-2010	SRI System	0.89	1.79	2.26	1.69	0.23	0.00	2.44	2.08
	Wet land System	2.48	4.58	3.20	2.69	0.50	0.08	1.38	1.44
	CD (0.05%)	3.10	2.44	0.66	NS	NS	0.95	3.12	1.84
	SEm±	1.12	1.97	1.04	0.71	0.19	0.06	0.75	0.45
2010-2011	SRI System	0.42	2.57	1.53	1.52	0.46	0.05	1.04	1.51
	Wet land System	0.98	4.04	1.31	1.48	0.52	0.11	0.83	1.28
	CD (0.05%)	0.87	1.46	NS	NS	NS	NS	NS	1.83
	SEm±	0.40	1.04	0.16	0.03	0.04	0.04	0.15	0.16

* DH: Dead Heart, WE: White ear, DL: Damaged leaves

showing 31.76 per cent reduction over the traditional system. Lower whorlmaggot incidence was reported earlier in the SRI system (Ravi *et al.*, 2007, Karthikeyan *et al*., 2007). There was no significant difference in the incidence of blue beetle under both the systems of cultivation. The mean incidence of blue beetle was 0.84 per cent in SRI system while it was 0.87 per cent in the conventional system. Similar observation was made by Karthikeyan *et al.* (2008).

The incidence of leaffolder was higher under SRI system in comparison to the normal system of cultivation. The mean incidence was 2.69 per cent in the SRI system against 1.66 per cent in the conventional system. There was 38.29 per cent increase in the leaffolder in the new system over wet land system and it may be due to higher production of leaves in the plants in the new system. This finding is in confirmation with the similar reports (Padmavathi *et al*., 2007; Ravi *et al.,* 2007; Ratnasudhakar and Narasimha Reddy, 2007; Karthikeyan *et al.,* 2008; Sumathi *et al.,* 2008) on higher leaf folder incidence under SRI system.

The mean grain and straw yield in the new system against wet land system showing 18.52 and 13.35 per cent increase in grain and straw yield over the wet land system. Virakamath (2007) also reported higher grain and straw yield in the SRI system in southern zone (Andra Pradesh, Tamilnadu and Ponicherry), West zone (Gujarat, Maharatra), North-west zone (Punjab, Uttaranchal), Hill zone (Meghalaya, Jammu & Kashmir, Tripura) and Eastern zone (Bihar, Chattisgarh, Jharkhand, Assam).

The three years of study revealed that the SRI system is superior to the conventional system of rice cultivation with lesser incidence of insect pests yellow stem borer, whorl maggot with higher grain yield and cost benefit ratio.

Table 5. Grain yield and C:B ratio in wet land and SRI systems during 2009-2011 in twenty farmers during the first year (Pooled Analysis).

Year (s)	System of cultivation	Yield Parameters (Kg/ha)		C: B ratio
		Grain Yield	Straw yield	
2008-2009	SRI System	6435	7067	1:3.10
	Wet land System	4558	5761	1:2.13
	P=0.05%	656	349	0.22
	SEm±	1327.24	923.48	0.69
2009-2010	SRI System	4749	6868	1:3.10
	Wet land System	4025	5643	1:2.13
	CD (0.05%)	NS	349	0.27
	SEm±	511.9	866.2	0.69
2010-2011	SRI System	5642	3955	1:2.47
	Wet land System	5128	4097	1:2.09
	CD (0.05%)	304	NS	0.15
	SEm±	363.5	100.4	0.27

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