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Cultivation methods impact on predators of rice pests

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Abstract

The study was conducted with two planting methods at Chaudhary Charan Singh Haryana Agricultural University, Rice Research Station, Kaul during 2014 and 2015. The spiders appeared early in direct seeding because of early establishment of crop as well higher population in direct seeding. The population density of mirid bugs ranged from 0.58 to 3.34 and 0.36 to 3.48/hill during 2014 while 0.64 to 2.80 and 0.36 to 2.02/hill during 2015 in direct seeding and transplanting crop. The overall population of spiders and mirid bugs was significantly higher in direct seeding rice.

Keywords: direct seeding rice, predators, transplanted rice

1. Introduction

Rice (*Oryza sativa* L.) is a staple food for more than half of the world's population. In Haryana rice is grown on an area of 10.62 million ha with total production of 33.45 million tones^[1]. More than 100 species of insects are known to attack the rice crop. About 20-25 of these have reached the status of pest causing economic losses. Among them, leaf folder, stem borers, planthoppers, leafhopper and gundhi bug, are the most important in India and other countries^[5].

Rice is cultivated mainly by transplanting the seedlings into puddled soil, which requires huge amount of water and is labour intensive. The sowing of rice by Direct seeded method is becoming popular because of its low-input cost. Water and labour are two major drivers of agricultural change worldwide. These two factors have already affected the development of rice based agricultural system in the past and will remain the main factors^[9]. The methods of cultivation not only influence the pests but natural enemies also. A study on natural enemies populations in different rice establishment techniques and found that the maximum percentage (20.93%) of spiders in integrated crop management, whereas the minimum (8.85%) was observed in seedling throwing^[4]. The spiders showed the positive correlation with rice pests, *Nilaparvata lugens* and *Leptocorisa acuta* while negative correlation with *Cnaphalocrocis medinalis*. High population of spider in different plots limits the exponential growth of pest population. The occurrence of dragon flies and wolf spiders were higher in system of rice intensification (SRI) while damsel flies and coccinellids populations were lower in SRI as compared to traditional transplanted system^[6]. The spiders like wolf spider, lynx spider and insect predators such as damsel flies, dragon flies and lady bird beetles found higher in traditional system as compared to System of Rice Intensification^[6]. The factors that may influence the pest status and predators in both the methods are early sowing of crop, higher plant density due to lack of plant to plant distance in direct sowing by drill machine and longer crop duration in the field.

2. Material and Method

Two crop establishment methods *viz.*, direct seeding and transplanting were used for raising rice crop during 2014 and 2015. To study the effect of two crop establishment methods, one acre (4000 m²) plot was divided into two equal halves one each for direct seeding and transplanting.

2.1 Direct seeding

Rice variety Pusa 1121 was sown by seed drill in rows 20 cm apart at a seed rate of 20 kg/ha during second week of June in both the years (2014 and 2015) in a dry well prepared and

levelled seed bed. The field was irrigated immediately after sowing the seed to ensure seed germination.

2.2 Transplanting

The nursery of variety Pusa 1121 was sown during second week of June in both the years on the same day when the direct seeding was done in direct seeding method. The transplanting of 25 days old seedlings was carried out in well puddled field at a spacing of 20x15cm with 2 seedlings/hill. Each plot (direct seeding and transplanting) was divided into 5 blocks/replicates of 400 m² area each (Fig-5). The recommended agronomic practices were followed to raise the crop under both crop establishment methods and no pesticide was applied till the harvest of the crop [2].

2.3 Observations

Population of natural enemies (Predators) was recorded from 10 randomly selected hills in each block at 7 days interval from 40-45 days after sowing till harvest by number of counts.

2.4 Statistical analysis

The data obtained in different crop establishment methods on incidence of insect pest and natural enemies were tabulated and statistically analyzed by comparing means with independent sample t-test (Z- test) by using IBM SPSS 19.0 version.

3. Result and Discussion

3.1 Effect of crop establishment methods on population of spiders

The results on periodic fluctuation in population of spiders are presented in (Table- 1, Fig 1, 2 & 6). The spiders population initially noticed in 31st week and continued till harvest *i.e* from last week of July to third week of October. The population ranged from 0.32 to 3.62 and 0.10 to 3.04/hill in direct seeding and transplanting method during 2014. The corresponding values were 0.0 to 3.74 and 0.0 to 2.90/hill during 2015. The population was significantly higher in direct seeding during both the years. The spiders appeared early in direct seeding because of early establishment of crop as well higher plant population in direct seeding which may helps them by providing a habitat to colonize early.

The present study are in accordance as the spiders population in different rice establishment techniques was studied and found the maximum percentage (20.93%) of spiders in integrated crop management, whereas the minimum (8.85%) was observed in Seedling throwing/ direct seeding [4]. In contrast with this the occurrence of natural enemies like wolf spider, lynx spider, damsel flies, dragon flies and lady bird beetles population was higher in traditional system as compared to system of rice intensification, a resource conservation technique like direct seeding [7]. The difference in results may because of different production technology, variety or time of sowing/transplanting.

Table 1: Effect of crop establishment methods on population of spiders during *Kharif* 2014 and 2015

Month	Standard Meteorological Weeks	Spiders/hill					
		2014			2015		
		Direct seeding	Transplanting	t-value	Direct seeding	Transplanting	t-value
July	31	0.32	0.10	2.25*	0.00	0.00	0.00
August	32	0.56	0.36	1.40	0.56	0.22	2.51**
August	33	1.54	0.9	2.88*	1.24	0.76	2.88**
August	34	1.94	1.04	3.60**	1.42	1.06	2.09*
August	35	2.32	1.20	3.99**	1.62	1.20	2.33*
September	36	2.36	1.76	1.89	1.84	1.38	2.37**
September	37	3.26	2.80	1.08	2.16	1.40	3.11**
September	38	2.96	2.06	2.28*	2.42	1.82	2.32*
September	39	2.06	2.80	2.46**	3.74	2.90	3.49**
October	40	2.34	2.38	0.15	2.42	1.54	4.30**
October	41	3.62	2.68	3.58**	2.42	1.82	2.53**
October	42	2.86	3.04	0.45	2.28	1.52	2.57**
Seasonal mean		2.17	1.76		1.84	1.30	

**Significant at 1 % level of significance * Significant at 5 % level of significance

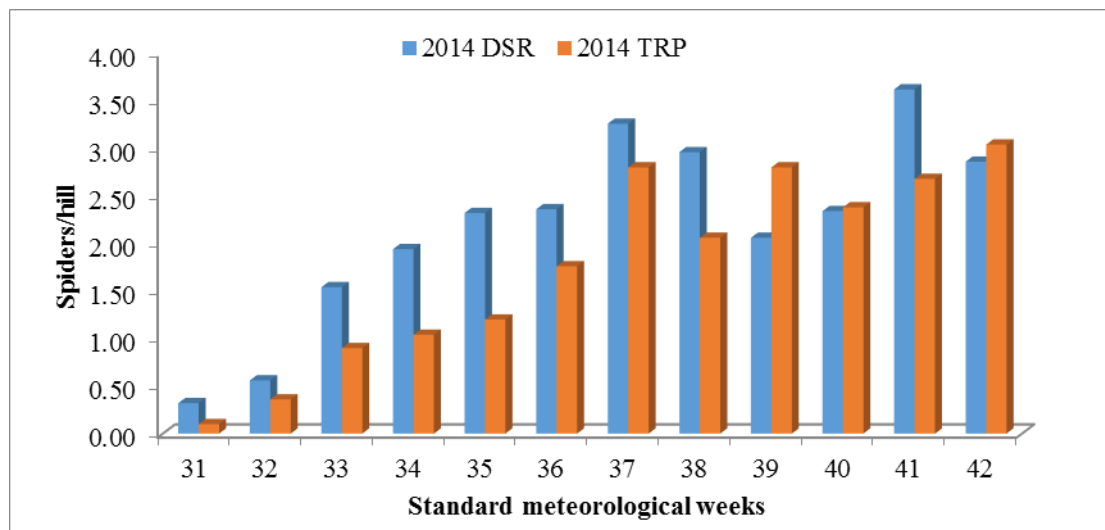


Fig 1: Effect of direct seeding and transplanting method on population of spiders during *Kharif* 2014

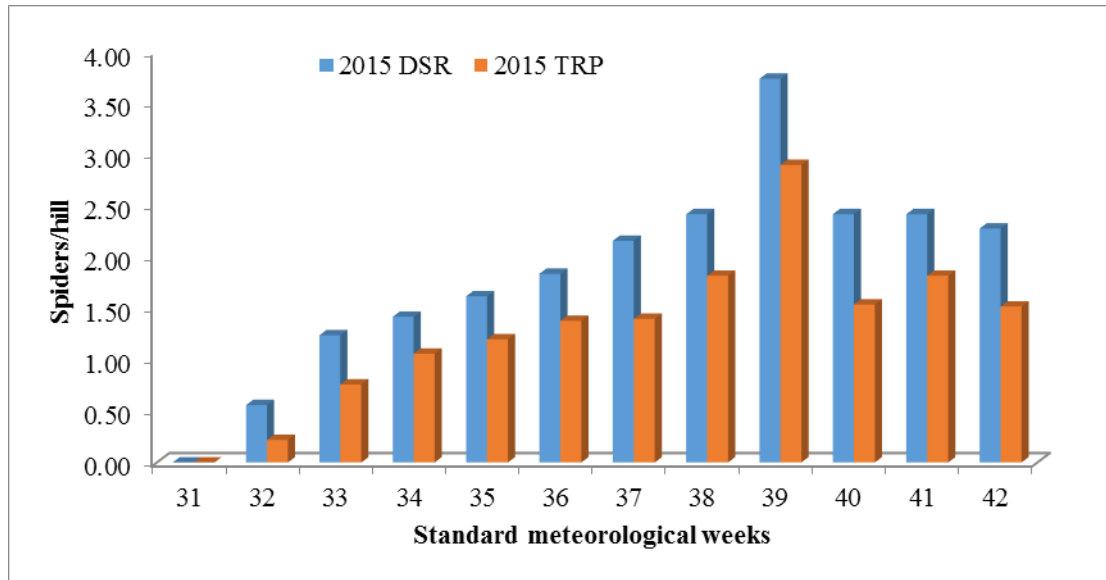


Fig 2: Effect of direct seeding and transplanting method on population of spiders during *Kharif* 2015

3.2 Effect on population of mirid bugs

The results on population of mirid bugs under both the crop establishment methods are presented (Table-2, Fig.3 & 4). The population of mirid bugs were start to appear late in the season and the density ranged from 0.58 to 3.34 and 0.36 to 3.48/hill during 2014 while 0.64 to 2.80 and 0.36 to 2.02/hill during 2015 in direct seeding and transplanting crop. Unlike

the population during 2015, no significant difference was observed during 2014. The population of mirid bugs to predate upon pests in rice ecosystem was reported by [3, 6, 8] throughout the crop season. The population of *Cyrtorhinus lividipennis* was start to appear in the late stage of crop and at that time the population may not be affected by cropping methods [10].

Table 2: Effect of crop establishment methods on population of mirid bugs during *Kharif* 2014 and 2015

Month	Standard Meteorological Weeks	Mirid bugs/ hill					
		2014			2015		
		Direct seeding	Transplanting	t-value	Direct seeding	Transplanting	t-value
September	37	0.58	0.36	1.51	0.64	0.36	1.84
September	38	1.02	0.78	1.23	1.60	1.08	2.15*
September	39	2.06	1.88	0.98	2.80	2.02	2.65**
October	40	3.34	3.48	0.35	1.84	1.50	1.39
October	41	3.00	2.90	0.41	2.36	1.90	1.91*
October	42	2.46	2.20	1.38	1.68	1.14	2.27*
Seasonal mean		2.07	1.93		1.82	1.33	

**Significant at 1 % level of significance * Significant at 5 % level of significance

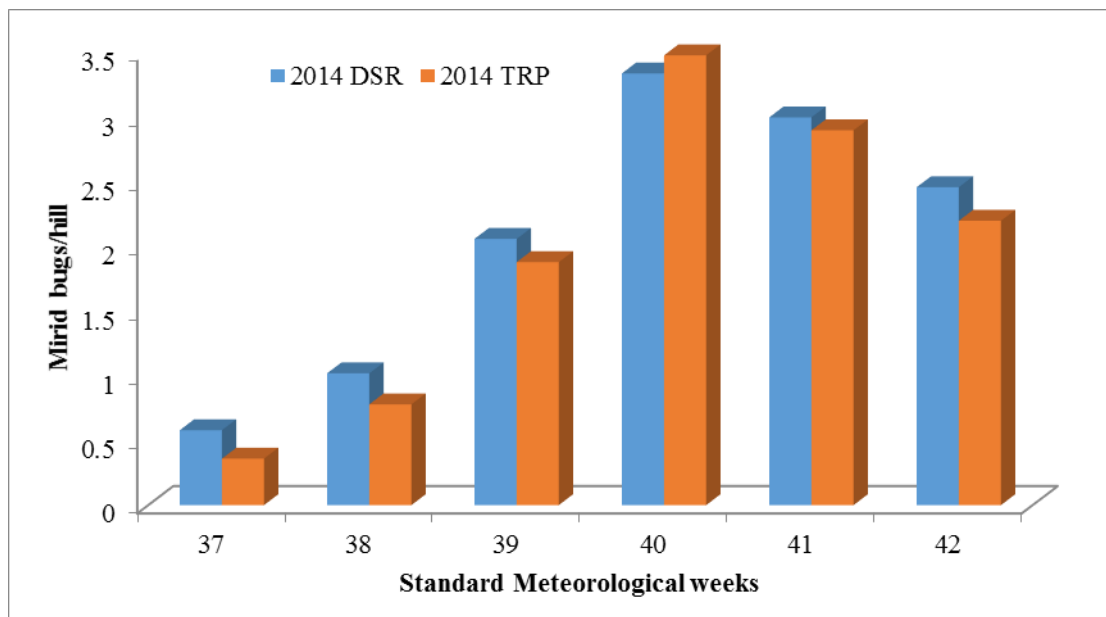


Fig 3: Effect of direct seeding and transplanting method on population of mirid bugs during *Kharif* 2014

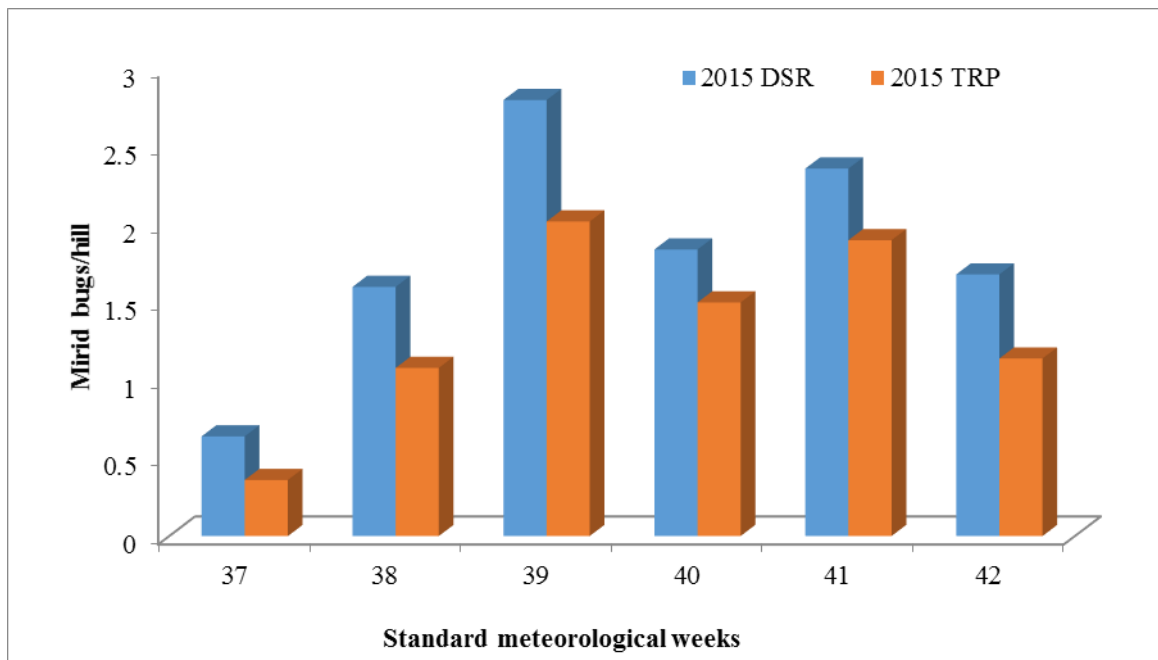


Fig 4: Effect of direct seeding and transplanting method on population of mirid bugs during *Kharif* 2015



Fig 5: Direct seeding rice crop



Fig 6: Spider in rice field

4. Conclusion

The spiders population initially noticed in 31st week and continued till harvest. The population was significantly higher in direct seeding during both the years. The spiders appeared early in direct seeding because of early establishment of crop as well higher plant population in direct seeding. The mirid bugs population was differed significantly and non - significantly during 2014 at different crop stages with overall higher population in direct seeding. However during 2015, the population mirid bugs was significantly higher in direct seeding than transplanting method.

5. Acknowledgement

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