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Weed Management in direct Seeded Rice under Conservation Agriculture based Rice - Yellow Sarson - Greengram Cropping System in Lateritic Belt of West Bengal

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ABSTRACT: Conservation agriculture (CA) is a viable alternate which is suitable for today's limited natural resources and changing climate. That's why it is becoming a common approach in rainfed areas for water and soil conservation. In CA, problem of weeds can be controlled by both manual weeding and/or by the use of herbicide. However, labour is becoming expensive and is rarely available at the critical time of weeding. . To control weeds, Integrated approaches must be considered and optimized to have proper weed control in conservation agriculture. Keeping this in view, an experiment was conducted at Agriculture Farm, Institute of Agriculture, Visva-Bharati, Sriniketan, West Bengal to investigate the effect of tillage and weed management practices on weed growth and productivity of direct seeded rice in direct seeded rice - yellow sarson -greengram cropping system under conventional and conservation tillage practices during 2018 and 2019. The experiment was set up in a strip plot design with three replications with four horizontal tillage strips and three vertical weed management strips. The Results showed that in both the years conventional tillage together with recommended herbicide (RH) (Pendimethalin at 1.0 kgha^{-1} followed by bispyribac-sodium at 25 g ha^{-1}) + one hand weeding (HW) recorded the lowest value of total weed density and dry weight at 60 DAS in both the years. Conventional tillage together with recommended herbicide (RH) (Pendimethalin at 1.0 kg ha^{-1} followed by bispyribac-sodium at 25 g ha^{-1}) + one hand weeding (HW) also registered higher grain yield than other treatments.

Keywords: Conservation agriculture, conventional tillage, direct seeded rice, pendimethalin, recommended herbicide, residue, weed management.

INTRODUCTION

For more than half of the world's population, rice (*Oryza sativa* L.) is one of the most important staple foods. The rice production area in India as of the year 2019-20 is estimated to be about 43.78 million hectares with a production of 122.4 million tonnes (Anonymous, 2021). Direct seeded rice (DSR) has a higher weed population than transplanted rice. Weed infestation is one of the leading causes of low productivity, with 50-60% output loss due to crop and weed seeds germinating at the same time (Pinjari *et al.*, 2016). Weed control in conservation agriculture (CA) is more difficult than in conventional agriculture because tillage activities do not bury weed seeds. Crop residue when retained in ZT practice, suppress weed growth, maintain soil temperature, and control air pollution caused due to residue burning (Sharma *et al.*, 2012). Tillage, crop establishment method, machinery, agronomic practices *etc*. play crucial role in weed management in conservation agriculture (Laford *et al.*, 2009). High labour expenses and timely unavailability have increased the use of herbicides in CA. Because a single herbicide cannot control a wide range of weeds, conservation agriculture can benefit from integrated weed management. In a conservation agriculture-based DSR-yellow sarson-greengram cropping system, the current experiment was done to investigate the effects of tillage and weed management measures on weed growth and rice productivity.

MATERIAL AND METHODS

A long term experiment on DSR-yellow sarson-greengram cropping system was started in2015-16. The present experiment on DSR was conducted during 2018 and 2019 under the same cropping system (4th and 5th year of the system) at Agriculture Farm, Institute of Agriculture, Visva-Bharati, Sriniketan, West Bengal. The texture of the soil in the experimental field was sandy loam. With three replications, the experiment was set up as a strip plot. The horizontal strip was divided into four tillage practises, including conventional tillage (CT) (DSR) — CT (yellow sarson) — CT (greengram), CT (DSR) — zero tillage (ZT) (yellow sarson) — ZT (greengram), ZT (DSR) — ZT (yellow sarson) — ZT (greengram), ZT + residue (R) (DSR) and three weed management practices, *viz.* recommended herbicides (RH) (pendimethalin at 1.0 kg ha^{-1} followed by bispyribac-sodium at 25 g ha^{-1} in DSR, pendimethalin at 0.75 kg ha^{-1} each in yellow sarson and greengram), Recommended herbicides + hand weeding (HW) at 35 days after sowing (DAS), Unweeded

control were assigned to the vertical strip. Rice, yellow sarson, and greengram were grown using crop varieties 'MTU-1010,' 'B-9,' and 'Samrat,' respectively. The zero till ferti-seed drill machine was used to sow direct seeded rice and greengram. The seed rate for direct seeded rice was 50 kg ha^{-1}, 5 kg ha^{-1} for yellow sarson, and 25 kg ha^{-1} for greengram. The recommended fertiliser doses of N, P_2O_5, and K_2O were applied: 80:40:40 kg ha^{-1} in DSR, 80:40:40 kg ha^{-1} in yellow sarson, and 20:40:40 kg ha^{-1} in greengram. Herbicides were sprayed using a hand operated knapsack sprayer. All other agronomic recommendations were followed, and plant protection measures were used as needed. Weed counts were recorded by inserting 50 cm × 50 cm quadrats from the specified sampling area of 1.0 m^2 in each plot, then drying them in a hot air oven at 70° C to determine weed dry weight. At harvest, rice yield attributes and grain yield were recorded and statistically assessed at a 5% level of significance.

RESULTS AND DISCUSSION

A. Effect on weeds

Digitaria sanguinalis and *Echinochloa colona* were the most common grassy weeds in DSR during all tillage techniques in 2018 and 2019.

Cynodondactylon, *Setaria glauca*, and *Panicum repens* were present as major grassy weeds under conservation tillage (ZT+R-ZT+R-ZT+R) and zero tillage (ZT-ZT-ZT). *Ludwigia parviflora* was the most common broadleaved weed detected under all tillage regimes for both the years. In addition to these *Eclipta alba* and *Cleome viscose* were the predominant broadleaved weeds in zero tillage and conservation tillage and in conventional tillage (CT-CT-CT) and conventional *fb* zero tillage (CT-ZT-ZT), *Lindernia crustacea*, *Alternanthera sessilis* and *Spilanthes acmella* were present as pre-dominant broadleaved weeds. *Fimbristylis miliacea* and *Cyperus iria* were the most predominant sedges in DSR under all the tillage practices during 2018 and 2019. Chakraborti *et al*. (2015 and 2017); Duary *et al*. (2016) both found similar weed flora in DSR.

Conventional tillage recorded lower total density and dry weight of weed than other tillage practices at 60 DAS and it was at par with conventional *fb* zero tillage (Table 1 and Fig. 1). Conventional tillage (CT-CT-CT) recorded 25.85 and 21.62 % lower total weed dry weight as compared to zero tillage (ZT-ZT-ZT) in 2018 and 2019, respectively.

Table 1: Total weed density of rice at 60 DAS as influenced by tillage and weed management practices.

Total weed density (No.m^{-2}) at 60 DAS								
	2018				2019			
Treatments	W_1	W_2	W_3	**Mean**	W_1	W_2	W_3	**Mean**
CT-CT-CT	55.33	17.33	131.67	**68.11**	97.00	27.00	172.00	**98.67**
CT-ZT-ZT	57.67	21.00	134.00	**70.89**	101.33	27.67	176.67	**101.89**
ZT-ZT-ZT	92.67	44.33	184.00	**107.00**	129.00	50.00	229.33	**136.11**
ZT+R-ZT+R-ZT+R	73.67	34.33	161.33	**89.78**	111.33	41.00	205.00	**119.11**
Mean	**69.83**	**29.25**	**152.75**		**109.67**	**36.42**	**195.75**	
	T	W	T ×W	W ×T	T	W	T×W	W×T
SE(m)±	1.53	1.80	2.61	2.87	2.18	1.79	3.54	3.46
CD(P=0.05)	5.28	7.05	10.25	8.86	7.53	7.03	13.88	10.65

Table 2: Grain yield of rice as influenced by tillage and weed management practices.

Grain yield (kg ha^{-1}) of rice								
	2018				2019			
Treatments	W_1	W_2	W_3	**Mean**	W_1	W_2	W_3	**Mean**
CT-CT-CT	3592	4792	1502	**3295**	3392	4492	1335	**3073**
CT-ZT-ZT	3667	4418	1425	**3170**	3297	4115	1322	**2911**
ZT-ZT-ZT	2683	3600	1267	**2517**	2217	3600	1033	**2283**
ZT+R-ZT+R-ZT+R	2708	4050	1300	**2686**	2575	3750	1067	**2464**
Mean	**3163**	**4215**	**1373**		**2870**	**3989**	**1189**	
	T	W	T ×W	W ×T	T	W	T×W	W×T
SE(m)±	83.68	48.72	138.90	127.28	99.25	50.33	140.73	117.19
CD(P=0.05)	289.56	191.31	427.99	392.20	343.43	197.64	433.64	361.10

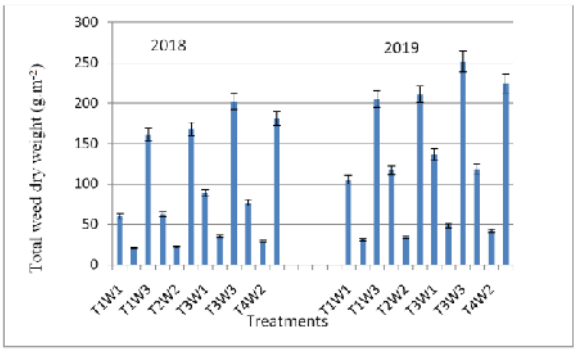

Fig. 1. Total weed dry weight in rice at 60 DAS as influenced by tillage and weed management practices.

Higher weed density and dry weight was recorded under low soil-disturbance systems as a result of zero tillage is likely to leave considerable amount of the weed seeds on the soil surface, where light encourages seed germination, resulting in more seedling emergence than high soil-disturbance system (Chauhan and Johnson 2009). The recommended herbicide in combination with one-hand weeding was found to be superior to other weed management approaches. Application of pendimethalin at 1.0 kg ha^{-1} *fb* bispyribac sodium at 25 g ha^{-1} at 20 DAS *fb* one hand weeding at 35 DAS recorded 84.92 and 82.48% lower total weed dry weight at 60 DAS than unweeded control in 2018 and 2019, respectively. The interaction effect was significant, indicating that under conventional tillage (CT-CT-CT and CT-ZT-ZT), the recommended herbicide combined with one hand weeding resulted in the lowest total weed density and dry weight at 60 DAS than conservation tillage (ZT-R+ZT+R-ZT+R and ZT-ZT-ZT) in both the years. In rice, efficient weed control was performed under pendimethalin *fb* manual weeding and pendimethalin *fb* bispyribac-Na *fb* manual weeding at all the stages of observations (Pinjari *et al*., 2016). *Echinochloa* sp. and *Digitaria sanguinalis* were well controlled by the sequential application of pendimethalin and bispyribac sodium, whereas *Eragrostis* spp. *and Leptochloa chinensis* were poorly controlled (Brar and Bhullar, 2012) .Pavithra *et al*. (2021) found that pendimethalin 1.0 kg ha^{-1} at 3 days after seeding (DAS) and *fb* bispyribac sodium 30 g ha^{-1} at 30 DAS were the most effective weed control treatments, with the lowest weed density and biomass of rice.

B. Effect on crop

During both years, tillage and weed management strategies had a considerable impact on rice grain yield. Among the tillage practises, conventional tillage (CT-CT-CT) produced the highest yield in both the years and it was at par with conventional *fb* zero tillage (CT-ZT-ZT).In 2018, conventional tillage (CT-CT-CT) yielded 30.90 and 22.67% more grain yield than zero tillage (ZT-ZT-ZT) and conservation tillage (ZT-R+ZT+R-ZT+R). In 2019, conventional tillage (CT-CT-CT) enhanced grain yield by 34.60 and 24.71% above zero tillage (ZT-ZT-ZT) and conservation tillage (ZT+R-ZT+R-ZT+R), respectively. Similar results have been reported by Govindan and Chinnusamy (2014); Paliwal *et al*. (2017); Surin *et al*. (2019). In a rice–wheat system, Upasani *et al*. (2014) found that continuous conventional tillage yielded 39.84 percent more than continuous zero tillage.

Among the weed management practices, recommended herbicide combined with one hand weeding at 35 DAS registered highest grain yield over other treatments during both the years. Grain yield was reduced by 67.42 and 70.19 % under unweeded control as compared to recommended herbicide with one hand weeding in 2018 and 2019, respectively. During both years, the interaction effect of tillage and weed control practises on grain yield was substantial, indicating that conventional tillage (CT-CT-CT) combined with prescribed herbicide and one hand weeding produced the highest grain yield and it was at par same treatment imposed under conventional *fb* zero tillage (CT-ZT-ZT).

CONCLUSION

Thus, after the fifth cropping cycle, it can be concluded that conventional tillage with recommended herbicides + one hand weeding at 35 DAS in direct seeded rice in the lateritic belt of West Bengal is recommended for effective weed management and higher rice productivity in the direct seeded rice-yellow sarson-greengram cropping system.

FUTURE SCOPE

As use of herbicide and tillage practices have significant and vital role in influencing the microbial status of soil, therefore, further work should be carried out on this aspect in the field under different crops and cropping system in various agro-climatic conditions.

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REFERENCES

Anonymous (2021). *Agricultural Statistics at a glance*. Ministry of Agriculture, India. p. 24.

Brar, H. S. and Bhullar, M. S. (2012). Dry-seeded rice productivity in relation to sowing time, variety and weed control. *Indian Journal of Weed Science*, *44* (3): 193-195.

Chakraborti, M., Duary, B. and Datta, M. (2015). Effective weed management practices to enhance the yield of direct seeded rice (*Oryza sativa* L.). *Advance Research Journal of Crop Improvement*, *6*(2): 112-115.

Chakraborti, M., Duary, B. and Datta, M. (2017). Integrated weed management in direct-seeded upland rice under Tripura condition. *Indian Journal of Weed Science*, *49*(2): 123–127.

Chauhan, B. S. and Johnson, D. E. (2009). Influence of tillage systems on weed seedling emergence pattern in rainfed rice. *Soil and Tillage Research*, *106*: 15-21.

Duary, B., Kumar, M., Teja, K. C. and Dash, S. (2016). Weed management in dry direct seeded rice through integrated approaches In: *Proceedings of 4th International Agronomy Congress*, New Delhi, India during Nov. 22–26, 2016. *Extended Summaries, 1*: 277- 278.

Govindan, R. and Chinnusamy, C. (2014). Tillage, crop establishment and weed management in rice under conservation agriculture system. *Indian Journal of Weed Science*, *46*(2): 117-122.

Lafond, G. P., McConkey, B. G. and Stumborg M. (2009). Conservation tillage models for small-scale farming: Linking the Canadian experience to the small farms of Mongolia autonomous region in China. *Soil and Tillage Research*, *104*: 150-155.

Paliwal, A., Singh, V. P., Joshi, N. and Guru, S. K. (2017). Impact of tillage and weed control practices on weed flora and productivity of rice under irrigated ecosystem. In: *Proceedings of Biennial Conference on*

"Doubling Farmers' Income by 2022: The Role of Weed Science", Udaipur, India during 1-3 March, 2017. p. 222.

Pavithra, M., Poonguzhalan, R., Narayanan, A. L. and Saravanane, P. (2021). Weed management in aerobic rice with sequential application of pendimethalin and bispyribac-sodium under coastal deltaic ecosystem. *Indian Journal of Weed Science*, *53*(1): 85–87.

Pinjari, S. S., Gangawane, S. B., Mhaskar, N. V., Chavan, S. A., Chavan, V. G. and Jagtap, D. N. (2016). Integrated use of herbicides to enhance yield and economics of direct-seeded rice *Indian Journal of Weed Science*, *48*(3): 279–283.

Sharma, A. R., Jat, M. L., Saharawat, Y. S., Singh, V. P. and Singh, R. (2012). Conservation agriculture for improving productivity and resource-use efficiency: prospects and research needs in Indian context. *Indian Journal of Agronomy, 57*(3s): 131– 140.

Surin, S. S., Ekka, A. B., Singh, M. K. and Upasani, R. R. (2019). Effect of tillage and weed control in direct-seeded rice-wheat cropping system. *Indian Journal of Weed Science*, *51*(1): 23–26.

Upasani R. R., Barla, S. and Singh, M. K. (2014). Tillage and weed management in direct-seeded rice (*Oryza sativa*)-wheat (*Triticum aestivum*) cropping system. *Indian Journal of Agronomy*, *59*(2): 75-79.

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