Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

J P P Journal of Pharmacognosy and Phytochemistry

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(6): 1742-1744
Received: 16-09-2020
Accepted: 23-10-2020

Kevizhalhou Kuotsu
Department of Agronomy, School of Agricultural Sciences and Rural Development, Nagaland University, Medziphema, Nagaland, India

Avanish Prakash Singh
Department of Agronomy, School of Agricultural Sciences and Rural Development, Nagaland University, Medziphema, Nagaland, India

Corresponding Author:
Kevizhalhou Kuotsu
Department of Agronomy, School of Agricultural Sciences and Rural Development, Nagaland University, Medziphema, Nagaland, India

Establishment and weed management effects on yield of lowland rice (*Oryza sativa*)

Kevizhalhou Kuotsu and Avanish Prakash Singh

Abstract
Field experiments were conducted during the rainy (*kharif*) seasons of 2016 and 2017 in the experimental farm of SASRD, NU, Medziphema campus to evaluate the efficacy of various weed management practices in different rice establishment methods for improving productivity and weed control. Results revealed minimum weed density and dry matter and maximum weed control efficiency in integrated crop management (ICM) while the opposite was observed in System of Rice Intensification (SRI). Significantly lower weed density and dry weight and higher weed control efficiency was observed under HW twice at 20 and 40 days after transplanting (DAT) among the weed management methods. SRI gave better crop growth in both the years. In terms of grain yield, SRI and ICM produced 17.5 and 12.2% higher grain yield respectively over CTR. Among the weed management methods, hand weeding at 20 and 40 DAT recorded 81% higher grain yield of rice over control.

Keywords: establishment method, productivity, weed density, weed management, yield

Introduction
Rice (*Oryza sativa*) is the staple food particularly in South and Southeast Asia where more than 90 percent of rice is produced and consumed. The global food security is highly dependent on the rice production in Asia as it contributes 90.6% of the world's rice production (Bandumula, 2017) [1]. India alone would require about 156 mt of rice by the year 2030 at an annual increment of 3 mt in the current rice production (Dass *et al*. 2016) [2].
System of Rice Intensification (SRI) and Integrated Crop Management (ICM) are considered to be very effective and gaining popularity with reports suggesting that the yield of rice could be enhanced by 2 to 3 times by adopting SRI and upto 1.5 t ha^{-1} by adopting the ICM practices (Balasubramaniam *et al*. 2004) [3]. However, weed competition is one of the prime yield–limiting biotic constraints with average yield losses estimated to be 40 - 60% which may go up to 96% with uncontrolled weed growth (Chauhan and Johnson, 2010) [4]. So, there is a need to develop a cost effective weed management technique. Hand weeding though very effective for controlling weeds is very labour intensive. Raising cost of labour and their reduced availability has led to search for alternative methods such as herbicide use either alone or in combination with manual or mechanical weeding (Kabdal *et al*. 2018) [5]. For keeping weed population below threshold level, there is a need to evolve an effective integrated strategy involving chemical and mechanical methods for better control of weeds in rice for which this investigation was undertaken to evaluate the comparative efficacy of various establishments and weed management practices.

Materials and methods
The experiment was conducted at the experimental research farm of the School of Agricultural Sciences and Rural Development (SASRD), Medziphema campus, Nagaland University during the *kharif* season of 2016 and 2017 located in the foothill of Nagaland with humid sub-tropical climate and an altitude of 310 m above mean sea level. The experiment was replicated thrice in split-plot design with three crop establishment techniques, *viz.* SRI, ICM and CTR as the main treatments and six weed management practices, *viz.* weedy check, hand weeding at 20 and 40 DAT, bispyribac sodium @ 0.25 l/ha, pretilachlor followed by hand weeding at 40 DAT, pretilachlor at 3 DAT *fb* bispyribac sodium at 40 DAT and cono-weeding at 20 and 40 DAT as the sub-plot treatments of sizes 5 m x 5 m. The soil of the experimental site was clay-loam in texture, with pH - 5.72, organic carbon - 1.42%, available N - 338 kg/ha, available P - 17.9 kg/ha and available K - 121 kg/ha. Fertilizer dose of 80: 60: 40 kg NPK/ha in the form of urea, single super phosphate and murate of potash were applied as common dose in all the plots for both the years.

The nurseries for all the establishment methods were sown on the same day but transplanting date varied as per the requirement of different establishment methods. For SRI, 10-day-old seedling at 1 seedling/hill was used with 25 cm × 25 cm spacing while for ICM, 15-day-old seedlings at 2 seedlings/hill were used with a spacing of 20 cm × 20 cm and for CTR, 30-day-old seedlings at 3 seedlings/hill with a spacing of 20 cm × 10 cm was followed. The nursery for SRI and ICM was prepared using a modified mat nursery (MMN) method and conventional method for CTR. The three establishment methods (SRI, ICM and CTR) were compared with each other considering respective package of practices as part of treatments. Rice variety RCM 9 was used as test variety for this experiment. All other recommended package of practices was followed and weed samples were collected from a 1 m^2 quadrant.

The observations on plant growth attributes were recorded manually from ten randomly tagged plants. Yield attributes were also recorded from the tagged plants at physiological maturity as per standard method. Grain and straw yield were recorded from net area of each plot. The data obtained under study were analyzed by the method of analysis of variance as described by Gomez and Gomez (1984) [6].

Results and Discussion

Weed parameters

Total weeds density and dry matter were observed to be minimum in ICM as compared to CTR while the highest values were observed under SRI (Table 1). Maintaining standing water for a few days after proper crop establishment or after the application of herbicides can greatly help in improving herbicide efficacy and weed management which could have been one of the reasons in ICM and CTR recording lower weed density as well as dry matter. Shan *et al*. (2012) [7] were of the opinion that poor establishment of crop initially failed to suppress weeds. Intermittent wetting and drying coupled with higher spacing in SRI could have resulted in higher weed values as the spacing between the rows allowed more penetration of light which led to enhanced weed growth as the weeds enjoyed congenial environment through wider spacing and aerobic conditions. Islam and Kalita (2015) [8] also reported similar results and attributed it to higher weed density and biomass due to aerobic conditions and more space between rice plants as compared to conventional transplanting.

Hand weeding at 20 and 40 DAT and weedy check recorded the minimum and maximum weed density as well as dry matter in both the years among weed management methods. Similar findings were reported by Kumar *et al*. (2015) [9]. The application of pretilachlor *fb* hand weeding recorded significantly lower weed population among the rest of the weed management methods. Other also reported that sequential application of herbicides or application of herbicides *fb* hand weeding gave lower weed density compared to single application of herbicides or weedy check (Parameswari and Srinivas, 2014) [10].

Table 1: Effect of establishment and weed management methods on weed parameters at 60 DAT

Treatments	Total weed density (no/m^2)		Total weed dry weight (g/m^2)		Weed control efficiency (%)	
	2016	2017	2016	2017	2016	2017
Rice establishment methods						
System of Rice Intensification	10.89 (123.28)	10.44 (115.94)	14.98 (233.94)	14.36 (219.81)	49.45	53.63
Integrated Crop Management	9.01 (87.22)	8.59 (79.72)	12.37 (165.27)	11.81 (151.41)	55.57	56.29
Conventionally Transplanted Rice	9.73 (101.06)	9.88 (102.67)	13.39 (192.56)	13.59 (194.64)	53.74	48.89
SEm±	0.20	0.28	0.28	0.38	2.45	2.48
CD (*P*=0.05)	0.77	1.10	1.12	1.48	9.63	9.73
Weed management methods						
Weedy check	14.83 (220.11)	14.54 (212.00)	20.42 (418.66)	20.04 (403.60)	-	-
Hand weeding at 20 and 40 DAT	7.47 (56.56)	7.19 (52.78)	10.26 (107.23)	9.86 (99.54)	74.59	75.19
Bispyribac Sodium @ 0.25 l ha^{-1} at 20 DAT	10.24 (105.22)	9.91 (98.67)	14.07 (198.88)	13.63 (187.36)	51.92	53.31
Pretilachlor @ 1 l ha^{-1} at 3 DAT *fb* one hand weeding at 40 DAT	8.00 (65.22)	7.85 (62.56)	11.01 (124.23)	10.78 (118.18)	70.69	70.49
Pretilachlor @ 1 l ha^{-1} at 3 DAT *fb* Bispyribac Sodium @ 0.25 l ha^{-1} at 20 DAT	8.91 (80.00)	8.89 (80.56)	12.26 (152.29)	12.22 (152.16)	63.82	61.35
Cono weeding at 20 and 40 DAT	9.80 (96.00)	9.45 (90.11)	13.47 (182.24)	12.99 (170.88)	56.49	57.29
SEm±	0.24	0.34	0.34	0.48	2.00	2.77
CD (*P*=0.05)	0.68	0.98	0.97	1.39	5.78	8.00

*Figures in parentheses are original values

Growth attributes

Plant height, number of leaves/hill and dry matter accumulation were higher in case of SRI among the establishment methods (Table 2). Seedlings in the case of SRI as well as ICM were not uprooted but carefully scooped out along with soil. Young seedlings are able to recover better as compared to older seedlings which may have led to attaining higher plant height and leaves as compared to CTR where seedlings were transplanted at 25 days. In addition, the wider spacing in case of SRI helps the crop in expressing its full growth potential. The results are in conformity with Dwibedi *et al*. (2017) [11].

Significantly maximum plant growth attributes among all treatments was recorded in the case of hand weeding twice while weedy check recorded the minimum values and is in corroboration with the findings of Parameswari and Srinivas (2016) [12]. The lower values can be attributed to the competition between rice and weeds.

Yield

Yield (Table 2) was observed to be higher under SRI. Usage of younger seedlings, wider spacing, aerobic conditions, avoiding transplanting shock and transplanting of seedling before third phyllochron could be reason for higher yields under SRI. Kumar *et al*. (2015) [9] also reported similar results.

The higher yield in weed control treatments could be due to less competition among crop plants and weeds in treated plots where weeds were eliminated to a large extent (Lhungdim *et al*. 2019) [13]. Control of weeds by herbicides during early stages of crop growth followed by hand weeding at a later stage resulted in lower competition for growth resources thus influencing the crop to grow better leading to higher yield in the case of pretilachlor application *fb* hand weeding at 40 DAT which recorded higher yields next to hand weeding twice (Sahu *et al*. 2015) [14].

Table 2: Effect of establishment and weed management methods on growth and yield of rice (pooled data of 2 years).

Treatment	Plant height (cm)	Number of leaves/hill	Dry matter accumulation (g/hill)	Test weight (g)	Grain yield (t/ha)	Straw yield (t/ha)
Rice establishment methods						
System of Rice Intensification	73.39	53.61	15.44	20.90	4.24	5.88
Integrated Crop Management	73.50	51.17	13.77	20.93	4.05	5.76
Conventionally Transplanted Rice	70.43	48.94	10.88	20.90	3.61	5.51
SEm±	0.53	0.85	0.25	0.41	0.07	0.07
CD (*P*=0.05)	1.74	3.35	0.83	NS	0.22	0.21
Weed management methods						
Weedy check	68.77	44.89	9.53	20.80	2.53	4.20
Hand weeding at 20 and 40 DAT	74.84	59.78	17.16	20.94	4.59	6.30
Bispyribac Sodium @ 0.25 l ha^{-1} at 20 DAT	72.39	52.89	12.20	20.89	4.01	5.88
Pretilachlor @ 1 l ha^{-1} at 3 DAT *fb* one hand weeding at 40 DAT	72.37	47.11	13.72	21.06	4.32	6.04
Pretilachlor @ 1 l ha^{-1} at 3 DAT *fb* Bispyribac Sodium @ 0.25 l ha^{-1} at 20 DAT	72.22	49.56	12.97	20.88	4.24	6.05
Cono weeding at 20 and 40 DAT	74.03	53.22	14.61	20.89	4.10	5.82
SEm±	0.87	1.50	0.48	0.53	0.12	0.11
CD (*P*=0.05)	2.45	4.35	1.37	NS	0.34	0.30

Conclusion

It can be concluded from the investigation that SRI method with hand weeding twice at 20 and 40 DAT could be recommended because of its higher productivity. However, keeping in mind the labour scarcity and high costs, SRI in combination with sequential application of pretilachlor and bispyribac sodium is recommended for higher income and profitability.

References

1. Bandumula N. Rice production in Asia: key to global food security. Proceedings of the National Academy of Sciences 2017. DoI 10.1007/s4011-017-0867-7
2. Dass A, Chandra S, Choudhary AK, Singh G, Sudhishri S. Influence of field re-ponding pattern and plant spacing on rice rooteshoot characteristics, yield, and water productivity of two modern cultivars under SRI management in Indian Mollisols. Paddy and Water Environment 2016;14:45-59.
3. Balasubramanian V, Rajendran R, Ravi V, Chellaiah N, Castro E, Chandrasekaran B, *et al*. Integrated crop management and mat nursery for enhancing yield and profitability in transplanting rice system of Asia. Paper presented at the 39th All India Rice Research Group meeting, IARI, New Delhi, India. 12 – 14 April, 2004. In special lectures 2004. DRR, Hyderabad.
4. Chauhan BS, Johnson DE. Relative importance of shoot and root competition in dry-seeded rice growing with jungle rice (*Echinochloa colona*) and ludwigia (*Ludwigia hyssopifolia*). Weed Science 2010;58:295-299.
5. Kabdal P, Pratap T, Yadav VR. Weed management in transplanted rice – a review. International Journal of Current Microbiology and Applied Sciences 2018;7(4):1660-1669.
6. Gomez KA, Gomez AA. Statistical Procedures for Agricultural Research, 2nd edn. 1984; New York: Wiley.
7. Shan FA, Bhat MA, Ganai AN, Hussain A, Bhat AT. Effect of crop establishment and weed control practices on the performance of rice (Oryza sativa L.). Applied Biological Research 2012;14(1):79-83.
8. Islam MM, Kalita DC. Establishment methods and weed management effects on productivity and soil fertility in wetland rice (*Oryza sativa* L.). Journal of the Indian Society of Soil Science 2015;63(3):339-346.
9. Kumar S, Sinha KK, Singh D. Crop establishment, fertility and weed management practices in scented hybrid rice. Indian Journal of Weed Science 2015;47(2):113-116.
10. Parameswari YS, Srinivas A. Influence of weed management practices on nutrient uptake and productivity of rice under different methods of crop establishment. Journal of Rice Research 2014;7(1-2):77-86.
11. Dwibedi SK, De GC, Dhua SR. Relative performance of rice (*Oryza sativa*)–ratoon production system as influenced by date of sowing and system of cultivation of plant rice genotypes. Indian Journal of Agronomy 2017;62(3):247-254
12. Parameswari YS, Srinivas A. Effect of crop establishment methods and weed management practices on rice (*Oryza Sativa* L.) yield. Journal of Rice Research 2016;9(2):51-54.
13. Lhungdim J, Devi YS, Devi KN, Chanu YB. Influence of weed control techniques and establishment method on yield and economics of rainfed lowland rice. Journal of Crop and Weed 2019;15(1):121-6.
14. Sahu R, Singh MK, Singh M. Weed management in rice as influenced by nitrogen application and herbicide use. Indian Journal of Weed Science 2015;47(1):1-5.