Journal of Advanced Zoology

ISSN: 0253-7214

Volume 44 Special Issue -02 Year 2023 Page 779:785

EFFECT OF HERBIGATION ON WEED DYNAMICS AND YIELD IN DIRECT SOWN AEROBIC RICE (*Oryza sativa* L.)

Divya Sree T[1*], Nambi J[2], Sundari A[3] and Saravanan K.R[4]

[1] Research Scholar, Department of Agronomy, Faculty of Agriculture, Annamalai University
[2] Associate Professor, [3] Professor, Department of Agronomy, Faculty of Agriculture,
[4]Assistant Professor, Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University

Corresponding author-*divyathota330@gmail.com*

Article History

Received: 27Aug 2023

Revised: 28Sept 2023

Accepted: 06Oct 2023

A Field experiment was conducted at Annamalai University experimental farm during the season *Summer*, 2020. to find out the effect of herbigation based weed management practices in direct sown aerobic rice on weed and yield parameters. The experiment was laid out in a randomized block design with eight treatments and replicated thrice. The results showed that among the different herbigation treatments, PE herbigation of pretilachlor + bensulfuron methyl 660 g ha^{-1} on 3 DAS *fb* PoE herbigation of bispyribac sodium 25 g ha^{-1} on 20 DAS recorded lower weed density Table 1. (23.70 m^{-2} and 33.52 m^{-2}) less dry weight of weeds (39.3 kg ha^{-1} and 65.10 kg ha^{-1}) which exhibited highest WCE (87.65 and 89 %) than other treatments on 20 and 40 DAS. whereas, weed free check stood superior in all the aspects of crop and weed parameters except in monetary returns. Suppression of weeds among the treatments resulted in weed free plot to record higher grain yield. PE herbigation of pretilachlor + bensulfuron methyl 660 g ha^{-1} on 3 DAS *fb* PoE herbigation of bispyribac sodium25 g ha^{-1} on 20 DAS recorded highest grain yield of (6156 kg ha^{-1}) and lowest weed index of (2.56 %) and it was on par with PE herbigation of pretilachlor + bensulfuron methyl 660 g ha^{-1} on 3 DAS *fb* HW on 30 DAS (6107 kg ha^{-1}) which was significantly superior to other treatments. Weedy check had accounted for lower yield of (3500 kg ha^{-1}) and highest weed index (44.60 %) due to heavy weed infestation.

Key words: Drip Irrigation, Weed Management, Herbigation, Direct Sowing, Aerobic Rice

INTRODUCTION

Globally, 164 million hectares of land been used to grow rice (*Oryza sativa* L.), which has a productivity of 4.6 tonnes per hectare and a production of 756.74 million tonnes (FAO STAT, 2022). India is second in production and has the greatest area of any nation that grows rice with a productivity of 2.27 tonnes per hectare, it produce 100 million tonnes of rice over an area of 43.97 million hectares. About 26% of the nation's land is used for agriculture, and rice accounts for 44% of all food grain output and 45% of all cereal production. More than half of the world's population consumes rice, making it one of the most important food crops and contributing about 20% of the world's dietary energy. In Tamil Nadu, 1.85 million hectares of rice are produced, producing 6.95 million tonnes and yielding 3.7 t ha^{-1} (Anonymous,2019). In many Asian nations, particularly in India, where there has vast and dense populations that depend on subsistence agriculture, this is essential for food security (Thakur et al., 2014). Farmers in important rice-producing regions are already struggling to meet the demand for food from an expanding population by growing more rice with less water. Drip irrigation has recently been suggested for aerobic rice to boost yield while saving water. With the use of mechanized multi-crop seed drills, seeds are immediately sown in well-drained, non-puddled soil for the production of drip irrigated rice. The crop is then produced in circumstances of unsaturated soil moisture for the duration of the crop (Sharda et al., 2017). In order to get high yields, it entails adopting high yielding varieties that are responsive to irrigation and fertigation as well as aerobic conditions (Sharma et. al., 2018). Because weeds develop alongside rice in aerobic rice systems and there is no water layer to inhibit weed growth, direct-seeded aerobic rice is more vulnerable to severe weed infestation than transplanted lowland rice. Weeds reduce output by between 56.4 to 90.70 percent in aerobic rice (Paradkar et al., 1997). Weed management is an important agro-technique for the productive development of aerobic rice since the crop and weeds compete equally for nutrients and moisture absorption. For the competition to be successful, weed-free conditions must be maintained during the critical period. This can be achieved through pre-emergence, post-emergence, a mixture of both, or hand weeding. Although manual weeding is the most popular and effective way of weed management in rice, it has become less practical due to rising labour costs and a labour shortage during the busiest season for agricultural operations. The most efficient, cheap, and practical method of managing weeds is through the use of herbicides. Another method is called "herbigation," in which herbicides are applied to a crop, weed, or field through the irrigation system while also being diluted with irrigation water. However, a thorough inquiry is necessary. The effectiveness of herbigation through a drip irrigation system, in addition to other weed control techniques, has to be tested in drip-irrigated aerobic rice. In order to better understand how different herbicide combinations affect the yield and weed dynamics of aerobic rice grown under drip irrigation, the current research has been carried out.

MATERIALS AND METHODS

To determine the impact of herbigation-based weed management strategies on weed dynamics and yield in direct-sown aerobic rice, a field experiment was carried out at the Annamalai University Experimental Farm during the kharif 2020 seasons. The experimental field plot of Q8 Block at the experimental farm of Annamalai University served as the site for the field trial. The experimental farm is located at latitudes 11°24'N and 79°41'E and is 5.79 m above mean sea level. The maximum temperature ranged from 38.4 0C to 30.6 0C with a mean of 34.3 0C, and the minimum temperature ranged from 27.2 0C to 20.9 0C with a mean of 24.80C. The mean relative humidity was 82.26 per cent, with a range of 92 to 75%. With a mean of 7.7 hr of bright sunshine per day and 3.55 km hr^{-1}, respectively, the wind speed ranged from 6.9 km hr^{-1} to 1.3 km hr^{-1} and from 9.7 hr day^{-1} to 4.6 hr day^{-1}. The soil in the test field was clay loamy with an EC of 0.32 dS and a pH of 7.2. Eight treatments, each reproduced three times, were used in the experiment's Randomized Block Design as T_1 - PE herbigation of pendimethalin 1.0 kg ha^{-1} on 3 DAS *fb* HW on 30 DAS, T_2 - PE herbigation of pyrazosulfuron ethyl @ 500 g ha^{-1} on 3 DAS *fb* HW on 30 DAS, T_3 - PE herbigation of pretilachlor + bensulfuron methyl 660 g ha-^{1} on 3 DAS *fb* HW on 30 DAS, T_4 - PE herbigation of pendimethalin 1.0 kg ha^{-1} on 3 DAS *fb* PoE herbigation bispyribac sodium 25 g ha^{-1} at 20 DAS ,T_5 - PE herbigation of pyrazosulfuron ethyl @ 500 g ha^{-1} on 3 DAS *fb* PoE of herbigation of bispyribac sodium 25 g ha^{-1} at 20 DAS, T_6- PE herbigation of pretilachlor + bensulfuron methyl 660 g ha^{-1} on 3 DAS *fb* PoE herbigation of bispyribac sodium 25 g ha^{-1} on 20 DAS, T_7 - Weed free check, T_8 - Weedy check. The trial plot was included using the medium duration variety of AU 1 GSR. In well ploughed dry soil, manualsowing has been done in lines. An emitter/dripper spacing of 60 cm and a lateral spacing of 100 cm were used to install the drip system. 4.0 litres per hour were discharged by the drippers. During the cropping period, irrigation was applied every three days based on data from an open pan evaporometer (USWB class placed at the Annamalai University in Chidambaram's Agro Meteorology Observatory). Fertigation was implemented using the recommended dose of fertilizer (150:50:50 kg N P K ha^{-1}). All of the plots had control valves installed to make it easier to regulate the water flow and apply herbicides in accordance with the treatments. For 30 minutes prior to herbigation and 30 minutes following herbigation, drip irrigation applied to disperse the chemicals evenly and thoroughly.

Weed flora, total weed count, weed dry matter production, weed control effeciency, grain yield, and weed index of biometric observations were noted. Each plot's weed count was calculated using a 0.25 m-2 quadrate and expressed as a number of m^{-2}. In order to calculate the dry weight of the weeds in each treatment, weeds from the net plot area were first sun-dried, then they were dried at 60 °C until they reached a constant weight. The data on weeds were analyzed using square root transformation (x+0.5).

After reading the relevant literature, indices were calculated. Gill and Vijaykumar used Mani et al. (1973) formula to calculate the effectiveness of their weed control measures (1969). The following indicators were computed:

$$\text{WCE (\%)} = \frac{\text{Weed population in control plot - Weed population in treated plot X 100}}{\text{Weed population in control plot}}$$

$$\text{Weed index (WI)} = \frac{\text{Grain yield in weed free plot - Grain Yield in weed free plot}}{\text{Grain yield in weed free plot}}$$

STATISTICAL ANALYSIS

The data on weeds were statistically analysed (Gomez and Gomez, 1984). The data on weed density were subjected to square root transformation √(x+0.5) before analysis. A five percent probability level was used to calculate the critical difference.

RESULTS AND DISCUSSION

The most common weed species found in the field were weed species *viz.*, *Echinocloa colona*, *Leptochloa chinensis*, *Panicum repens*, *Cynodan dactylon*, among grasses *Cyperus* *rotundus*, *Cyperus difformis* among sedges *Eclipta alba*, *Trianthema portulacastrum*, *Phyllanthus maderaspatensis*, *Phyllanthus niruri*, among Broad leaved weeds. Whereas, *Chloris barbata Euphorbia prostrata*, *Commelena benghalensis*, *Portulaca olereceae* are less in number. Similar weed species under direct sown aerobic rice were also reported by Palani(2020), Kanimozhi (2019), Nambi (2017) and Jagadish (2015).

EFFECT ON WEEDS

Weed density, weed dry weight, and weed control efficiency were significantly impacted by the application of pre-emergence and post-emergence herbicides (Table 1.) Among the weed management practices based on herbigation, T_6- PE herbigation of pretilachlor + bensulfuron methyl 660 g ha^{-1} on 3 DAS *fb* PoE herbigation of bispyribac sodium 25 g ha^{-1} on 20 DAS registered significantly lower weed density (23.70 m^{-2} and 33.52 m^{-2}), dry weight (39.3 kg ha^{-1} and 65.10 kg ha^{-1}) and higher WCE (87.65 % and 89 %) at 20 and 40 DAS. This is because pretilachlor + bensulfuron methyl was applied through herbigation, which effectively controlled the weeds by inhibiting cell division, mitosis, and acetolactate synthase (Sunil et al., 2010) which is on par with T_3- PE herbigation of pretilachlor + bensulfuron methyl 660 g ha^{-1} on 3 DAS *fb* HW on 30 DAS. Weed free check registered significantly lower weed density dry weight and higher WCE (97 %, 97.2 %) at 20 and 40 DAS. Reduced weed density, dry weight and higher weed control efficiency might be due to broad spectrum control of weeds by PE herbigation of pretilachlor + bensulfuron methyl 660 g ha^{-1} on 3 DAS *fb* PoE herbigation of bispyribac sodium 25 g ha^{-1} on 20 DAS. Unweeded control recorded higher weed density (191.96 m^{-2}, 241.96 m^{-2}), increased dry weight (339.8 kg ha^{-1}, 499.4 kg ha^{-1}) at 20 and 40 DAS.

The weed index serves as a gauge for yield loss brought on by weed competition. Among various herbigation-based weed control techniques T_6 - PE herbigation of pretilachlor + bensulfuron methyl 660 g ha^{-1} on 3 DAS *fb* PoE herbigation of bispyribac sodium 25 g ha^{-1} on 20 DAS recorded lower weed index (2.56 %) (Table 2, Fig 2)., weedy check (44.60 %) Due of fierce weed competition(Table 2) showed the highest weed index. Lower growth and yield components in the weedy check indicated that weed competition for nutrients, moisture, space, and light was greater. In the end, this severely decreased the grain yield. Weed free was associated with a lower weed index. These findings are consistent with those made by Bhanu Rekha et al., 2003, and Abhishek et al., (2017).

EFFECT ON YIELD

The maximum grain yield of (5755 kg ha^{-1}) of about 55 percent higher than any other herbigation-based weed management technique was noted in PE herbigation of pretilachlor + bensulfuron methyl 660 g ha^{-1} on 3 DAS *fb* PoE herbigation Bispyribac sodium 25 g ha^{-1} on 20 DAS. Better weed control was responsible for this because weed-free conditions allowed for more space, nutrients, moisture, and light to reach the crop. This improved growth by eliminating weeds of all kinds during the majority of crop growth period led to a higher grain yield and it was comparable to T_3- PE herbigation with pretilachlor + bensulfuron methyl 660 g ha^{-1} on 3 DAS *fb* HW on 30 DAS, which was better than weedy check and other treatments.

CONCLUSION

According to the study carried out , PE herbicide application of pretilachlor + bensulfuron methyl 660 g ha^{-1} on 3 DAS *fb* PoE herbicide application of bispyribac sodium 25 g ha^{-1} on 20 DAS resulted in lower weed DMP, higher WCE, and lower weed index. These results led to higher grain yield and straw yield. Therefore, it is advised that farmers can use the aforementioned herbicide combination through herbigation in order to achieve effective management of weeds and higher grain yield.

Table 1. Effect of herbigation on weed density andweed dry matter production and weed control Index on 20 and 40 DAS in direct sown aerobic rice

Treatments	Total weed count at 60 DAS (no. m^{-2})				Total weed count at 40 DAS				Weed DMP (kg. ha^{-1})		WCE (%)	
	Grasses	Sedges	BLW	Total weed density	Grasses	Sedges	BLW	Total weed density	20 DAS	40 DAS	20 DAS	40 DAS
T_1	4.28 (17.79)	2.81 (7.37)	4.84 (22.93)	6.97 (48.09)	4.72 (21.79)	3.14 (9.37)	5.24 (26.93)	7.65 (58.09)	80.05	113.3	74.95	76.8
T_2	4.93 (23.77)	3.33 (10.56)	5.52 (29.96)	8.05 (64.29)	5.32 (27.77)	3.61 (12.56)	5.87 (33.96	8.65 (74.29)	106.97	144.4	66.51	91.5
T_3	3.08 (8.97)	1.95 (3.30)	3.59 (12.36)	5.01 (24.63)	3.67 (12.97)	2.41 (5.30)	4.11 (16.36)	5.93 (34.63)	40.36	67.44	87.17	73.3
T_4	4.02 (15.67)	2.64 (6.46)	4.58 (20.51)	6.57 (42.64)	4.49 (19.67)	2.99 (8.46)	5.00 (24.51)	7.29 (52.64)	86.18	102.2	77.79	66.1
T_5	4.79 (22.44)	3.14 (9.38)	5.53 (30.12)	7.90 (61.94)	5.19 (26.44)	3.45 (11.38)	5.88 (34.12)	8.51 (71.94)	100.92	137.4	67.73	60.8
T_6	3.00 (8.52)	1.89 (3.08)	3.55 (12.10)	4.92 (23.70)	3.61 (12.52)	2.36 (5.08)	4.07 (16.10)	5.85 (33.52)	39.3	65.10	87.65	89.0
T_7	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.00	0.00	97.40	97.2
T_8	8.44 (70.80)	5.87 (33.92)	9.37 (87.24)	13.87 (191.96)	9.56 (90.80)	6.66 (43.92)	10.38 (107.24)	15.57 (241.96)	339.8	499.4	0.00	0.00
S.Ed.	0.09	0.06	0.12	0.15	0.11	0.07	0.12	0.17	2.12	3.02	NA	NA
CD (p=0.5)	0.21	0.14	0.25	0.33	0.23	0.16	0.25	0.37	4.50	6.40	NA	NA

*Figures in parenthesis indicates original values, DAS-Days after sowing, BLW- Broad leavedweeds, NA - statistically not analyzed

Table 2. Effect of herbigation on grain yield, straw yield and weed index in direct sown aerobic rice

Treatment	Grain yield (kg. ha^{-1})	Straw yield (kg. ha^{-1})	Weed Index
T_1	5451.80	8504.70	13.72
T_2	4100.50	6437.80	35.10
T_3	6107.10	9160.60	03.34

T_4	5544.90	8650.00	12.24
T_5	4415.50	6932.30	30.12
T_6	6156.60	9334.90	02.56
T_7	6318.70	9478.10	00.00
T_8	3500.20	5775.30	44.60
S.Ed.	150.40	243.00	NA
CD(p=0.5)	314.60	494.00	NA

REFERENCES

Abhishek, G.M., Thimmegowda, M.N.,Ramachandrappa, B.K., Nagaraju and Murukannappa, 2017. Efficiency of herbigation based weed management practices in aerobic rice. **International J. of science and nature, 8** (3):447-452.

Anonymous, 2019. Department of Economics and Statistics, Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers welfare.

Bhanu Rekha K, Mahavishnan K, Srinivasa Raju, M. 2003. Effect of weed management on crop- weed competition, grain yield and nutrient uptake in rice. **Andhra Agric. J.; 50**(3-4):211-215.

FAO STAT. 2022. Data, Crops and Livestock products. Food and Agriculture Organization of United Nations.

Gill GS and Vijayakumar 1969 “Weed index” A new method for reporting weed control trials. **Indian J. Agron. 16**: 96-98

Gomez, K.A. and Gomez, A.A. (1984) Statistical Procedures for Agricultural Research. 2nd Edition, John Wiley and Sons, New York, 680 p.

Jagadish, Thimmegowda, M. N., Rohini, Meti, N., and Prakash, G. 2015. Water use efficiency and economics of weed management practices under drip irrigated aerobic rice. **Advance in life Sci.,5(**8): 3410-3415.

Kanimozhi G., N.K. Sathayamoorthy, R. Babu and J. Prabhakaran 2019. Effect of herbigation through micro sprinkler on weeds flora, weed dry weight and weed control **-IJCS; 7**(3): 3528- 3531

Mani, V.S., Mala, M.L., Gautam, K.C., and Bhagavandas, 1973. Weed killing chemicals in potatocultivation. **Indian Farming, 23**(1): 17-18.

Nambi.J. 2017 Study of integrated weed management practices in direct seeded puddled rice. Journal of pharmacognosy and phytochemistry. SPL:1172-1174

Palani, R., T. Ramesh, S. Rathika and Balasubramaniam, P. 2020. Evaluation of Weed Management Techniques in Drip Irrigated Aerobic Rice. **International J. Current**

Microbiol. App. Sci. 9(12): 2463-2471.

Paradkar, N.R., Kurchania, S.P., and Tiwari, J.P. 1997. Chemical control of *Parthenium hysterophorus* L. and other associated weeds in upland drilled rice. **Indian J. of Weed Sci., 29**(3&4): 151-154.

Sharda, R., G. Mahajan, M. Siag, A. Singh and B.S. Chauhan 2017. Performance of drip-irrigated dry-seeded rice (*Oryza sativa L*.) in South Asia. Paddy and Water Environment, **15**: 93–100.

Sharma, N., R. Bansal, S.N. Singh and B. Singh 2018. A pragmatical approach on the rice fields demonstrating increase in yield and water saving by using micro irrigation technology. **International J. of Applied Engineering Research, 13**: 5197–5200.

Thakur, A.K., R.K. Mohanty, D.U. Patil and A. Kumar 2014. Impact of water management on yield and water productivity with system of rice intensification (SRI) and conventional transplanting system in rice. Paddy and Water Environment, **12**: 413–424.