Int.J.Curr.Microbiol.App.Sci (2019) *8*(12): 790-798

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 8 Number 12 (2019)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2019.812.103

Evaluation of Different Herbicides in Direct Seeded Rice (*Oryza sativa L.*)

R. Srinivasa Rao*, J. Hemantha Kumar, M. Venkataramulu and P. Raghurami Reddy

Professor Jayashankar Telangana State Agricultural University, India
District Agricultural Advisory and Transfer of Technology Centre,
Khammam, 507 003, Telangana, India

**Corresponding author*

Keywords

Cost of cultivation, Grain yield, Herbicides, Harvest Index, Panicles, Rice

Article Info

Accepted:
10 November 2019
Available Online:
10 December 2019

A B S T R A C T

The on farm demonstration was conducted in farmers fields in five locations of Khammam District of Central Telangana Zone during three kharif seasons of 2013, 2014 and 2015 by District Agricultural Advisory and Transfer of Technology Centre, Khammam belongs to Professor Jayashankar Telangana State Agricultural University, Hyderabad in order to find out the suitable pre and post emergence of herbicides in direct sowing rice crop viz, T1-Butachlor@ 1.5kg/ha fb Bispyribac sodium 250 ml/ha, T2-Pendimethalin @ 2.5 Lt/ha fb Bispyribac sodium 250 ml/ha T3-Pyrazosulfuron ethyl 200 gr/ha +Bispyribac sodium 250 ml/ha, T4-Oxadiargyl 100 gr/ha + Bispyribac sodium 250 ml/ha, T5-FarmersPractice (Delayed and Ignored Practices). The experimental results revealed that the significant influence on both growth and yield attributes as well as on economics of the direct seeding rice. The maximum growth in terms of plant height (98.6 cm), no of effective tillers (308), and no of hills per square meter (32) as well as the yield (5964 kg/ha), no of panicles per square meter (300), and length of the panicle (24.6 cm), Harvest Index (42.6 %) were higher with the application of Pyrazosulfuron ethyl 200 gr/ha +Bispyribac sodium 250 ml/ha than other treatments. Similarly maximum monitory net returns (58,373/-) and weed control efficiency (84.4%) were recorded with the application of Pyrazosulfuron ethyl 200 gr/ha +Bispyribac sodium 250 ml/ha, however it was on par with application of Oxadiargyl 100 gr/ha + Bispyribac sodium 250 ml/ha. The lowest growth and yield attributes were observed in Farmers Practice.

Introduction

Rice is the main staple food in Asia and particularly in Indian subcontinent. India rank first in area (42.4 mill ha) and second in rice production with share of 21 percent (104 mill tones) of world rice production. Moreover, rice is major agriculture commodity of India for earning foreign currency and contributes about 338090 million rupees in agricultural exports (20%) in 2012- 2013 (anonymous 2013). Further in provides employment to millions of people in rice cultivation and rice based industry. This indicates the importance of rice crop in national food security and economy of India. However, in wave of shrinking of resources like arable land, irrigation water and energy there is shifting of

rice crop by more remunerative crops like soybean which require less and labour and water (Tomar *et al.,* 2012). Short fall in rice production leads to economical, social and nutritional insecurity in India and this has been witnessed in recent past and will be acute in future. Moreover, uncertainties of rain fall, limitation for increasing irrigation facilities towards traditional rice cultivation method, fertilizer and pesticide availability are major challenges for attaining desired rice production at state and national level. Weed management is big challenge in direct seeded rice. The extent of yield reduction due to weed infestation was 15-20 per cent under transplanted system, 30-35 per cent under direct seeded low land system and more than 50 per cent under upland situation (Pillai and Rao, 1974). Whereas Gopinath *et al.,* (2012) reported reduction in grain yield by 75.8, 70.6 and 62.6% under dry seeded rice, wet seeded rice and transplanted rice respectively due to un controlled weeds. In view of this there is an urgent need to design and develop new methods and techniques of crop production to meet the increasing demand for food, feed and forage through effective utilization of available resources. In Central Telangana Zone of Khammam District where the direct seeded rice cultivation (15%) is increasing year by year. Accordingly a trial was conducted to test the performance of different herbicides in direct seeded rice cultivation. Weed infestation is one of the major reasons for poor productivity in direct seeded rice. Weeds interfere with normal crop growth by competing for available nutrients, light and water. Uncontrolled weeds reduce the grain yield by 96% in direct seeded rice and 61% in wet- seeded rice (Maite and Mukerjee, 2008). In direct seeded rice initial 30-40 days of crop growth is critical. The yield decreases in direct seeded rice with increase in competition of weeds during initial period. Manual and mechanical methods were not effective in controlling of weeds in direct seeded rice because of high labour cost, scarcity of labour during the critical period of weed competition and unfavorable weather at weeding time. Hence usage of herbicides is becoming increasingly popular as viable alternative to hand weeding. Therefore the present study was undertaken to evaluate different herbicides to control the weed flora in direct seeded rice.

Materials and Methods

The field investigation entitled "Evaluation of different herbicides in direct seeded rice (*Oryza sativa L*)" was conducted during kharif season of 2013, 2014 and 2015 in five locations of Khammam district. The soils of the experimental locations was medium to deep sandy clay loam texture with PH 7.6, organic carbon 0.57, available Nitrogen 228 kg/ha, available Phosphorus 47.8 kg/ha, and available Potassium 310.4 kg/ha. The experiment was laid out in five randomized locations with five treatments. The total an average rainfall received during three years cropping season was 1045 mm. The germinated seeds of short to long duration rice variety BPT-5204 were sown on June second fortnight to July first week in three years. The seed rate adopted for direct sowing of rice was 45 kg/ha. The crop was fertilized with 100:48:50 kg NPK/ha. Full dose of P, half dose of K applied at the time of sowing remaining half at the time of panicle initiation stage and one third dose of N applied at 20 DAS, remaining one third dose of N were applied at tillering stage and last one third dose of N applied at panicle initiation stage. Post emergence herbicides were applied at 15 DAS with the help of knapsack sprayer fitted with flat fan nozzle at spray volume 300 l/ha. The observations on growth attributes were taken at different intervals and yield attributing characters like no of panicles m^{-2}, panicle length, no of grains per panicle and test weight were recorded at harvest. The cost

of cultivation was worked out based on the labour and input cost incurred towards rice cultivation in different treatments. Harvest Index was calculated using the formula and expressed in percentage.

Harvest index (%)

$$= \frac{\text{Grain Yield}}{\text{Grain Yield + Straw Yield}} \times 100$$

The weed control efficiency (WCE) was calculated using the formula and expressed in percentage.

Weed control efficiency (%)

$$= \frac{DWC - DWT}{DWC} \times 100$$

DWC = Dry weight of weeds in un-weeded plot

DWT = Dry weight of weeds in weed control treatment plot

Data analysis

The data was analyzed using ANOVA and the least significant difference (LSD) values at 5% level of significance were calculated and used the RBD test significant difference between treatment means.

Results and Discussion

Growth attributes

The data on progressive of growth and development of rice as influenced by the application of different herbicides during kharif season were recorded at periodical intervals in cropping season. The plant height was increased continuously up to maturity. The increase in plant height was rapid during 30 to 90 days after sowing and there after it was slow down. Application of PE-Pyrazosulfuron ethyl 200 gr/ha + POE-Bispyribac sodium 250 ml/ha (T3) was recorded maximum plant height (98.6 cm), no of hills m^{-2} (32.0) and more no of tillers (308.0) m^{-2} than other treatments however it was on par with the application of PE-Oxadiargyl 100 gr/ha + POE-Bispyribac sodium 250 ml/ha (T4). Among the herbicides application of Oxadiargyl 100 gr/ha and PE-Pyrazosulfuron ethyl 200 gr/ha + POE-Bispyribac sodium 250 ml/ha combination were enhance the availability of more nutrients, water and light by suppress the weed growth during crop weed competition at critical period of 30-40 DAS. Similar results were reported by Kumar *et al.,* (2013) (Table 1).

The lowest yield attributes plant height (68.6 cm), no of hills per square meters (24.3) and no of tillers (227.3) were observed in Farmers practice (T5) due to ignored delayed practices than other treatments. Application of Butachlor @ 1.5 lt/ha and Pendimethalin @ 2.5 lt/ha along with application of POE-Bispyribac sodium 250 ml/ha were also proved maximum contribution in related to plant growth attributes than Farmers practice.

Yield attributes and yield

The data on yield and yield attributes were significantly improved by the application of herbicides in direct seeded rice. Application of PE-Pyrazosulfuron ethyl 200 gr/ha + POE-Bispyribac sodium 250 ml/ha (T3)was recorded maximum no of Panicles/m^{-2}(300), length of Panicle (24.6cm), yield (5964 kg/ha) and harvest index (42.6%) than all other treatments however it was on par with the application of PE- Oxadiargyl 100 gr/ha + POE-Bispyribac sodium 250 ml/ha (T4). Similar results were revealed by Gopinath *et al.,* (2012) (Table 2).

Table.1 The growth attributes were influenced by application of different herbicides in direct seeded Rice

Treatments	Plant Height (cm)				No of hills/m^{-2}				No of Tillers/ m^{-2}			
	2013	**2014**	**2015**	**Pooled**	**2013**	**2014**	**2015**	**Pooled**	**2013**	**2014**	**2015**	**Pooled**
T1-PE-Butachlor (50EC) @ 1.5kg/ha fb POE-Bispyribac sodium (10 EC) 250 ml/ha	72.4	78.6	68.2	**73.0**	28.0	30.0	26.0	**28.0**	254	252	250	**251.3**
T2- PE-Pendimethalin (30EC) @2.5 Lt/ha fb POE-Bispyribac sodium (10 EC) 250 ml/ha	68.7	74.5	68.9	**70.7**	26.0	24.0	28.0	**26.0**	248	247	250	**241.0**
T3-PE-Pyrazosulfuron ethyl (10EC) 200 gr/ha + POE - Bispyribac sodium (10 EC) 250 ml/ha	98.6	108.4	88.8	**98.6**	32.0	30.0	34.0	**32.0**	308	306	310	**308.0**
T4-PE-Oxadiargyl (10EC) 100 gr/ha + POE - Bispyribac sodium (10EC) 250 ml/ha.	98.6	102.7	88.5	**96.6**	30.0	28.0	32.0	**30.0**	288	284	290	**287.3**
T5-FarmersPractice (Delayed and Ignored Practices)	68.8	70.4	66.6	**68.6**	24.0	25.0	24.0	**24.3**	223	230	229	**227.3**
SEm±	**8.22**	**8.60**	**7.12**	**7.98**	**2.40**	**2.20**	**2.30**	**2.30**	**18.6**	**19.3**	**20.4**	**19.8**
C.D. at 5%	**24.4**	**26.4**	**21.4**	**24.0**	**6.00**	**5.40**	**5.80**	**5.70**	**53.0**	**54.0**	**57.8**	**56.4**

Fb-followed by
PE- Pre Emergence
POE-Post Emergence

Table.2 Yield attributes and weed control efficiency (%) were influenced by application of different herbicides in direct seeded Rice

Treatments	No of Panicles/ m^{-2}				Length of Panicle (cm)				Weed Control Efficiency (%)			
	2013	2014	2015	Pooled	2013	2014	2015	Pooled	2013	2014	2015	Pooled
T1-PE-Butachlor (50EC) @ 1.5kg/ha fb POE-Bispyribac sodium (10 EC) 250 ml/ha	248	246	244	**245.3**	21.3	20.4	20.0	**20.5**	62.4	65.6	64.7	**64.2**
T2-PE-Pendimethalin (30EC) @2.5 Lt/ha fb POE- Bispyribac sodium (10 EC) 250 ml/ha	241	240	242	**241.0**	20.5	19.7	20.0	**20.0**	58.8	62.4	61.0	**60.7**
T3-PE-Pyrazosulfuron ethyl (10EC) 200 gr/ha + POE -Bispyribac sodium (10 EC) 250 ml/ha	300	298	302	**300.0**	24.4	24.6	25.0	**24.6**	82.5	86.0	84.7	**84.4**
T4-PE-Oxadiargyl (10EC) 100 gr/ha +POE - Bispyribac sodium (10EC) 250 ml/ha.	282	278	284	**281.3**	24.0	24.4	22.4	**23.6**	78.6	80.0	81.6	**80.0**
T5-FarmersPractice (Delayed and Ignored Practices)	217	224	223	**221.3**	19.0	20.0	19.6	**19.5**	57.6	58.4	60.3	**58.7**
SEm+	**17.4**	**22.3**	**20.4**	**18.6**	**1.2**	**1.7**	**2.3**	**1.8**	**7.4**	**7.8**	**6.4**	**6.8**
C.D. at 5%	**48.6**	**61.6**	**57.4**	**52.8**	**3.4**	**4.8**	**5.0**	**5.2**	**18.6**	**19.0**	**17.8**	**18.2**

Table.3 Yield and attributes were influenced by application of different herbicides in direct seeded Rice

Treatments	Grain Yield (kg/ha)				Straw Yield (kg/ha)				Harvest Index (%)			
	2013	**2014**	**2015**	**Pooled**	**2013**	**2014**	**2015**	**Pooled**	**2013**	**2014**	**2015**	**Pooled**
T1-PE-Butachlor (50EC) @ 1.5kg/ha fb POE-Bispyribac sodium (10 EC) 250 ml/ha	4684	4840	4776	**4767**	7540	7738	7876	**7718**	38.3	38.4	37.6	**38.1**
T2-PE-Pendimethalin (30EC) @2.5 Lt/ha fb POE- Bispyribac sodium (10 EC) 250 ml/ha	4624	4764	4748	**4712**	7630	7725	7678	**7678**	37.7	38.1	38.2	**38.0**
T3-PE-Pyrazosulfuron ethyl (10EC) 200 gr/ha + POE -Bispyribac sodium (10 EC) 250 ml/ha	5786	5872	6234	**5964**	7867	7964	8123	**7985**	42.1	42.4	43.4	**42.6**
T4-PE-Oxadiargyl (10EC) 100 gr/ha +POE - Bispyribac sodium (10EC) 250 ml/ha.	5480	5220	6028	**5576**	7846	7924	8078	**7949**	41.1	39.7	42.7	**41.1**
T5-FarmersPractice (Delayed and Ignored Practices)	4376	4458	4340	**4391**	7624	7698	7586	**7636**	36.4	36.6	36.3	**36.4**
SEm±	**426.0**	**352.0**	**524.0**	**438.0**	**110.0**	**87.0**	**96.0**	**102**	**1.4**	**1.5**	**2.0**	**1.7**
C.D. at 5%	**1100**	**1030**	**1452**	**1194**	**325.0**	**223**	**245**	**264**	**3.8**	**4.0**	**5.7**	**4.5**

Table.4 Economics of the direct seeded rice crop were influenced by application of different herbicides

Treatments	Cost of Cultivation (Rs/ha)				Goss Returns (Rs/ha				Net Returns (Rs/ha)			
	2013	2014	2015	Pooled	2013	2014	2015	Pooled	2013	2014	2015	Pooled
T1-PE-Butachlor (50EC) @ 1.5kg/ha fb POE-Bispyribac sodium (10 EC) 250 ml/ha	45420	46120	45846	**45795**	83312	87120	85968	**85467**	37892	41000	40122	**39672**
T2-PE-Pendimethalin (30EC) @2.5 Lt/ha fb POE- Bispyribac sodium (10 EC) 250 ml/ha	45650	47670	46580	**46633**	83232	85752	85464	**84816**	37582	38082	38884	**38183**
T3-PE-Pyrazosulfuron ethyl (10EC) 200 gr/ha + POE -Bispyribac sodium (10 EC) 250 ml/ha	48640	48756	49540	**48979**	104148	105696	112212	**107352**	55508	56940	62672	**58373**
T4-PE-Oxadiargyl (10EC) 100 gr/ha +POE - Bispyribac sodium (10EC) 250 ml/ha.	47540	46970	48960	**47823**	98640	93960	108504	**100368**	51100	46990	59544	**52545**
T5-FarmersPractice (Delayed and Ignored Practices)	45340	46560	45230	**45710**	78768	80244	78120	**79044**	33428	33684	32890	**33334**
SEm±	**1075**	**887**	**1240**	**1075**	**6978**	**6214**	**8752**	**7296**	**5884**	**5326**	**7524**	**6243**
C.D. at 5%	**3220**	**2656**	**3692**	**3184**	**20834**	**18570**	**26240**	**21883**	**17612**	**15932**	**22538**	**18686**

Application of PE-Pyrazosulfuron ethyl 200 gr/ha + POE-Bispyribac sodium 250 ml/ha were improved availability of natural resources and critical inputs for establishment of rice crop by reduced the maximum germination of weeds as well as suppressing the weed growth with proper efficient mode of action at initial days of critical crop weed competition. In direct seeded rice yield and yield attributes were tremendously increased due to timely control of weeds in critical period of crop weed competition has enhanced the availability of nutrients, light and moisture to the crop with the application of T3-PE-Pyrazosulfuron ethyl (10EC) 200 gr/ha + POE -Bispyribac sodium (10 EC) 250 ml/ha and T4-PE-Oxadiargyl (10EC) 100 gr/ha + POE -Bispyribac sodium (10EC) 250 ml/ha there by the yield was maximum increased with timely application of broad spectrum herbicides combination. Dhanawate (2000) reported similar results in herbicides usage in direct seeded rice. The combination of T1-PE-Butachlor (50EC) @ 1.5kg/ha fb POE-Bispyribac sodium (10 EC) 250 ml/ha and T2-PE-Pendimethalin (30EC) @2.5 Lt/ha fb POE- Bispyribac sodium (10 EC) 250 ml/ha were also showed good performance than farmers practice in terms of yield and yield attributes in direct seeded rice. The lowest yield (4391 kg/ha), No of panicles/m^{-2} (221.3), length of panicle (19.5 cm), and harvest index (36.4%) were observed in farmers practice (T5) due to weed infestation, timely uncontrolled weed growth and weeds interfere with normal crop growth by heavy competition for available nutrients, light and water. Similar results were revealed by Mishra *et al.,* (2007) (Table 3).

Weed control efficiency

The Weed Control Efficiency was significantly influenced by the herbicides in direct sowing rice crop. Highest Weed Control Efficiency (84.4%) were observed with application of T3-PE-Pyrazosulfuron ethyl (10EC) 200 gr/ha + POE -Bispyribac sodium (10 EC) 250 ml/ha over all the treatments, however it was on par with T4-PE-Oxadiargyl (10EC) 100 gr/ha + POE -Bispyribac sodium (10EC) 250 ml/ha, Similar results were revealed by Mishra *et al.,* (2007).

The lowest Weed Control Efficiency (58.7%) was recorded in farmers practice. Similarly application of T1-PE-Butachlor (50EC) @ 1.5kg/ha fb POE-Bispyribac sodium (10 EC) 250 ml/ha and T2- PE-Pendimethalin (30EC) @2.5 Lt/ha fb POE- Bispyribac sodium (10 EC) 250 ml/ha were showed good performance than farmers practice

Influence of herbicide on economics

The data on economics of direct seeded rice was significantly influenced by different combination of herbicidal application. Application with combination of PE-Pyrazosulfuron ethyl 200 gr/ha + POE-Bispyribac sodium 250 ml/ha (T3) and combination of PE- Oxadiargyl 100 gr/ha + POE-Bispyribac sodium 250 ml/ha (T4) were gave higher Gross returns (1, 07,352 and 1,00,368) and net returns (58,373 and 52,545) and best remunerative than all other treatments (Table 4).

Timely controls of weeds with timely application of herbicides has increased the yield, save the money in terms of labour cost reduces the cost of cultivation and get the higher monitory benefit returns. Lowest Gross returns (79,044) and net returns (33,334) were observed with the farmers practice (T5) than all other treatments due to timely uncontrolled weed growth during critical period of crop weed competition reduces the yield and yield attributes of rice there by drastically affected the monitory benefit returns. Similar results were reported by Rao *et al.,* (2008) and Kumar *et al.,* (2013).

References

Anonymous, 2013. Book on agricultural statistics, 2013, Govt of India, Ministry of agriculture, Dept. of agriculture and co-operation. *Directorate of economics and statistics*, New Delhi. PP. 1-73

Dhanawate, V.B., 2000, Effect of row spacing and herbicides on growth and yield of direct seeded rice. *M.Sc. Thesis, Dept of Agronomy, Balasaheb Sawant Konkan Krishi Vidyapeeth*, Dapoli, (India).

Gopinath, K.A., Mina, B.L., Singh, K.P. and Nataraj, K.C. 2012, Integrated weed management in direct seeded rice (*Oryza sativa*). *Indian Journal of Agronomy*. 57(3): 245-249.

Kumar, S., Rana, S.S., Chander, N. and Ramesh, 2013, Mixed weed flora management by Bispyribac sodium in transplanted rice. *Indian Journal of Weed Science*. 45(3): 151-155.

Maity, S.K. and Mukarjee P.K. 2008, Integrated weed management in dry seeded rainy season rice (*Oryza sativa*) Indian Journal of Agronomy, 53(2): 116-120.

Mishra, M.S., Dixit, A. and Varshaney, J.G. 2007, Efficiency of penoxsulam on weeds and yield of Transplanted rice (*Oryza sativa*). *Indian Journal of Weed Science*. 39: 24-27.

Pillai, G.K. and. Rao M.V. 1974, Integrated weed management in rice. *Indian Farming*, 12: 17-23.

Rao A.S., Ratnam, M. and Reddy T.Y. 2008, Weed management in direct seeded semi dry rice. *Indian Journal of Weed Science*. 40: 153-156.

How to cite this article:

Srinivasa Rao, R., J. Hemantha Kumar, M. Venkataramulu and Raghurami Reddy, P. 2019. Evaluation of Different Herbicides in Direct Seeded Rice (*Oryza sativa L.*). *Int.J.Curr.Microbiol.App.Sci.* 8(12): 790-798. doi: https://doi.org/10.20546/ijcmas.2019.812.103