E-ISSN: 2618-0618
P-ISSN: 2618-060X

www.agronomyjournals.com
2024; SP-7(10): 765-769
Received: 16-08-2024
Accepted: 22-09-2024

SP Rathod
M. Sc. (Agri.) Scholar, Department of Agronomy, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

MJ Mane
Professor, Department of Agronomy, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

TN Thorat
Associate Professor, Department of Agronomy, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

BG Thaware
Jr. Plant Physiologist, Regional Fruit Research Station, Vengurla, Maharashtra, India

SS More
Jr. Soil Scientist, Regional Fruit Research Station, Vengurla, Maharashtra, India

VV Pisal
M. Sc. (Agri.) Scholar, Department of Agronomy, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

PP Sabale
M. Sc. (Agri.) Scholar, Department of Agronomy, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

SB Abhale
M. Sc. (Agri.) Scholar, Department of Soil Science and Agricultural Chemistry, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

Corresponding Author:
SP Rathod
M.Sc., (Agri.) Scholar, Department of Agronomy, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

Effect of integrated weed management on growth and yield of direct seeded dibbled rice (*Oryza sativa* L.)

SP Rathod, MJ Mane, TN Thorat, BG Thaware, SS More, VV Pisal, PP Sabale and SB Abhale

DOI: https://doi.org/10.33545/2618060X.2024.v7.i10Sk.1898

Abstract
A field experiment was conducted during *kharif* 2023 at Instructional Farm, Department of Agronomy, College of Agriculture, Dapoli (MS) to evaluate integrated weed management in direct seeded dibbled rice. The experiment was conducted in randomized block design with ten treatments which was replicated thrice. Results of the experiment showed that growth attributes *viz*, (plant height, number of functional leaves hill^{-1}, number of tillers hill^{-1}, dry matter accumulation hill^{-1}) and yield of rice found maximum in treatment T_9 i.e., Weed Free Check (1 HH at 20 DAS and 2HW at 40 and 60 DAS) over the rest of treatments. Whereas, treatment Oxyfluorfen 23.5% EC @ 0.3 kg a.i. ha^{-1} (PE) *fb* Bispyribac sodium (Fujisuper 10% SC) @ 25 g ha^{-1} (PoE) at 30 DAS (T_3), Oxyfluorfen 23.5% EC @ 0.3 kg a.i. ha^{-1}(PE) *fb* 1 HW at 30 DAS (T_1) and Pendimethalin 38.7% CS @ 1.0 kg a.i. ha^{-1} (PE) *fb* Bispyribac sodium (Fujisuper 10% SC) @ 25 g ha^{-1} (PoE) at 30 DAS (T_4) were statistically at par to the treatment T_9. Least weed index was found in treatment T_3 i.e., Oxyfluorfen 23.5% EC @ 0.3 kg a.i. ha^{-1} (PE) *fb* Bispyribac sodium (Fujisuper 10% SC) @ 25 g ha^{-1} (PoE) at 30 DAS. Weed control efficiency found maximum in treatment T_9 i.e., Weed Free Check (1 HH at 20 DAS and 2HW at 40 and 60 DAS).

Keywords: Integrated, Direct seeded, dibbled, weed index, weed control efficiency

Introduction
Weeds are one of several factors that drastically impact crop productivity and cause significant declines in crop yields. Weeds consume available nutrients faster than crop plants, leaving crop plants with inadequate nourishment for growth. Weeds are estimated to damage the Indian economy ₹1980 crores per year (Mukhopadhyay, 1992) [10]. As a result, weeds provide the most significant physiological barrier to direct seeded rice growing. Furthermore, in locations with high rainfall, such as the Konkan region, puddled or direct-seeded rice suffers large losses in both macronutrient and micronutrient content. Nitrogenous fertilizers might lose as much as 70% of their value. Herbicide spraying may result in reduced crop growth. As a result, applying organic manure coupled with major and micronutrients to rice crops is critical for long-term productivity in order to ensure good crop growth and a stable soil nutrient level. However, multiple studies discovered a loss in yield while transitioning from puddled transplanted rice (PTR) to DSR with alternate wetting and drying (AWD) water management (Bhushan *et al.*, 2007, Choudhury *et al.*, 2007) [2, 5].
Herbicides are required for DSR systems, but excessive use might harm the ecosystem and result in the establishment of resistant weeds (Karim *et al.*, 2004, Powles and Yu, 2010) [7, 13]. Thus, scientists must design techniques to reduce the unnecessary environmental dangers connected with pesticide use and eliminate labour-intensive manual weeding in DSR systems.

Materials and Methods
The present investigation took place in the *kharif* season of 2023 at the Agronomy Farm, College of Agriculture, Dapoli, District Ratnagiri (M.S.). The experimental plot no. 20, is located in the subtropical region at 17^{0}76'24" N and longitude 73^{0}17'47" E longitude, with an elevation of approximately 157.8 meters above mean sea level. The experiment was laid out in a randomized block design with ten treatments which were replicated three times.

Table 1: Treatment details along with symbol used

Treatments	Symbols
Oxyfluorfen 23.5% EC @ 0.3 kg a.i. ha^{-1}(PE) *fb* 1 HW at 30 DAS	T_1
Pendimethalin 38.7% CS @ 1.0 kg a.i. ha^{-1}(PE) *fb* 1 HW at 30 DAS	T_2
Oxyfluorfen 23.5% EC @ 0.3 kg a.i. ha^{-1} (PE) *fb* Bispyribac sodium (Fujisuper 10% SC) @ 25 g ha^{-1} (PoE) at 30 DAS	T_3
Pendimethalin 38.7% CS @ 1.0 kg a.i. ha^{-1} (PE) *fb* Bispyribac sodium (Fujisuper 10% SC) @ 25 g ha^{-1} (PoE) at 30 DAS	T_4
Oxyfluorfen 23.5% EC @ 0.3 kg a.i. ha^{-1} (PE) *fb* Metsulfuron methyl + Chlorimuron ethyl @ 4 g a.i. ha^{-1} (PoE) at 30 DAS	T_5
Pendimethalin 38.7% CS @ 1.0 kg a.i. ha^{-1} (PE) *fb* Metsulfuron methyl + Chlorimuron ethyl @ 4 g a.i. ha^{-1} (PoE) at 30 DAS	T_6
Oxyfluorfen 23.5% EC @ 0.3 kg a.i. ha^{-1} (PE) *fb* 2,4-D @ 0.5kg a.i. ha^{-1} (PoE) at 25-30 DAS	T_7
Pendimethalin 38.7% CS @ 1.0 kg a.i. ha^{-1} (PE) *fb* 2,4-D @ 0.5 kg a.i. ha^{-1} (PoE) at 25-30 DAS	T_8
Weed Free Check (1 HH at 20 DAS and 2HW at 40 and 60 DAS)	T_9
Unweeded Control	T_{10}

Throughout the growth phase of the rice crop, it experienced a substantial rainfall of 3949.8 mm. The average daily sunshine duration was 4.8 hours. The soil in which the crop was cultivated had 10.85 g kg^{-1} of organic carbon, pH level of 5.82 and an electrical conductivity of 0.111 dS m^{-1}. The climatic conditions were highly favourable for the growth and development of the rice crop.

1. Weed index

A measure of crop yield loss across treatments in comparison to a weed free plot like two or three hand weeding adapted in an experiment.

$$\text{Weed Index (WI\%)} = \frac{Y_{wf} - Y_t}{Y_{wf}} \times 100$$

Y_{wf}: Crop yield in weed-free plot Y_t: Crop yield in treated plot to which WI to be calculated

2. Weed control efficiency

The dry weight of weeds collected from treatments were compared with the weight of weeds from unweeded treatments and the weed control efficiency was calculated. (Mani *et. al.*1973) [9].

$$\text{Weed control efficiency (\%)} = \frac{WD_C - WD_T}{WD_C} \times \quad 100$$

WD_C - Weed biomass (dry matter m^{-2}) in control plot
WD_T - Weed biomass (dry matter m^{-2}) in treated plot

Weed control efficiency was calculated on the basis of dry matter production of weeds. The data obtained during investigation will be subjected to statistical analysis by following the procedure pertinent to Randomized Block Design (RBD) analysis as given by Panse and Sukhatme (1967).

Results and Discussion

Effect on rice crop

Growth attributes

From the data presented in Table 2, the maximum growth attributes such as plant height, number of functional leaves hill^{-1}, number of tillers hill^{-1} and dry matter accumulation hill^{-1} was observed in the treatment weed free check (1 HH at 20 DAS and 2HW at 40 and 60 DAS) (T_9) however treatment Oxyfluorfen 23.5% EC @ 0.3 kg a.i. ha^{-1} (PE) *fb* Bispyribac sodium (Fujisuper 10% SC) @ 25 g ha^{-1} (PoE) at 30 DAS (T_3), Oxyfluorfen 23.5% EC @ 0.3 kg a.i. ha^{-1}(PE) *fb* 1 HW at 30 DAS (T_1) and Pendimethalin 38.7% CS @ 1.0 kg a.i. ha^{-1} (PE) *fb* Bispyribac sodium (Fujisuper 10% SC) @ 25 g ha^{-1} (PoE) at 30 DAS (T_4) were statistically at par to the treatment T_9. The increase in crop height in these treatments might be due to better control of weeds resulting in minimum competition of weeds with rice plants during the entire crop growth period which is helped in better utilization of nutrients, moisture, space and light by the crop as a result better plant height. Baloch *et al.* (2005) [1] found that rice without weed competition recorded higher number of productive tillers due to greater space used by rice and earlier canopy closure due to better competitive ability and nutrient use efficiency. Functional leaves have positive correlation with number of tillers. The considerable gains in rice growth observed following chemical weed control can be attributed to a reduction in crop weed competition, as demonstrated by weed dynamics studies. Various pre-emergence and post-emergence herbicides effectively reduced weed populations throughout the optimal periods of rice growth, resulting in less competition for essential resources such as light, nutrients, space, and other growth requirements. With less competition, rice plants were able to survive and acquire access to essential growth nutrients. Observable outcomes included higher values in a variety of morphological markers, indicating improved plant development. This included increased plant height, more functioning leaves, more tillering, better development of reproductive organs, and overall plant vigour. This gain in growth qualities, particularly improved photosynthetic ability, as a result of decreased competition, ultimately translated into higher yields, particularly in terms of dry matter production. These results were in close conformity with Baloch *et al.* (2005) [1], Madhukumar *et al.* (2013) [8], Chauhan and Yadav (2013) [4].

Effect on yield

From the data given in Table 3, the grain yield and straw yield of rice crop (kg ha^{-1}) was significantly higher in treatment Weed Free Check (1 HH at 20 DAS and 2HW at 40 and 60 DAS) (T_9) over all other treatments. Whereas treatments Oxyfluorfen 23.5% EC @ 0.3 kg a.i. ha^{-1} (PE) *fb* Bispyribac sodium (Fujisuper 10% SC) @ 25 g ha^{-1} (PoE) at 30 DAS (T_3), Oxyfluorfen 23.5% EC @ 0.3 kg a.i. ha^{-1}(PE) *fb* 1 HW at 30 DAS (T_1) and Pendimethalin 38.7% CS @ 1.0 kg a.i. ha^{-1} (PE) *fb* Bispyribac sodium (Fujisuper 10% SC) @ 25 g ha^{-1} (PoE) at 30 DAS (T_4) which were statistically at par with T_9. However, the treatment Unweeded control (T_{10}) recorded lowest grain yield among all the treatments under study. The reported results were most likely due to the efficiency of weed management efforts, which greatly reduced competition for resources between cultivated crops and weeds. By minimizing competition, crops had better access to key resources such as nutrients, water, and sunlight. Rawat *et al.* (2012) [14] reported in their findings that crop grown in weed free plots had lush growth due to the elimination of weeds from inter and intra row spaces,

as well as better aeration due to surface soil manipulation, and thus more space, water, light, and nutrients were available for better growth and development, resulting in superior growth and yield attributes and, as a result, the highest crop yield. These findings were consistent with those reported by Veeraputhiran and Balasubramanian (2013) [16] and Verma *et al.* (2013) [17].

Effect on weed flora

Major weed flora of the experiment plot consisted of grasses *viz.* (*Isachane globosa*, *Brachiaria mutica*, *Digitaria sanguinalis*, *Echinochloa colona*), Sedges (*Cyperus iria*), BLW (*Sesbania sp.*, *Alternanthera sessilis* and *Corchorus trilocularis*).

Oxyfluorfen 23.5% EC @ 0.3 kg a.i. ha^{-1} (PE) *fb* Bispyribac sodium (Fujisuper 10% SC) @ 25 g ha^{-1} (PoE) at 30 DAS (T_3) recorded minimum weed index. This was due to less weed count and weed biomass as compared to different weed management practices. These results were in close conformity with Sureshkumar, (2016) [15], Channabasavanna *et al*. (2014) [3].

Weed Free Check (1 HH at 20 DAS and 2HW at 40 and 60 DAS) (T_9) recorded highest weed control efficiency as compared to all the treatments, since least weed biomass found least in this treatment. This might be due to mechanical weed management practices like hoeing and hand weeding results in complete removal of weeds and prevents further growth of weeds in the field. These results were in agreement with Gopinath and Kundu, (2008) [6], Pavithra *et al*. (2021) [12].

Table 2: Plant height (cm), Number of functional leaves hill^{-1} Number of tillers hill^{-1} Dry matter accumulation (g) hill^{-1} as influenced by different treatments at harvest

Treatments	At harvest			
	Plant height (cm)	Number of functional leaves hill^{-1}	Number of tillers hill^{-1}	Dry matter accumulation (g) hill^{-1}
T_1: Oxyfluorfen 23.5% EC @ 0.3 kg a.i. ha^{-1}(PE) *fb* 1 HW at 30 DAS	95.73	13.20	10.95	35.23
T_2: Pendimethalin 38.7% CS @ 1.0 kg a.i. ha^{-1}(PE) *fb* 1 HW at 30 DAS	93.77	12.60	10.27	33.76
T_3: Oxyfluorfen 23.5% EC @ 0.3 kg a.i. ha^{-1} (PE) *fb* Bispyribac sodium (Fujisuper 10% SC) @ 25 g ha^{-1} (PoE) at 30 DAS	95.60	13.43	11.10	35.69
T_4: Pendimethalin 38.7% CS @ 1.0 kg a.i. ha^{-1} (PE) *fb* Bispyribac sodium (Fujisuper 10% SC) @ 25 g ha^{-1} (PoE) at 30 DAS	94.90	13.16	10.92	34.90
T_5: Oxyfluorfen 23.5% EC @ 0.3 kg a.i. ha^{-1} (PE) *fb* Metsulfuron methyl + Chlorimuron ethyl @ 4 g a.i. ha^{-1} (PoE) at 30 DAS	93.00	12.53	10.23	33.88
T_6: Pendimethalin 38.7% CS @ 1.0 kg a.i. ha^{-1} (PE) *fb* Metsulfuron methyl + Chlorimuron ethyl @ 4 g a.i. ha^{-1} (PoE) at 30 DAS	91.87	11.80	10.10	32.21
T_7: Oxyfluorfen 23.5% EC @ 0.3 kg a.i. ha^{-1} (PE) *fb* 2,4-D @ 0.5kg a.i. ha^{-1} (PoE) at 25-30 DAS	92.90	12.33	10.17	33.16
T_8: Pendimethalin 38.7% CS @ 1.0 kg a.i. ha^{-1} (PE) *fb* 2,4-D @ 0.5 kg a.i. ha^{-1} (PoE) at 25-30 DAS	92.63	11.96	10.12	32.51
T_9: Weed Free Check (1 HH at 20 DAS and 2HW at 40 and 60 DAS)	97.20	14.10	11.25	37.15
T_{10}: Unweeded Control	90.43	11.63	9.76	31.90
S.Em. (±)	0.96	0.45	0.31	0.86
C.D. at 5%	2.86	1.35	0.91	2.56
General Mean	93.80	12.68	10.49	34.04

Table 3: Mean grain yield, straw yield (kg ha^{-1}), weed index (%) and weed control efficiency (%) as influenced by different treatments

Treatment	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Weed Index (%)	Weed control efficiency (%)
T_1: Oxyfluorfen 23.5% EC @ 0.3 kg a.i. ha^{-1}(PE) *fb* 1 HW at 30 DAS	3869.17	5438.22	4.11	78.85
T_2: Pendimethalin 38.7% CS @ 1.0 kg a.i. ha^{-1}(PE) *fb* 1 HW at 30 DAS	3669.65	5169.93	8.93	68.18
T_3: Oxyfluorfen 23.5% EC @ 0.3 kg a.i. ha^{-1} (PE) *fb* Bispyribac sodium (Fujisuper 10% SC) @ 25 g ha^{-1} (PoE) at 30 DAS	3879.28	5447.07	3.92	83.06
T_4: Pendimethalin 38.7% CS @ 1.0 kg a.i. ha^{-1} (PE) *fb* Bispyribac sodium (Fujisuper 10% SC) @ 25 g ha^{-1} (PoE) at 30 DAS	3817.83	5372.22	5.32	74.82
T_5: Oxyfluorfen 23.5% EC @ 0.3 kg a.i. ha^{-1} (PE) *fb* Metsulfuron methyl + Chlorimuron ethyl @ 4 g a.i. ha^{-1} (PoE) at 30 DAS	3578.36	5046.78	11.14	59.83
T_6: Pendimethalin 38.7% CS @ 1.0 kg a.i. ha^{-1} (PE) *fb* Metsulfuron methyl + Chlorimuron ethyl @ 4 g a.i. ha^{-1} (PoE) at 30 DAS	3274.16	4650.03	18.36	33.26
T_7: Oxyfluorfen 23.5% EC @ 0.3 kg a.i. ha^{-1} (PE) *fb* 2,4-D @ 0.5kg a.i. ha^{-1} (PoE) at 25-30 DAS	3511.10	4958.78	12.74	51.86
T_8: Pendimethalin 38.7% CS @ 1.0 kg a.i. ha^{-1} (PE) *fb* 2,4-D @ 0.5 kg a.i. ha^{-1} (PoE) at 25-30 DAS	3458.81	4889.24	14.00	42.35
T_9: Weed Free Check (1 HH at 20 DAS and 2HW at 40 and 60 DAS)	4043.65	5663.03	0.00	90.44
T_{10}: Unweeded Control	1519.75	2284.64	60.81	--
S.Em. (±)	83.65	122.72	--	--
C.D. at 5%	248.55	364.61	--	--
General Mean	3462.18	4892.00	11.93	58.26

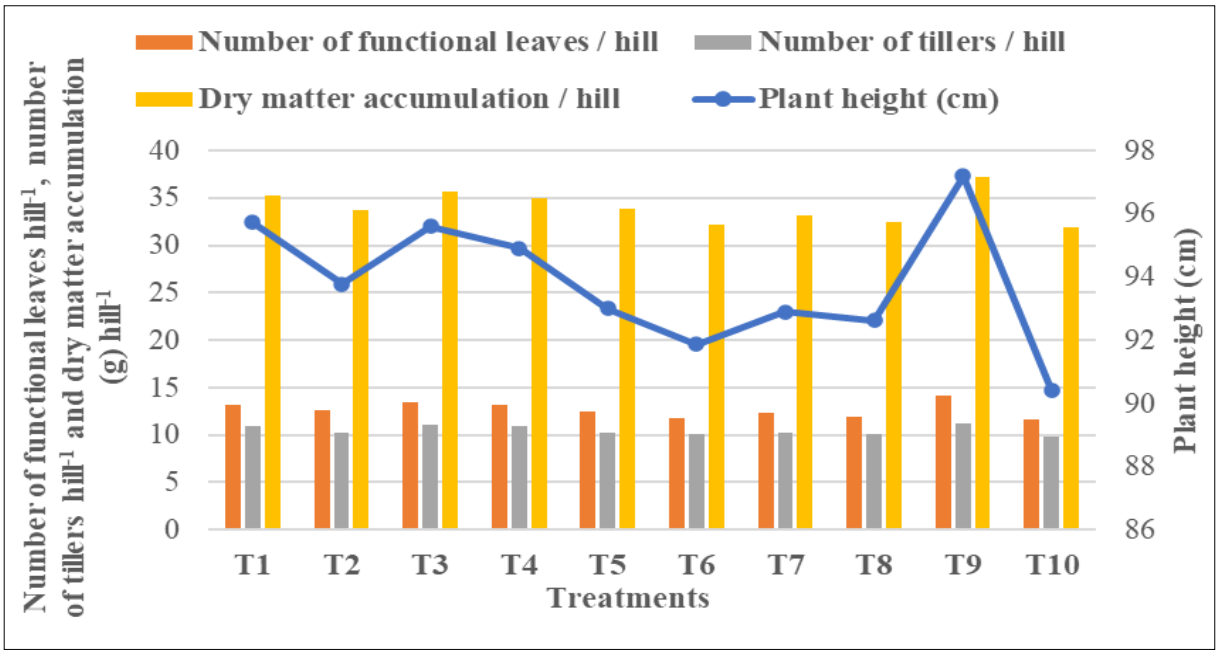

Fig 1: Plant height (cm), Number of functional leaves hill^{-1}, Number of tillers hill^{-1} and Dry matter accumulation (g) hill^{-1} as influenced by different treatments at harvest

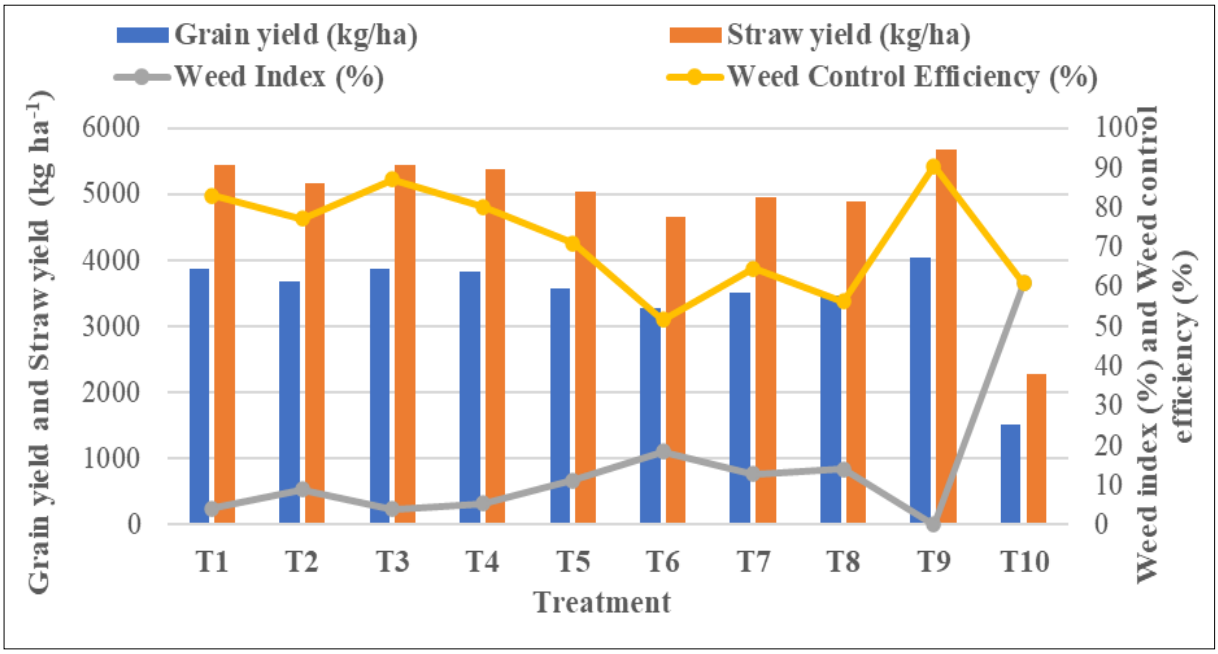

Fig 2: Mean grain yield, straw yield (kg ha^{-1}), weed index (%) and weed control efficiency (%) as influenced by different treatments

Conclusion

The highest growth attributes *viz*, (plant height, number of functional leaves hill^{-1}, number of tillers hill^{-1} and dry matter accumulation hill^{-1}), grain yield and straw yield (kg ha^{-1}) and weed control efficiency was observed in the treatment weed free check (1 HH at 20 DAS and 2HW at 40 and 60 DAS) (T_9). Whereas lowest weed index found in Oxyfluorfen 23.5% EC @ 0.3 kg a.i. ha^{-1} (PE) *fb* Bispyribac sodium (Fujisuper 10% SC) @ 25 g ha^{-1} (PoE) at 30 DAS (T_3) treatment.

Acknowledgement

Department of Agronomy at the College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, 415712, District Ratnagiri, Maharashtra (India), is grateful for the assistance and informative suggestions offered throughout the investigation.

References

1. Baloch MS, Hassan GU, Morimoto T. Weeding techniques in transplanted and direct wet-seeded rice in Pakistan. Weed Biology and Management. 2005;5(4):190-196.
2. Bhushan L, Ladha JK, Gupta RK, Singh S, Tirol-Padre A, Saharawat YS, Gathala M, Pathak H. Saving of water and labour in a rice–wheat system with no-tillage and direct seeding technologies. Agronomy Journal. 2007;99(5):1288-1296.
3. Channabasavanna AS, Saunshi S, Shrinivas CS. Effect of herbicides on weed control and yield of wet seeded rice (*Oryza sativa* L.). The Bioscan. 2014;9(2):581-584.
4. Chauhan BS, Yadav A. Weed management approaches for dry-seeded rice in India: A review. Indian Journal of Weed Science. 2013;45(1):1-6.
5. Choudhury BU, Bouman BAM, Singh AK. Yield and water

productivity of rice–wheat on raised beds at New Delhi, India. Field Crops Research. 2007;100(2-3):229-239.
6. Gopinath KA, Kundu S. Evaluation of metsulfuron-methyl and chlorimuron-ethyl for weed control in direct-seeded rice (*Oryza sativa* L.). Indian Journal of Agricultural Sciences. 2008;78(5):466-469.
7. Karim RS, Man AB, Sahid IB. Weed problems and their management in rice fields of Malaysia: an overview. Weed Biology and Management. 2004;4(4):177-186.
8. Madhukumar V, Kalyana Murthy KN, Sanjay MT, Prashanth R, Kumbar B. Efficacy of pre- and post-emergent herbicides on growth and yield of *kharif* aerobic rice. International Journal of Advanced Biological Research. 2013;3(3):360-365.
9. Mani VS, Malla ML, Gautam KC, Bhagwandas B. Weed-killing chemicals in potato cultivation. Indian Farming. 1973;23(1):17-18.
10. Mukhopadhyay SK. Emerging problems and advances in weed management. In: Presidential Address, Agriculture Section, Indian Science Congress; 1992 Jan; Baroda.
11. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. New Delhi: I.C.A.R.; 1967.
12. Pavithra M, Poonguzhalan R, Narayanan AL, Saravanane P. Weed management in aerobic rice with sequential application of pendimethalin and bispyribac-sodium under coastal deltaic ecosystem. Indian Journal of Weed Science. 2021;53(1):85-87.
13. Powles SB, Yu Q. Evolution in action: plants resistant to herbicides. Annual Review of Plant Biology. 2010;61(1):317-347.
14. Rawat A, Chaudhary CS, Upadhyaya VV, Jain V. Efficacy of Bispyribac-Sodium on weed flora and yield of drilled rice. Indian Journal of Weed Science. 2012;44(3):183-185.
15. Sureshkumar R. Weed characters and indices of transplanted rice as influenced by different weed management practices. International Journal of Agriculture Sciences. 2016;8(51):2221-2223.
16. Veeraputhiran R, Balasubramanian R. Evaluation of Bispyribac-sodium in transplanted rice. Indian Journal of Weed Science. 2013;45(1):12-15.
17. Verma P, Dhama V, Yadav P. Efficacy of different herbicides in transplanted basmati rice (*Oryza sativa* L.) under different nutrient options. Plant Archives. 2013;13(2):1123-1128.