www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(3): 1399-1403

www.thepharmajournal.com
Received: 14-12-2022
Accepted: 30-01-2023

Soumyashree Swain
Department of Agronomy, Faculty of Agricultural Sciences, (IAS), Siksha O Anusandhan Deemed to be University, Bhubaneswar, Odisha, India

Sankarsana Nanda
Department of Agronomy, Faculty of Agricultural Sciences, (IAS), Siksha O Anusandhan Deemed to be University, Bhubaneswar, Odisha, India

Subrat Kumar Mahapatra
Department of Agricultural Statistics, Faculty of Agricultural Sciences, (IAS), Siksha O Anusandhan, Deemed to be University, Bhubaneswar, Odisha, India

Jayashankar Pradhan
Krishi Vigyan Kendra, Gajapati, Odisha, India

Sangram Paramaguru
Krishi Vigyan Kendra, Gajapati, Odisha, India

Monalisa Patra
Department of Agronomy, Faculty of Agricultural Sciences, (IAS), Siksha O Anusandhan Deemed to be University, Bhubaneswar, Odisha, India

Rutuparna Paikaray
Krishi Vigyan Kendra, Angul, Odisha, India

Corresponding Author:
Soumyashree Swain
Department of Agronomy, Faculty of Agricultural Sciences, (IAS), Siksha O Anusandhan Deemed to be University, Bhubaneswar, Odisha, India

Effect of fertility levels and weed management practices on weed dynamics, yield and economics of transplanted rice (*Oryza sativa* L.)

Soumyashree Swain, Sankarsana Nanda, Subrat Kumar Mahapatra, Jayashankar Pradhan, Sangram Paramaguru, Monalisa Patra and Rutuparna Paikaray

Abstract
An Experiment was conducted to check the effect of fertility levels and weed management practices on the Weed Dynamics, yield and Economics of Transplanted Rice (*Oryza sativa* L.) at Agricultural Research Station, Faculty of Agricultural Sciences, Institute of Agricultural Sciences, Siksha 'O' Anusandhan Deemed to be University, Binjhagiri, Chatabar, Khordha, Odisha during *kharif*, 2019. The experiment was conducted in a Factorial RBD design having twelve treatments each of three replications, which consisting of three levels of fertility (100% RDF, 75% RDF and 50% RDF) and four weed control methods (Almix @ 4g /ha, Bispyribac sodium @ 25 g/ha, Hand weeding at 20&40 DAT and weed check). Sahabhagi Dhan variety was used for the experiment. From this experiment, we found that the combination of 100% RDF with post emergence application of Bispyribac sodium @ 25 g/ha recorded highest plant growth attributes, yield attributes, grain yield (3.63 t/ha), straw yield (4.76 t/ha) and reducing the cost of cultivation and also recorded the maximum net return (Rs.31, 746/ha) and return per rupee investment (1.81).

Keywords: Fertility levels, herbicides, weed control efficiency, economics and rice

Introduction
Rice (*Oryza sativa* L.) is considered as an important field crop of India as well as in Odisha, which also used as a staple food crop of India. Rice is grown in almost 112 countries of world and around 90% rice production of the world are produced in Asia. Globally, India is the second largest producer of rice after China. In Odisha Scenario, farmers usually grow the rice crop by transplanting of seedling under puddle condition. Puddling support the weeds to buries down the lower layer of the slurry, where they decompose by an aerobic action to form ammonium compounds which are retained much better than nitrate in the soil and can be used directly by the crop. Weeds are widely regarded as pests of great agricultural menace as they cause serious problems by causing severe competition with crop plants for nutrients, moistures, solar energy and space. Agricultural losses due to weeds is 45%, insects 30%, disease 20% and 5% others detrimental factors. Transplanted rice faces divers type of weed flora consisting of grasses, sedges and broad-leaved weeds (Gupta, O.P. 2014) [3]. Depending on the intensity of weed infestation, yield losses in transplanted rice may vary from 29 to 63% (Nalini *et al*., 2012) [5]. Besides yield reduction, weed deplete nutrients from soil to an extent of 42.7 kg nitrogen, 10 kg phosphorous and 21.08 kg potassium per hectare, respectively (Puniya *et al*., 2007) [8]. Nutrient management must be sound for achieving the production target in sustainable manner. Use of chemical fertilizer is the fastest way of counteracting the pace of nutrient mining. Nitrogen is known as the key nutrient of rice as it is directly influencing the growth, development and yield of rice. Phosphorus is necessary for cell division, seed formation, crop maturation, root growth and development. The phenomenon of grain filling and crop lodging is influenced by the potassium fertilization. The Nutrient use efficiency is very low in Indian Soil. The causes of nutrient deficiency are due to the improper use of RDF, time and method of fertilizer application, inadequate moisture status of soil, weed infestation and crop weed competition. In Recent days, weed control is the most important aspects which can be accomplished by cultural, mechanical and chemical methods.

Weed management through manual hand weeding is the efficient and safest one but high physical energy and cost investment makes it difficult for its timely implication in large area where as in case of chemical method, it is vital for efficient in timely and quickly controlling of weeds in the crop field.

Materials and Method

The experiment was conducted by using Factorial RBD design having twelve treatments each of three replications, which consisting of three levels of fertility i.e., 100% RDF, 75% RDF and 50% RDF (RDF: 60-30-30 N: P2O5: K2O kg/ha) and four weed control methods i.e., Almix @ 4g /ha, Bispyribac sodium @ 25 g/ha, Hand weeding at 20&40 DAT and weed check, respectively. The initial available nutrient in the soil was 207:21:126 kg/ha of N: P2O5: K2O, respectively. The test variety of rice was Sahabhagi Dhan (105 Days) having seed rate 40 kg/ha and spacing is 20 cm x 10 cm. The treatments used for the experiment purpose are.

F1W1-100% RDF, Almix @ 4 g/ha.
F1W2-100% RDF, Bispyribac Sodium @ 25 g/ha.
F1W3-100% RDF, Hand weeding at 20 & 40 DAT.
F1W4-100% RDF, Weed check.
F2W1-75% RDF, Almix @ 4 g/ha.
F2W2-75% RDF, Bispyribac Sodium @ 25 g/ha.
F2W3 -75% RDF, Hand weeding at 20&40 DAT.
F2W4-75% RDF, Weed check.
F3W1-50% RDF, Almix @ 4 g/ha.
F3W2-50% RDF, Bispyribac Sodium @ 25 g/ha.
F3W3-50% RDF, Hand weeding at 20&40 DAT.
F3W4-50% RDF, Weed check.

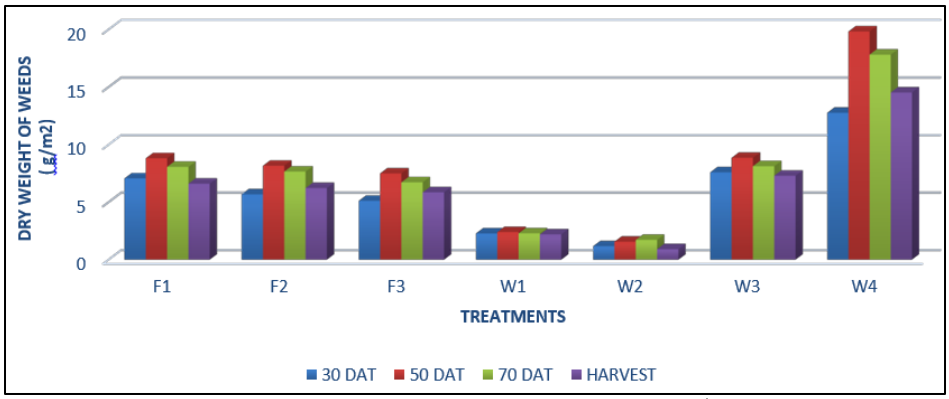
Result and Discussion

Effect on Weed Dynamics

From the above experiment, we can find that there was significant increase in weed population from 30 DAT to 50 DAT, but after that it gradually decreases. Similar observations were also recorded by Singh *et al*., (2006) in their experimentation. It is also estimated that with the increase in fertilizer levels, the weed population also increases significantly, which is due to the availability of more nutrients in weed during the crop growth. Hundred per cent recommended dose of fertilizer recorded significantly higher weed population per m2i.e., 3.76, 3.98, 3.89 and 3.67 at 30, 50, 70 DAT and during harvest respectively. But at 50% RDF lower order weed populations were found. The post emergence application of Bispyribac sodium @ 25 g/ha recorded significantly lower number of weed population due to the intrinsic efficiency of herbicide. Similar results were observed by Gnavel and Anbhazhagan (2010) [2]. The unweeded control treatment recorded significantly higher weed population at 30, 50, 70 DAT and harvest respectively, due to unchecked weed growth.

Table 1: Effect of weed management at different levels of fertility on weed dynamics of rice

Treatments	Weeds Population/m2				Dry weight of weeds (g/m2)				Weed control efficiency (%)		Weed index (%)
Fertility Levels (%)	**30 DAT**	**50 DAT**	**70 DAT**	**Harvest**	**30 DAT**	**50 DAT**	**70 DAT**	**Harvest**	**30 DAT**	**50 DAT**	
F1-100% RDF	3.76 (13.6)	3.98 (15.3)	3.89 (14.6)	3.67 (13.0)	7.07	8.82	8.07	6.61	44.63	55.52	-
F2-75% RDF	3.40 (11.0)	3.56 (12.1)	3.19 (9.7)	3.05 (8.8)	5.68	8.17	7.66	6.23	55.52	58.79	6.64
F3-50% RDF	3.14 (9.4)	3.46 (11.5)	3.10 (9.1)	2.90 (7.9)	5.12	7.50	6.73	5.86	59.90	62.17	36.55
S.Em (±)	0.01	0.02	0.02	0.01	0.02	0.02	0.01	0.02	-	-	-
CD(0.05)	0.04	0.07	0.07	0.04	0.08	0.06	0.04	0.07	-	-	-
Weed control methods											
W1-Almix @ 4g/ha	2.43 (5.0)	2.56 (6.0)	2.50 (5.7)	2.40 (5.26)	2.28	2.40	2.29	2.20	82.14	87.89	12.38
W2-Bispyribac sodium @ 25g/ha	1.70 (2.39)	2.01 (3.5)	1.94 (3.3)	1.65 (2.2)	1.17	1.56	1.72	0.91	90.83	92.13	2.71
W3-Hand weeding at 20&40 DAT	3.59 (12.4)	3.85 (14.3)	3.42 (11.2)	3.25 (10.0)	7.60	8.86	8.13	7.30	40.48	55.32	14.50
W4-Weedy check	6.02 (35.7)	6.24 (38.4)	5.72 (32.2)	5.53 (30.0)	12.77	19.83	17.82	14.53	-	-	27.79
S.Em (±)	0.01	0.03	0.02	0.01	0.03	0.02	0.01	0.02	-	-	-
CD(0.05)	0.05	0.08	0.08	0.05	0.09	0.06	0.05	0.08	-	-	-



(Figures in parentheses are original values. The data was transformed to√(x+0.5) before analysis)

Fig 1: Effect of weed management at different levels of fertility on dry weight of weeds (g/m2)

The dry weights of weeds were consistently lower at 50% fertilizer level, but it increased with increasing levels of fertilizer. The weight was significantly higher at 100% recommended dose of fertilizer. Significant increase in dry matter of weeds accumulated by use of high level of fertilizer (Singh *et al*., 2008) [13]. Post emergence application of Bispyribac sodium @ 25g/ha was found to be more efficient and recorded reduction in weed dry weight (1.17, 1.56, 1.72 and 0.91 g/m2 at 30, 50, 70 DAT and harvest, respectively). Moderate dry weight of weeds was also recorded in post emergence application of Almix. The unweeded control treatment registered maximum dry weight of weeds at all stages of observation, i.e. 12.77, 19.83, 17.82 and 14.53 g/m2 at 30, 50, 70 DAT and harvest, respectively.

The deceasing trend of WCE is found with increase in fertility level irrespective of stages of observation. Fifty per cent recommended dose of fertilizer recorded significantly higher WCE of 59.90% and 62.17% at 30 DAT and 50 DAT, respectively. In 100% RDF Lowest WCE of 44.63% and 55.52% were recorded at 30 and 50 DAT. WCE of a treatment has strong negative bearing with weed biomass. Post emergence application of Bispyribac sodium registered maximum weed control efficiency (90.83% and 92.13% at 30 & 50 DAT irrespectively) than all other treatments because of least dry matter production of the weeds over weed check treatment. Similar results were observed by Gnavel and Anbhazhagan (2010) [2]. Among all the weed control treatments the magnitude of weed suppression was higher in Bispyribac sodium followed by Almix.

Effect on yield

The experimental findings revealed that the grain yield of rice was increased significantly with increasing use of recommended dose of fertilizer. Hundred per cent RDF recorded significantly higher grain yield of 3.31t/ha. The higher yield at higher levels of fertility was ascribed to positive bearing on growth attributing characters such as leaf area, leaf area index and yield attributing characters like panicle length, fertile grains per panicle, and test weight. These results corroborated the finding of Singh *et al*., (2009) [11]. Data pertaining to grain yield in unweeded control treatment is the lowest value (2.39 t/ha). This was due to severe competition between crop and weeds for growth and development of rice. Post emergence application of Bispyribac sodium @25g/ha recorded higher grain yield of 3.22 t/ha. These results are in close conformity with the finding of Kumaran *et al*. (2015) [4].

The yield of straw was found to be 4.50 t/ha at 100% RDF, which is significantly higher than 75% RDF and 50% RDF. Similar results were observed by Pal *et al*., (2008) [6]. Among all the weed control treatments post emergence application of Bispyribac sodium @ 25g/ha recorded significantly higher straw yield of 4.35 t/ha than others. The result was in conformity with the findings of Parthipan and Ravi (2014) [7]. The unweeded control recorded the lowest straw yield (3.45 t/ha) because of poor assimilation of photosynthates.

Increasing use of fertility levels had a positive bearing with the harvesting index. Seventy five per cent RDF recorded 41.89% harvest index, whereas, 100% RDF recorded 42.38%. Similar results were observed by Singh *et al*. (2009).The lowest harvest index of 40.20% was recorded at 50% RDF. It is also found that the weed control methods substantially influence the harvest index. Lower harvest index of 40.25% was recorded in weed check treatment. Whereas post emergence application of Bispyribac sodium recorded significantly higher harvest index of 42.48%, respectively.

Table 2: Effect of weed management at different levels of fertility on yield of rice

Treatments	Grain yield (Tonnes/ha)	Straw yield (Tonnes/ha)	Harvest index (%)
Fertility Levels (%)			
F1-100% RDF	3.31	4.50	42.38
F2-75% RDF	3.09	4.29	41.89
F3-50% RDF	2.10	3.06	40.20
S.Em (±)	0.04	0.05	-
CD(0.05)	0.14	0.17	-
Weed control methods			
W1-Almix @ 4g/ha	2.90	4.02	41.84
W2-Bispyribac sodium @ 25g/ha	3.22	4.35	42.48
W3-Hand weeding at 20&40 DAT	2.83	3.99	41.39
W4-Weedy check	2.39	3.45	40.25
S.Em (±)	0.05	0.06	-
CD (0.05)	0.16	0.19	-

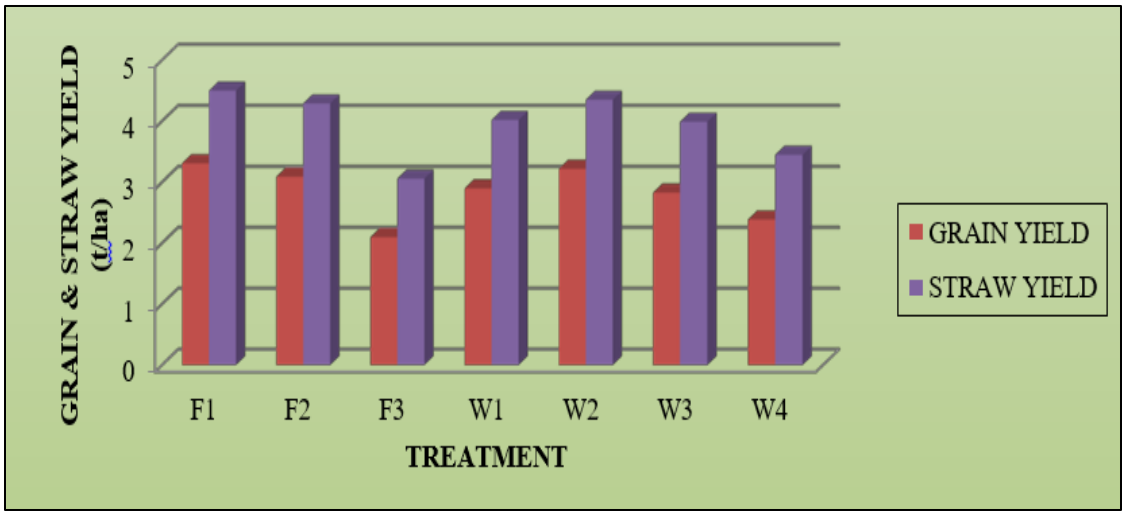


Fig 2: Effect of weed management at different levels of fertility on grain and straw yield (t/ha)

Effect on economics

An In-depth study to the economics of the treatment is presented under the Table 3. The data revealed that higher levels of fertility had an edge over lower levels in recording higher net profit and return per rupee investment. It was interesting to note that the combined influence of 100% RDF with post emergence application of Bispyribac sodium @ 25g/ha achieved higher net return (Rs.31, 746/ha) and return per rupee investment (1.81) the result corroborated the finding of Das *et al*., (2017) [1]. It could be possibly due to higher grain yield and better weed free environment as a result of judicious use of fertilizer and integrated approach on weed management practices through use of post emergence application of Bispyribac sodium @ 25 g/ha at 21 DAT. Similar results were also obtained by Raghavendra *et al*., (2015) [9]. The second in order was 100% RDF with post emergence application of Almix with net return of Rs 25,542/ha and return per rupee investment (1.65). The lowest return per rupee investment (0.72) was recorded at 50% RDF under weedy check treatment.

Table 3: Effect of weed management practices at different levels of fertility on economics of rice

Treatment	Gross return (Rs/ha)	Cost of cultivation (Rs/ha)	Net return (Rs/ha)	Return per rupee investment (Rs)
100% RDF, Almix @ 4 g/ha	64,425	38,883	25,542	1.65
100% RDF, Bispyribac sodium @ 25 g/ha	70,654	38,900	31,746	1.81
100% RDF, Hand weeding	63,840	43,443	20,397	1.46
100% RDF, Weedy check	51,600	38,350	13,250	1.34
75% RDF, Almix @ 4 g/ha	60,535	38,017	22,518	1.59
75% RDF, Bispyribac sodium @ 25 g/ha	66,310	38,042	28,268	1.74
75% RDF, Hand weeding	59,426	42,577	16,849	1.39
75% RDF, Weedy check	47,500	37,500	10,050	1.26
50% RDF, Almix @ 4 g/ha	45,000	37,151	7,854	1.21
50% RDF, Bispyribac sodium @ 25 g/ha	51,424	37,176	14,248	1.38
50% RDF, Hand weeding	43,170	41,711	1,459	1.03
50% RDF, Weedy check	25,130	34,711	-9,581	0.72

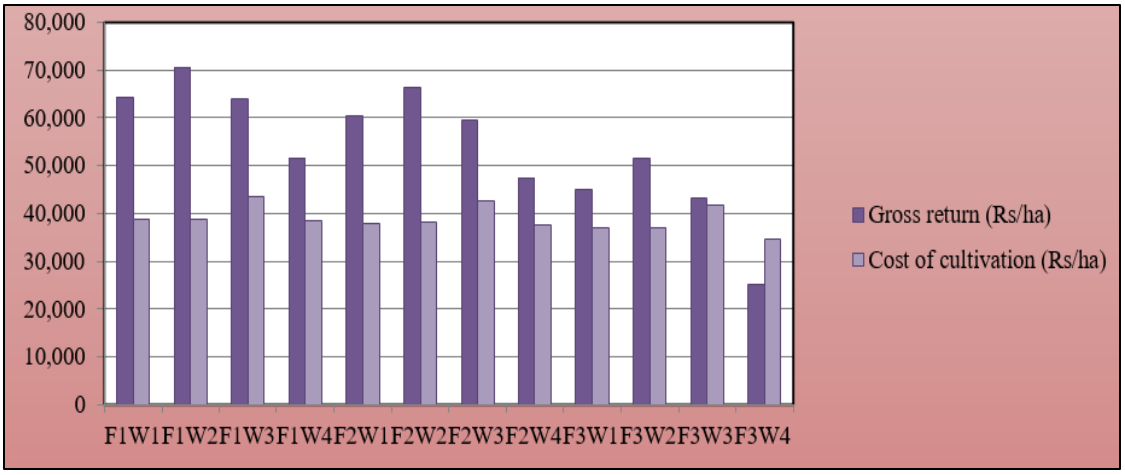


Fig 3: Effect of weed management practices at different levels of fertility on Gross return and Cost of cultivation of rice (Rs. /ha)

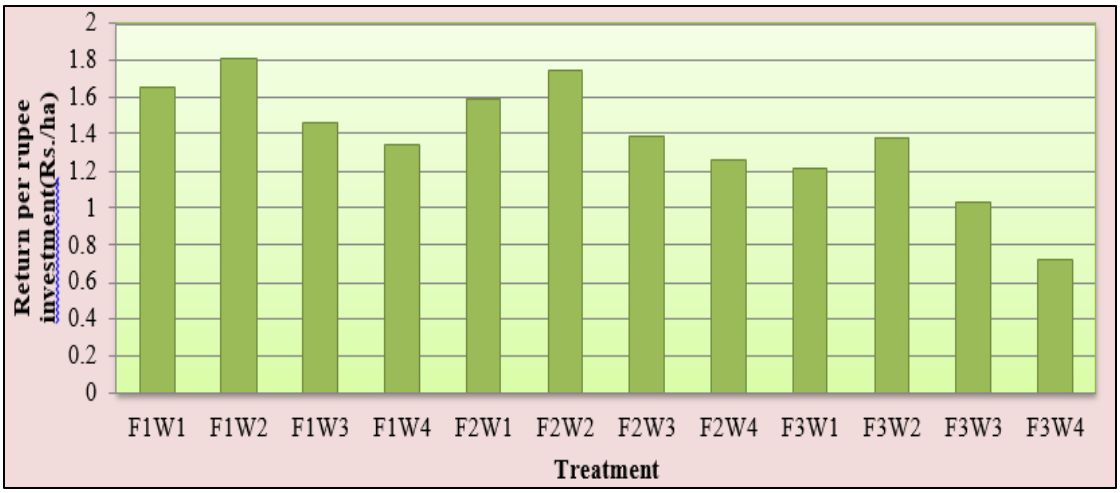


Fig 4: Effect of weed management practices at different levels of fertility on return per rupee investment (Rs. /ha)

Conclusion

From the above experiment it can concluded that the Post emergence application of Bispyribac sodium @ 25g/ha was found to be most effective in controlling the weed population and weed dry weight as compared to post emergence application of Almix, hand weeding and weed check treatment. The weed control efficiency and weed index was relatively higher with the post emergence application of Bispyribac sodium. The interaction of 100 per cent RDF with post emergence application of Bispyribac sodium @ 25 g/ha was found to be most beneficial in increased the grain yield (3.63 t/ha), straw yield (4.76 t/ha) maximum net return (Rs. 31,746/ha) and also higher return per rupee investment (1.81).

References

1. Das R, Beral S, Pathak A, Mandal MK. Weed management in transplanted rice through bispyribac sodium 10% SC and its effect on soil micro-flora and succeeding crop black gram, International Journal of Current Microbiology and Applied Sciences. 2017;4(6):681- 688.
2. Ganavel I, Anbhazhagan R. Bio-efficacy of pre and post-emergence herbicides in transplanted aromatic rice. Research Journal of Agricultural Sciences. 2010;1(4):315-317.
3. Gupta OP. Modern Weed Management Agribios. (India). Jodhpur; c2014.
4. Kumaran G, Kathiresan. Efficacy of new herbicide (bispyribac sodium 10% SC) Against different weed flora, nutrient uptake in rice and their residual effects on succeeding crop of green gram under zero tillage, Journal of Applied and Natural Science. 2015;7(1):279-285.
5. Nalini K, Murali Arthanari, Chinnuswamy C. Early post emergence herbicidal weed management in transplanted rice. In Abstract of Papers Biennial Conference of ISWS on Environment. Kerala Agricultural University; c2012. p. 74.
6. Pal D, Dolai AK, Ghosh RK, Mallick S, Mandal D, Barui K. Bio-efficacy and phytotoxicity of ethoxysulfuron on the weed control and yield performance of transplanted kharif rice in gangetic alluvial soil of West Bengal, Journal of Crop and Weed. 2008;4(1):38-40.
7. Parthipan T, Ravi V. Productivity of transplanted rice as influenced by weed control methods, African Journal of Agricultural Research. 2014;9(29):2250-2255.
8. Puniya R, Pandey PC, Bisht PC. Performance of Trisulfuron, Trisulfuron + Pretilachlor and Bensulfuron Methyl in transplanted rice. Indian Journal of Weed Science. 2007;39(1&2):120-122
9. Raghavendra BM, Susheela K, Rao VP, Madhavi M. Efficacy of different weed management practices on growth and yield of direct wet seeded rice sown through drum seeder. The Bioscan. 2015;10(1):97-101.
10. Singh AK, Chandra U, Singh R. Growth and yield response of hybrid rice to planting methods and fertilizer levels. Annals of Plant Physiology. 2009;23(2):155-157.
11. Singh AK, Chandra, Singh T. Effect of different fertilizer levels on chlorophyll content, growth and yield of hybrid rice. Annals of Plant Physiology. 2009;23(1):77-79.
12. Singh P, Singh SS. Effect of establishment method, fertility level and weed management practices on aromatic rice (*Oryza sativa* L.), Indian Journal of Agronomy. 2006;51(4):282-292.
13. Singh P, Singh SS. Production potential and economic analysis of Direct wet seeded aromatic rice (*Oryza sativa* L.) C.V. Pusa Basmati-1 as influenced by fertility level and weed management practices. Oryza. 2008;45(1):23-26.