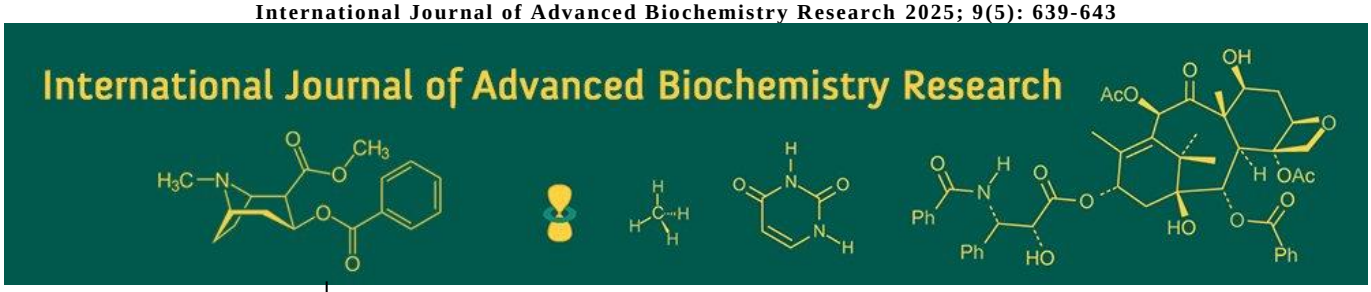

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating: 5.29
IJABR 2025; 9(5): 639-643
www.biochemjournal.com
Received: 25-02-2025
Accepted: 29-03-2025

Pritam Ghosh
Department of Agronomy, Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati, Sriniketan, West Bengal, India

Soumyadeb Kumar
Department of Agronomy, Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati, Sriniketan, West Bengal, India

AK Dolai
Department of Agronomy, Institute of Agricultural Science, University of Calcutta, West Bengal, India

Pronomita Ghosh
Department of Agronomy, Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati, Sriniketan, West Bengal, India

Anshuli Priya
Department of Agronomy, Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati, Sriniketan, West Bengal, India

Corresponding Author:
Pritam Ghosh
Department of Agronomy, Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati, Sriniketan, West Bengal, India

Performance of summer rice under different weed management practices

Pritam Ghosh, Soumyadeb Kumar, AK Dolai, Pronomita Ghosh and Anshuli Priya

DOI: https://www.doi.org/10.33545/26174693.2025.v9.i5h.4393

Abstract
During summer season of 2019-20, a field experiment was conducted to study the performance of summer rice under different weed management practices. There were total 9 treatments which includes- pre-emergence application of pyrazosulfuron ethyl 25 g/ha (T_1) and oxadiargyl 90 g/ha (T_2), T_1 fb mechanical weeding at 40 DAT (T_3), T_2 fb mechanical weeding at 40 DAT (T_4), T_1 fb manual weeding at 40 DAT (T_5), T_2 fb manual weeding at 40 DAT (T_6), mechanical weeding at 20 and 40 DAT (T_7), manual weeding at 20 and 40 DAT (T_8) and unweeded control (T_9). Pre emergence application of herbicides (pyrazosulfuron ethyl 25 g/ha and oxadiargyl 90 g/ha) fb one mechanical or manual weeding at 40 DAT (T_3 to T_6) significantly reduced the population and dry weight of all the three categories of weeds in comparison with twice mechanical weeding and the unweeded control. The maximum weed control efficiency, leaf area index (5.33), crop growth rate (17.34 g/ m^2/day), yield components, grain yield (5.10 t/ha) and straw yield (6.20 t/ha) of rice was recorded from twice manual weeding (T_8) which did not vary significantly from T_3-T_6. Pre-emergence application of pyrazosulfuron ethyl 25g/ha fb mechanical weeding at 40 DAT resulted in the highest return per rupee invested (2.22 Rs.). There was no significant difference among all weed management practices regarding return per rupee invested except twice mechanical weeding which recorded significantly lower results. The weeds resulted 57.64% yield reduction in transplanted summer rice.

Keywords: Pyrazosulfuron ethyl, Oxadiargyl, transplanted rice, weed control efficiency, integrated weed management

Introduction
Rice (*Oryza sativa* L.) is the most important cereal crop in India. More than 60% of the world population consumes it as staple food (Rathna Priya *et al.*, 2019) [13]. Although India has achieved self-sufficiency in rice requirement, but land is the scare resource to meet the demand of 126.14 million tons by the year 2030 for which we must increase our productivity (Paroda and Kumar, 2000) [11]. In rice, severe yield loss occurs due to infestation of weeds at different stages of crop growth. The loss caused by weeds is due to their competition with crop for nutrients, soil, moisture, light, space, etc. (Parameswari and Srinivas, 2017) [10]. The yield losses due to uncontrolled weed growth in low land and upland rice ranges from 12 to 81% (Chopra and Chopra, 2003) [1], depending on the weed flora, their density, and the duration of competition. Season long weed competition reduced grain yield by 50-60% and 70-80% in transplanted rice and direct seeded rice, respectively (Dass *et al.*, 2017) [2]. Thus, it is essential to control the weeds in time to avoid yield loss. Nowadays, manual weeding in rice though very effective but not feasible due to scarcity of labour, high labour wages, and time consuming. Moreover, it is difficult to differentiate grassy weeds and rice seedlings due to their morphological similarity which makes hand weeding difficult particularly at early stages of crop growth. Considering all these problems, chemical control using herbicide alone or in combination with manual or mechanical method is being considered as the most effective and economic tools of weed management with higher economic returns (Khaliq *et al.*, 2011) [6]. Use of herbicides from beginning provides better weed management and higher competitive ability to the crop. But any single approach such as use of chemical herbicides or manual or mechanical weeding is not convenient in controlling weeds. Thus, attention should be shifted to suitable combination of chemical, manual and mechanical weed control measures in the form of an economically and ecologically viable technique (Mahajan and

Chauhan, 2013) [7]. Therefore, a study involving weed management in summer rice was conducted to access the suitable integration of different methods of weed management on weeds and yields of rice.

Materials and Methods

A field experiment was conducted during summer season of 2019-2020 to study the effect of weed management practices on growth and productivity of summer rice (*Oryza sativa* L.) in red and lateritic soil of West Bengal. The soil was a sandy clay loam having pH 5.9, low in available organic carbon (0.40%), available nitrogen (285.34 kg/ha) and medium in phosphorus (22.8 kg/ha), and low in available potassium (140.34 kg/ha). The experiment was laid out in a randomized block design comprising 9 treatments and 3 replications. The treatments comprised pyrazosulfuron ethyl 25 g/ha at 3 DAT, oxadiargyl 90 g/ha at 3 DAT, pyrazosulfuron ethyl 25 g/ha at 3 DAT *fb* mechanical weeding at 40 DAT, oxadiargyl 90 g/ha at 3 DAT *fb* mechanical weeding at 40 DAT, pyrazosulfuron ethyl 25 g/ha *fb* manual weeding at 40 DAT, oxadiargyl 90 g/ha at 3 DAT *fb* manual weeding at 40 DAT, mechanical weeding at 20 and 40 DAT, manual weeding at 20 and 40 DAT and unweeded control. Rice seedlings (variety of MTU 1010) were transplanted in north-south direction with a spacing of 25 cm × 25 cm. The fertilizers were applied at the recommended dose i.e., 120:60:60 kg of N: P_2O_5:K_2O per ha, respectively. The sources of fertilizers were urea, single super phosphate and muriate of potash for N, P_2O_5, K_2O, respectively. One fourth of N dose, full dose of P_2O_5 & three fourth K_2O dose were applied as basal. Half dose of N was applied at active tillering stage and remaining one fourth of N along with one fourth of K_2O were applied as second top dressing at the panicle initiation stage. The herbicides were applied according to the treatments using a knap-sack sprayer fitted with flat-fan nozzle. The spray volume for herbicide application was 500 liters/ha. Weed removal was practiced in manual weeding treatments through hand pulling. Mechanical weeding was done with the help of a cono-weeder. No weed control measure was undertaken in unweeded control plot. Category wise weed density and dry weight were measured at 60 DAT. The weed population was recorded by counting the number of weeds using a quadrate of 0.5m x 0.5 m randomly in each plot and was converted to population/m^2. For recording dry matter, these weeds were removed separately, cleaned thoroughly, sundried initially and then oven dried at 65 °C for 72 hour still constant weight was obtained. Weed control efficiency (Singh *et al.*, 2013) [15] and weed index (Gill and Kumar, 1969) [3] were calculated using weed dry weight and grain yield, respectively as per the following formula-

$$\text{Weed Control Efficiency (\%)} = \frac{X - Y}{X} \times 10$$

Where,
X= Weed dry weight in untreated or unweeded control plot
Y= Weed dry weight of treated plot

$$\text{Weed Index (\%)} = \frac{\text{Yield from weed free plot} - \text{Yield from treated plot}}{\text{Yield from weed free plot}} \times 100$$

Data on growth parameters of rice such as plant height, LAI, CGR, no. of tillers/m^2 were recorded at 60 DAT where in yield components such as number of panicles/m^2, number of grains/panicles, test weight, grain yield, straw yield and harvest index were calculated at harvesting time. Economics was calculated on the basis of existing price of various inputs like seed, fertilizer, labour, irrigation, plant protection chemicals etc. The yield of rice crop like grain and straw yield was converted into monetary value based on the prevailing local market prices and expressed in rupees/ha. Net returns and return per rupee invested were worked out on the basis of gross return and cost of cultivation. Weed data such as population and dry weight were transformed through square root $\sqrt{(X + 0.5)}$ transformation. The statistical analysis was done as described by Gomez and Gomez (1984) [4].

Results and Discussion

Weeds

The major weed species found in the experimental plot were barnyard grass (*Echinochloa crus-galli*) and jungle rice (*Echinochloa colona*) among grasses; flat sedge (*Cyperus iria*), umbrella sedge (*Cyperus difformis*) and club rush (*Scirpus sp*.), among sedges; water primrose (*Ludwigia parviflora*) and water fern (*Marsilea quadrifolia*) among broadleaved weeds. The population of grasses, sedges and broadleavedweeds varied significantly at 60 DAT (Tables 1). Population of total weeds was observed maximum in the unweeded control plot while the lowest population was recorded in twice manual weeded plots. All the weed management treatments significantly reduced the population of all categories of weeds than unweeded control. Pre-emergence application of pyrazosulfuron ethyl and oxadiargyl at 3 DAT when followed by one mechanical weeding or manual weeding at 40 DAT (T_3 to T_6), significantly reduced the population of total weeds than their sole application (T_1 and T_2) as well as mechanical weeding twice at 20 and 40 DAT (T_7). Mechanical weeding at 20 and 40 DAT recorded significantly higher population of all categories of weeds than T_3 to T_6 at 60 DAT. The maximum dry weight of all categories of weeds (Table 1) was observed in the unweeded control (T_9) while the lowest dry weight was found in T_3. Pre-emergence application of pyrazosulfuron ethyl 25 g/ha and oxadiargyl 90 g/ha at 3 DAT followed by one mechanical or manual weeding at 40 DAT (T_3 to T_6) were statistically at par and resulted significantly lower dry weight of all the categories of weeds than sole application of the herbicides ($T_1$and T_2).Twice mechanical weedings at 20 and 40 DAT (T_7) was not effective in reducing the dry weight of weeds as the weeds present around the rice hills could not be removed and recorded significantly higher dry weight of weeds than all other weed management treatments. Reshma, 2014 also opined similar views. Pyrazosulfuron ethyl 25 g/ha at 3 DAT fb mechanical weeding at 40 DAT recorded maximum weed control efficiency (79.71%) at 60 DAT (Table 1) which was closely followed by manual weeding twice at 20 and 40 DAT (79.29%). The four treatments where one manual or mechanical weeding was practiced at 40 DAT after pre-emergence application of herbicides (T_3 to T_6) resulted higher weed control efficiency than sole application of these herbicides (63.87 and 54.05%) and two mechanical weedings (65.13%). The uncontrolled growth of weeds caused 57.64% yield loss of summer rice (Table 2). Parthipan and Ravi, 2014 were of the similar observation. Among the weed management treatments pre-emergence application of oxadiargyl followed by manual weeding at 40

DAT resulted 2.94% yield loss due to lower weed population and dry weight as well as higher grain yield.

Crop growth and yield

All the weed management treatments were statistically at par and resulted significantly higher plant height than unweeded control. The maximum crop growth parameters such as leaf area index and crop growth rate (Table 2) were observed in manual weeding at 20 and 40 DAT (T_8) which was closely followed by oxadiargyl 90 g/ha fb manual weeding at 40 DAT (T_4) and pyrazosulfuron ethyl 25 g/ha fb manual weeding at 40 DAT(T_3). It corroborates the findings of Murthy *et al.* (2012) [8]. However, mechanical weeding at 20 and 40 DAT (T_7) resulted significantly lower LAI than manual weeding at 20 and 40 DAT (T_8). The maximum number of tillers/m^2 was also observed in manual weeding at 20 and 40 DAT at 60 DAT and was closely followed by pyrazosulfuron ethyl followed by manual weeding at 40 DAT. Similar findings were reported by Islam *et al.*, 2016 [5]. All the weed management treatments did not vary significantly and resulted significantly higher no. of tillers/ m^2 than twice mechanical weedings (T_7) and unweeded control (T_9). The maximum number of panicles/m^2 and filled grains/panicle were observed in manual weeding at 20 and 40 DAT which was statistically at par with the weed management treatments, T_1 to T_6 but was significantly higher than twice mechanical weedings (T_7). However, all the weed management treatments except mechanical weeding twice resulted significantly higher number of panicles/m^2 and filled grains/panicle than unweeded control. The maximum grain yield, straw yield and harvest index were recorded in manual weeding at 20 and 40 DAT (T_8) which was statistically at par with all other weed management treatments (T_1 to T_6) but was significantly higher than two mechanical weedings (T_7). Application of pyrazosulfuron ethyl 25 g/ha followed by mechanical or manual weeding at 40 DAT (T_3 and T_5) recorded 12.99% and 14.46% higher grain yield, respectively than sole application of pyrazosulfuron ethyl 25 g/ha as pre-emergence. Similarly, oxadiargyl 90 g/ha at 3 DAT fb mechanical weeding at 40 DAT (T_4) and oxadiargyl 90 g/ha at 3 DAT fb manual weeding at 40 DAT (T_6) recorded 13.09% and 24.68% higher grain yield, respectively than sole application of oxadiargyl 90 g/ha at 3 DAT (T_2). This might be due to better utilization of all growth resources by the rice plants as there was less crop-weed competition because these two herbicides performed well in controlling all categories of weeds present in the experimental field.

Economics

Sole application of the herbicides ($T_1$and T_2) or when followed by one manual or mechanical weeding at 40 DAT (T_3 to T_6) as well as two manual weedings (T_8) did not show any significant difference and registered significantly higher gross return, net return and return per rupee invested than unweeded control (Table 3). However, manual weeding at 20 DAT and 40 DAT (T_8) resulted the maximum gross return. The highest net return was observed in oxadiargyl 90 g/ha fb manual weeding at 40 DAT (T_6). Return per rupee invested was recorded highest in pyrazosulfuron ethyl followed by mechanical weeding (T_3) which was closely followed by oxadiargyl followed by manual weeding (T_6). Similar findings were reported by Murthy and Reddy (2013) [9].

Table 1: Effect of weed management practices on population and dry weight of weeds in summer rice at 60 DAT

Treatments	Population of weeds (No./m2)				Dry weight of weeds (g/m2)				WCE (%)
	Grasses	Sedge	BLW	Total	Grasses	Sedge	BLW	Total	
T_1: Pyrazosulfuron ethyl 25 g/ha at 3 DAT	8.42 (70.67)*	3.84 (14.67)	4.90 (24.00)	10.48 (109.33)	9.50 (89.77)	1.87 (3.04)	1.08 (0.75)	9.70 (93.56)	63.87
T_2: Oxadiargyl 90 g/ha at 3 DAT	8.74 (76.00)	3.19 (10.00)	4.78 (22.67)	10.44 (108.67)	9.91 (97.72)	2.77 (4.70)	1.37 (1.48)	10.21 (103.90)	54.05
T_3: Pyrazosulfuron ethyl 25 g/ha fb mechanical weeding at 40 DAT	4.97 (25.33)	2.39 (5.33)	2.39 (6.67)	6.10 (37.33)	7.48 (55.55)	1.25 (1.23)	1.00 (0.55)	7.60 (57.32)	79.71
T_4: Oxadiargyl 90 g/ha at 3 DAT fb mechanical weeding at 40 DAT	5.51 (32.00)	1.91 (4.00)	2.56 (8.00)	6.53 (44.00)	8.14 (65.87)	1.27 (1.31)	0.89 (0.32)	8.23 (67.49)	76.11
T_5: Pyrazosulfuron ethyl 25 g/ha fb manual weeding at 40 DAT	4.64 (21.33)	2.39 (5.33)	2.39 (6.67)	5.75 (33.33)	7.98 (63.28)	1.33 (1.39)	0.85 (0.23)	8.08 (64.89)	77.03
T_6: Oxadiargyl 90 g/ha at 3 DAT fb manual weeding at 40 DAT	5.27 (28.00)	2.65 (6.67)	2.56 (8.00)	6.49 (42.67)	8.99 (80.31)	1.35 (1.47)	0.82 (0.18)	9.08 (81.95)	71.00
T_7: Mechanical weeding at 20 and 40 DAT	9.53 (90.67)	5.91 (34.67)	4.90 (24.00)	12.24 (149.34)	11.82 (139.24)	3.47 (11.55)	2.80 (7.41)	12.60 (158.20)	65.13
T_8: Manual weeding at 20 DAT and 40 DAT	5.02 (25.00)	2.50 (6.00)	1.91 (4.00)	5.92 (35.00)	7.59 (56.59)	1.37 (1.48)	0.96 (0.45)	7.88 (58.52)	79.29
T_9: Unweeded control	11.93 (142.00)	8.74 (76.00)	9.11 (82.67)	16.46 (270.67)	15.54 (241.08)	5.00 (24.53)	4.18 (16.99)	16.82 (282.60)	0.00
S.Em(±)	0.53	0.32	0.32	0.52	0.16	0.16	0.11	0.64	-
CD (5%)	1.58	0.97	0.95	1.56	0.49	0.47	0.34	1.92	-
CV (%)	12.85	15.06	13.89	10.09	2.99	14.05	11.12	11.17	-

*Figures in parentheses are original values; Data were subjected to square root (√X + 0.5) transformation. DAT=Days after transplanting; fb= followed by.

Table 2: Effect of weed management on growth parameters, yield components and yield of summer rice

Treatments	Plant height at 60 DAT (cm)	Leaf area index at 60 DAT	Crop growth rate at 60 DAT (g/m2/day)	No. of tillers/m2 at 60 DAT	No. of panicles/m2	No. of filled grain/ panicle	1000 Grain Weight (g)	Grain yield (t/ha)	Straw yield (t/ha)	Harvest index (%)	Weed Index (%)
T_1: Pyrazosulfuron ethyl 25 g/ha at 3 DAT	52.33	4.87	15.70	312.33	304.00	89.73	22.67	4.08	5.86	41.04	20.00
T_2: Oxadiargyl 90 g/ha at 3 DAT	50.93	4.58	16.04	317.00	309.33	90.60	22.44	3.97	5.84	40.46	22.15
T_3: Pyrazosulfuron ethyl 25 g/ha fb mechanical weeding at 40 DAT	53.20	5.10	16.10	344.67	341.33	91.52	22.61	4.61	6.05	43.24	9.60
T_4: Oxadiargyl 90 g/ha at 3 DAT fb mechanical weeding at 40 DAT	51.73	5.20	17.00	339.00	335.60	90.80	22.54	4.49	6.16	42.15	11.96
T_5: Pyrazosulfuron ethyl 25 g/ha fb manual weeding at 40 DAT	52.67	5.04	15.84	352.33	348.80	91.40	22.56	4.67	5.92	44.09	8.43
T_6: Oxadiargyl 90 g/ha at 3 DAT fb manual weeding at 40 DAT	51.27	5.00	16.77	343.00	341.33	96.60	22.84	4.95	6.09	44.83	2.94
T_7: Mechanical weeding at 20 and 40 DAT	52.00	4.17	14.28	175.00	171.87	70.13	22.37	3.42	5.24	39.49	32.94
T_8: Manual weeding at 20 and 40 DAT	52.33	5.33	17.34	357.67	354.27	104.73	23.12	5.10	6.20	45.13	0.00
T_9: Unweeded control	39.50	2.77	10.59	97.93	94.93	46.71	22.00	2.01	3.88	34.12	57.64
S.Em(±)	1.92	0.33	0.91	16.09	28.75	6.45	0.34	0.40	0.29	1.59	-
CD (5%)	5.76	0.98	2.72	48.23	86.19	19.33	1.01	1.20	0.88	4.75	-
CV (%)	6.57	12.13	10.14	9.50	17.23	12.69	2.58	16.84	8.97	6.63	-

Table 3: Effect of weed management practices on economics of summer rice

Treatments	Gross return (Rs. /ha)	Net return (Rs. /ha)	Return per rupee invested (Rs.)
T_1: Pyrazosulfuron ethyl 25 g/ha at3 DAT	77030	41217	2.15
T_2: Oxadiargyl 90 g/ha at 3 DAT	74953	38521	2.05
T_3: Pyrazosulfuron ethyl 25 g/ha 3 DAT fb mechanical weeding at 40 DAT	86973	47860	2.22
T_4: Oxadiargyl 90 g/ha at 3 DAT fb mechanical weeding at 40 DAT	84834	45102	2.14
T_5: Pyrazosulfuron ethyl 25 g/ha fb manual weeding at 40 DAT	88106	45693	2.08
T_6: Oxadiargyl 90 g/ha at 3 DAT fb manual weeding at 40 DAT	93393	50361	2.17
T_7: Mechanical weeding at 20 and 40 DAT	64569	24037	1.59
T_8: Manual weeding at 20 and 40 DAT	96288	49156	2.04
T_9: Unweeded control	37760	2728	1.08
S.Em(±)	7171.66	7171.66	0.17
CD (5%)	21500.63	21500.63	0.50
CV (%)	16.13	24.54	14.99

Conclusion

Pre-emergence application of herbicides (pyrazosulfuron ethyl or oxadiargyl) and/or mechanical or manual weeding at 40 DAT was found effective in improving growth and productivity of summer rice by controlling the weeds efficiently.

References

1. Chopra NK, Chopra N. Effect of doses and stages of application of pyrazosulfuron ethyl on weeds in transplanted rice. Indian Journal of Weed Science. 2003;35(1&2):27-29.
2. Dass A, Shekhawat K, Chaudhary AK, Sepat S, Rathode SS, Mahajan G, Chauhan, BS. Weed management in rice using crop competition-a review. Crop Protection. 2017;95:45-52.
3. Gill HS. Weed index-a new method for reporting weed control trials. Indian Journal of Agronomy. 1969;14:96-98.
4. Gomez KA, Gomez AA. Statistical procedures for agricultural research. John wiley & sons.1984
5. Islam MS, Islam MM, Rahmann MH, Bir MSH, Lee JJ, Park KW. Effect of herbicides on weed infestation and yield in boro rice. Research on Crops. 2016;17:415-420.
6. Khaliq A, Riaz MY, Matloob A. Bio-economic assessment of chemical and non-chemical weed management strategies in dry seeded fine rice (*Oryza sativa* L.). Journal of Plant Breeding and CropScience. 2011;3(12):302-310.
7. Mahajan G, Chauhan BS, Gill MS. Dry-seeded rice culture in Punjab State of India: lessons learned from farmers. Field Crops Research. 2013;144: 89-99.
8. Murthy KV, Reddy DS, Reddy PG. Integrated weed management practices for rice under aerobic culture. Indian J. Weed Science. 2012;44(2):70-76.
9. Murthy KV, Reddy DS. Effect of irrigation and weed management practices on nutrient uptake and

economics of production of aerobic rice. J. Agril. And Veterinary Science. 2013;3(1):15-21.
10. Parameswari YS, Srinivas A. Weed management in rice: A review. International Journal of Applied and Pure Science and Agriculture. 2017;3(1):2394-5532.
11. Paroda RS, Kumar P. Food production and demand in South Asia. Agricultural Economics Research Review. 2000;13(1):1-24.
12. Parthipan T, Ravi P. Productivity of transplanted rice as influenced by weed control methods. African J. of Agri. Res. 2016;11(16):1445-1449.
13. Rathna Priya TS, Eliazer Nelson ARL, Ravichandran K, Antony U. Nutritional and functional properties of coloured rice varieties of South India: a review. Journal of Ethnic Foods. 2019;6(1):1-11.
14. Reshma RS. Efficacy and economics of weed management strategies in aerobic rice. M.Sc. (Ag) thesis. Kerala Agricultural University, Thrissur, India.2014.
15. Singh RK, Singh SRK, Gautam US. Weed control efficiency of herbicides in irrigated wheat (*Triticum aestivum*). Indian Research Journal of Extension Education. 2013;13(1):126-128.