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Efficacy of different herbicides combinations on weed dynamics, growth and yield of transplanted rice (*Oryza sativa* L.) under eastern Uttar Pradesh

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Abstract
A field experiment was conducted at the Agronomy Research Farm, A.N.D. University of Agriculture & Technology, Kumarganj, Faizabad (U.P.) during the *Kharif* season of 2017-18 with twelve treatments in Randomized Block Design and replicated three times. Total weed population and its dry weight, and weed index were lowest with Pretilachlor @ 750 g a.i. ha^{-1} (PE) *fb* Bispyribac-Na @ 25 g a.i. ha^{-1} (POE). However, highest weed control efficiency was recorded with Pretilachlor @ 750 g a.i. ha^{-1} (PE) *fb* Bispyribac-Na @ 25 g a.i. ha^{-1} (POE). The growth attributes like plant height (122.8 cm), number of shoots (441 m^{-2}), leaf area index (3.98), dry matter accumulation (1202 g m^{-2}) and yield attributes like number of effective shoots (428 m^{-2}), length of panicle (23 cm), number of grain panicle^{-1}(186), test weight (23.4 g) were significantly higher with Pretilachlor @ 750 g a.i. ha^{-1} (PE) *fb* Bispyribac-Na @ 25 g a.i. ha^{-1} (POE). and grain yield (54.0 q ha^{-1}) as well as harvest index (44.73).

Keywords: Weeds, pre and post-emergence, herbicides, transplanted, weed control efficiency, weed index, rice

Introduction
Rice (*Oryza sativa* L.) is one of the most important cereal crop grown under different aquatic condition and mostly under submergence or variable ponding conditions. It belongs to family Poaceae (Gramineae). It accounts 43% of total food grain production and 55% of cereal production in the country. It is a high caloric food, which contain 75% starch, 6-7% protein, 2-2.5% fat, 0.8% cellulose and 5-9% ash.

Weeds compete with rice for moisture, nutrients, light, temperature and space. Uncontrolled weeds have caused yield reduction in the range 28 to 45% in transplanted rice (Manhas *et al*., 2012) [6]. Furthermore, any delay in weeding lead to increased weed biomass which has a negative correlation with yield. The major wed flora like *Echinochloa colona* and *E. crusgalli*, *Ammannia baccifera, Cyperus iria, Cyperus difformis, Eclipta alba, Fimbristylis miliacea, Ischaemum rugosum, Leptochloa chinensis, Monochoria vaginalis* and *Paspalum distichum* were found the most abundant in rice crop (Singh *et al.* 2016) [6, 8].

Weeds under rice crop emerged in different stages of crop growth and compete for light, moisture and nutrients with rice crop if not managed properly. Weed control in rice manually though effective but scarcity of labour at right time and their high wages makes it costly. Besides intra row weeds in rice crop are not removed in manually weeding. On the other hand, Weed species in rice are diverse like, grassy, sedges and broad leaf weeds which cannot be controlled by single herbicides or pre-emergence herbicides because weeds emerged in later stage remains uncontrolled and reduce the rice yield.

Hence, under diverse weeds flora which emerged in different stage of crop growth can be controlled by sequential spray of herbicide (PE *fb* POE). Similar result was reported by (Das *et al.* 2015) [7].

Keeping these facts in view, the present experiment was planned with single and sequential herbicide application to find out the economically viable and effective weed control methods in transplanted rice crop.

Materials and Methods
The experiment was conducted to find out the effective and economically viable weed control methods for transplanted Rice (*Oryza sativa* L.) at the Agronomy Research Farm, N.D.

University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.) during *Kharif* season, 2017-18 (July to November). The experimental site is situated at a distance of about 42 km in south-east from Ayodhya on Raebareli road. Geographically, experimental site falls under sub-tropical zone in Indo-gangetic plains and lies between $26^0$47' North latitude, $82^0$12' East longitudes, at an altitude of about 113.0 meter from mean sea level. The soil of experimental field was low in available nitrogen (204.00 kg ha-1) and organic carbon (0.34%), medium in available phosphorus (15.35 kg ha-1) and high in potassium (267.00 kg ha-1). The reaction of the soil was slightly alkaline. The twelve treatments comprised of *viz*; Butachlor @1.5 kg a.i. ha^{-1} (PE), Pretilachlor @750 g a.i. ha^{-1} (PE), Bispyribac-Na @25 g a.i. ha^{-1} (POE), Almix @4 g a.i. ha^{-1} (POE), Butachlor @1.5 kg a.i. ha^{-1} (PE) *fb* Bispyribac-Na @25 g a.i. ha^{-1} (POE), Butachlor @1.5 kg a.i. ha^{-1} (PE) *fb* Almix @4 g a.i. ha^{-1} (POE), Pretilachlor @750 g a.i. ha^{-1} (PE) *fb* Bispyribac-Na @25 g a.i. ha^{-1} (POE), Pretilachlor @750 g a.i. ha^{-1} (PE) *fb* Almix @4 g a.i. ha^{-1} (POE), Bispyribac-Na @25 g a.i. ha^{-1} (POE) *fb* Almix @4 g a.i. ha^{-1} (POE), Two Mechanical weeding (Cono-weeder) (20/40 DAT), Weed free (20/40/60 DAT), and Weedy check. Were laid out in Randomized Block Design with three replications. The twenty one days old seedling of rice variety SARJU-52 was transplanted in experimental field on July 26th, 2017, using 2-3 per hills seedling 20 x 10 cm. Recommended doses of fertilizer of 120:60:40 kg N, P_2O_5, K_2O ha^{-1} and Zinc sulphate @ 25 kg ha^{-1} was adopted. The herbicides were applied as pre-emergence (2 DAT) and post emergence (25 DAT) at 3-4 leaf stage of weeds with the help of manually operated Knapsack sprayer fitted with flat fan nozzle using 250 litres of water per hectare. The unweeded control plots were kept undisturbed for the entire cropping period. The data on weed density and its dry weight of different weed flora m^{-2} were recorded at different growth stages of rice crop. Grain yield of rice along with yield components like effective panicles m^{-2} were recorded at harvest and statistically analyzed as per procedure (Gomez and Gomez, 1984). Weed species were recorded from a Quadrate placed at three places randomly at 30th, 60th, 90th day stages and at harvest. Weed dry matter at 30th, 60th, 90th day and at harvest stages were recorded from the sample taken for weed density. The samples were sun drying first and thereafter kept in electric oven at 70 ^{0}C ±1 ^{0}C for 48 hrs. to obtain a constant weight. Weed control efficiency of different weeds management practices was calculated on the basis of weed dry weight by the following formula:

$$W.C.E.(\%) = \frac{W_0 - W_1}{W_0} \times 100$$

Where

W_0 - Weed dry weight of weedy check

W_1 - Weed dry weight of treated plot

Weed index of different weed management practices was calculated by following formula:

$$W.I. = \frac{Y_{wf} - Y_1}{Y_{wf}} \times 100$$

Where

Y_{wf} - Grain yield of weed free plot or best treatment

Y_1 - Grain yield of treated plot

Results and Discussion

Weed flora

The major weed flora noted in the experimental field in the weedy check plot was recorded as Echinochloa colona and Echinochloa crusgalli among grasses, and Eclipta alba and Causillia auxillaris among the broad leaved and Cyperus rotundus and Cyperus iria in sedges were the dominant weed species. Among non-grassy weeds, Caesulia axillaris was the pre-dominant weed species and its density was found highest followed by Eclipta alba throughout the growing period of crop. Among the grasses, Echinochloa crusgalli was the pre-dominant weed species followed by Echinochloa colona at all the growth stages of rice. Similar weed flora in rice crop under normal condition has also been reported by number of scientists working in different agro-climatic zones of the country (Kalyan Sundaram *et al*., 2002) and Singh *et al*., 2005) [6, 8].

Effect on weed

The data pertaining to weed species wise recorded at 90th days and presented in table-1. Reveled that all weed control treatments affected significantly the weed density species-wise. All weed control methods reduced significantly the weed population species-wise in weedy check plot.

Among the single herbicide application, Post-emergence spray Bispyribac-Na @25 g a.i. ha-1 recorded the lowest population of weed species recorded followed by Almix @4 g a.i. ha-1 (POE) and Pretilachlor @750 g a.i. ha-1 (PE), however being highest with Butachlor @1500 g a.i. ha-1 (PE).

Sequential spray of Pretilachlor @750 g a.i. ha-1 (PE) fb Bispyribac-Na @25 g a.i. ha-1 (POE) recorded significantly the lowest weed population of different weed species over rest of the weed control treatment, however being at par with Pretilachlor @750 g a.i. ha-1 (PE) fb Almix @4 g a.i. ha-1 (POE) for Caesulia axillaris, Cyprus spp. and other weed spp. as well as total weed population. Similar results were found by Suganthi *et al*. (2005) [9]; Walia *et al*. (2008) [11] and Yadav *et al*. (2009) [12].

Effect on weed dry weight, weed control efficiency and weed index

It is evident from the data presented in (table 2) indicates that different weed control methods affected significantly the dry weight of weed at 90 days stage.

All weed control treatment reduced the dry weight of weeds significantly over weedy check. Herbicide applied alone either pre or post emergence, Pretilachlor @ 750 g a.i. ha-1 (PE) or Bispyribac-Na @ 25 g a.i. ha-1 (POE) recorded the lowest weed dry weight (4.98 g m-2) followed by almix @ 4 g a.i. ha-1 (POE) (5.08 g m-2) and Butachlor @1.5 kg a.i. ha-1 (PE) (5.25 g m-2). Weedy check recorded the highest weed dry weight (8.91 g m-2).

Among the sequential use of herbicides, application of Pretilachlor @ 750 g a.i. ha-1 (PE) fb Bispyribac-Na @ 25 g a.i. ha-1 (POE) recorded significantly the lowest weed dry weight over (3.38 g m-2) over rest of the sequential herbicide treatment.

Application of Bispyribac-Na @ 25 g a.i. ha-1 as (POE) recorded the highest weed control efficiency (68.90%) followed by Almix @ 4 g a.i. ha-1 as (POE), Pretilachlor @ 750 g a.i. ha-1 (PE) and lowest with Butachlor @1.5 kg a.i. ha-1 (PE). Sequential spray of Pretilachlor @ 750 g a.i. ha-1 (PE) fb Bispyribac-Na @ 25 g a.i. ha-1 as (POE) recorded the highest weel control efficiency (80.14%) followed by Butachlor @ 1.5 kg a.i. ha-1 (PE) fb Bispyribac-Na @ 25 g a.i.

ha-1 (POE) and being lowest with Butachlor @ 1.5 kg a.i. ha-1 (PE) fb Bispyribac-Na @ 25 g a.i. ha-1 (POE). Weedy check treatment reduced the grain yield of rice to the tune of 32.28%. Among the herbicides applied as alone, Bispyribac-Na @ 25 g a.i. ha-1 (POE) reduce the grain yield of rice (13.65%) followed by Almix @ 4 g a.i. ha-1(POE) (14.57%). However the lowest reduction in grain yield of rice (1.29%) was recorded with Pretilachlor @ 750 g a.i. ha-1 (PE) fb Bispyribac-Na @ 25 g a.i. ha-1 (POE) which was followed by Bispyribac-Na @ 25 g a.i. ha-1(POE) fb Almix @ 4 g a.i. ha-1(POE) (2.50%), Pretilachlor @ 750 g a.i. ha-1 fb Almix @ 4 g a.i. ha-1 (6.27%) and Butachlor @ 1.5 kg a.i. ha-1 (PE) fb Bispyribac-Na @ 25 g a.i. ha-1 (POE) These results were also in conformity with the work of Halder *et al*. (2007) [4] and Gopinath *et al*. (2008) [3].

Effect on crop

Growth attributes

All Sequential spray of herbicide treatments (T5 to T9) recorded significantly highest values of all growth parameter over herbicide applied alone either pre or post emergence. Application of Pretilachlor @ 750 g a.i. ha-1 (Pre) fb Bispyribac-Na @ 25 g a.i. ha-1 (POE) recorded significantly highest values of all growth parameter over rest of the treatments except T5, T6, T7, T8, T9 T10 in case of plant height and no. of shoots m-2, T9 incase of leaf area index, T3 to T10 in case of dry matter accumulation by crop where non-significant difference was observed. Weedy check reduced significantly the all growth parameter like plant height, shoot m-2, leaf area index and dry matter accumulation as compare to rest of the treatment. This was because of higher weed population and its dry matter accumulation which compete for space, light, moisture and nutrient with crop caused heavy reduction in growth of the rice plant. Similar result was reported by Uma *et al*. (2014) [10] and Duary B. (2015) [2].

Weed free up to 60 Days (T11) reduce significantly highest values of plant height, no. of shoot m-2, leaf area index and dry matter accumulation over rest of the weed control treatments except T5, T6, T7, T8, T9 and T10 in case of plant height and no. of shoot m-2 and T9 in case of leaf area index, and T3, T4, T5, T6, T7, T8, T9 and T10 in case of dry matter accumulation (table-3).

Effect on yield

It is obvious from the data presented in table-4 that grain and straw yield was affected statistically due to different weed control treatment.

Weed free up to 60 days produced higher grain yield of 54.50 q ha-1 which was significantly superior over rest of the treatment, however being at par with T7, T8, T9 and T10 treatments. Among the herbicide treatments, application of Pretilachlor @ 750 g a.i. ha-1 (Pre) fb Bispyribac-Na @ 25 g a.i. ha-1 (POE) produce significantly highest grain yield over rest of the treatments except treatment T8, T9 and T10 where non-significantly different was observed with regards to grain yield. Similar trends of results was observed in case straw yield, where Weed free up to 60 days produced significantly higher straw yield over rest of the treatments except T5, T6, T7, T8, T9 and T10. Weed check produced the lowest grain yield (36.70 q ha-1) and straw yield (49.05 q ha-1).

The higher grain and straw yield with Weed free was mainly attributed to better growth and yield attributes due to lower population and dry weight of weeds resulted in higher nutrients availability. However, better Weed control with Pretilachlor @ 750 g a.i. ha-1 (Pre) fb Bispyribac-Na @ 25 g a.i. ha-1 (POE) resulted in higher nutrient availability to crop favoured the higher growth and yield attributes and higher grain and straw yield. Similar higher grain yield of rice was recorded by Pretilachlor @ 750 g a.i. ha-1 (Pre) fb Bispyribac-Na @ 25 g a.i. ha-1 (POE).

Similar result was reported by scientist like Jayadeva *et al*. (2010) [5] and Bhat *et al*. (2011) [1].

The values of harvest index was highest (45.03%) followed by application of Pretilachlor @ 750 g a.i. ha-1 (Pre) fb Bispyribac-Na @ 25 g a.i. ha-1 (POE) i.e. 44.73. and lowest values of harvest index was registered with Weedy check (42.80%).

The percent increase in yield with Pretilachlor @ 750 g a.i. ha-1 (Pre) fb Bispyribac-Na @ 25 g a.i. ha-1 (POE) was recorded to the tune of 20.26, 18.68, 15.38, 16.03, 13.34, 14.40, 6.29 and 4.44 per cent over Butachlor @ 1.5 kg a.i. ha-1, Pretilachlor @ 750 g a.i. ha-1, Bispyribac-Na @ 25 g a.i. ha-1, Almix @ 4 g a.i. ha-1, Butachlor @ 1.5 kg a.i. ha-1 fb Bispyribac-Na @ 25 g a.i. ha-1, Butachlor @ 1.5 kg a.i. ha-1 fb Almix @ 4 g a.i. ha-1, Pretilachlor @ 750 g a.i. ha-1 fb Almix @ 4 g a.i. ha-1, Bispyribac-Na @ 25 g a.i. ha-1,fb Almix @ 4 g a.i. ha-1 treatments, respectively.

Table 1: Effect of weed control treatments on density (no. m^{-2}) of different weed species At 90 DAT of rice

Treatments	Grassy		BLWs		Sedges	Other Weeds	Total Weeds
	E. Crusgali	E. Colonm	C. Auxillaris	Eclipta Alba	Cyperus Spp.		
	90 DAT	90 DAT	90 DAT	90 DAT	90 DAT	90 DAT	90 DAT
Butachlor @ 1.5 kg a.i. ha^{-1} (PE)	2.81 (7.40)	2.75 (7.10)	2.53 (5.90)	2.86 (7.70)	2.62 (6.40)	2.70 (6.80)	6.46 (41.30)
Pretilachlor @750 g a.i. ha^{-1} (PE)	2.76 (7.10)	2.70 (6.80)	2.57 (6.10)	2.83 (7.50)	2.53 (5.90)	2.62 (6.40)	6.34 (39.80)
Bispyribac-Na @ 25 g a.i. ha^{-1} (POE)	2.66 (6.60)	2.62 (6.40)	2.43 (5.40)	2.70 (6.80)	2.53 (5.90)	2.55 (6.00)	6.12 (37.10)
Almix @ 4 g a.i. ha^{-1} (POE)	2.70 (6.80)	2.66 (6.60)	2.49 (5.70)	2.79 (7.30)	2.60 (6.30)	2.51 (5.80)	6.24 (38.50)
Butachlor @ 1.5 kg a.i. ha^{-1} (PE) *fb* Bispyribac-Na @ 25 g a.i. ha^{-1} (POE)	2.53 (5.90)	2.47 (5.60)	2.41 (5.30)	2.49 (5.70)	2.36 (5.10)	2.47 (5.60)	5.80 (33.20)
Butachlor @ 1.5 kg a.i. ha^{-1} (PE) *fb* Almix @ 4 g a.i. ha^{-1} (POE)	2.62 (6.40)	2.55 (6.00)	2.38 (5.20)	2.57 (6.10)	2.49 (5.70)	2.51 (5.80)	5.97 (35.20)
Pretilachlor @750 g a.i. ha^{-1} (PE) *fb* Bispyribac-Na @ 25 g a.i. ha^{-1} (POE)	1.90 (3.10)	2.02 (3.60)	1.73 (2.50)	1.70 (2.40)	1.64 (2.20)	1.81 (2.80)	4.13 (16.60)
Pretilachlor @750 g a.i. ha^{-1} (PE) *fb* Almix @ 4 g a.i. ha^{-1} (POE)	2.26 (4.60)	2.30 (4.80)	2.05 (3.70)	2.17 (4.20)	2.10 (3.90)	2.21 (4.40)	5.10 (25.60)

Bispyribac-Na @ 25 g a.i. ha^{-1} (POE) *fb* Almix @ 4 g a.i. ha^{-1} (POE)	2.12 (4.00)	2.32 (4.90)	1.87 (3.00)	2.02 (3.60)	1.90 (3.10)	2.02 (3.60)	4.76 (22.20)
Mechanical weeding (Conoweeder) Two (20/40 DAT)	2.47 (5.60)	2.41 (5.30)	2.19 (4.30)	2.34 (5.00)	2.26 (4.60)	2.32 (4.90)	5.49 (29.70)
Weed free (three hand weeding at 20/40/60 DAT)	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)
Weedy check	4.96 (24.20)	4.28 (17.90)	5.31 (27.70)	3.60 (12.50)	4.98 (24.40)	3.70 (13.20)	10.96 (119.90)
S.Em+-	0.09	0.08	0.09	0.08	0.09	0.08	0.22
C.D. at 5%	0.26	0.25	0.23	0.24	0.26	0.24	0.64

Table 2: Effect of weed control treatments on dry matter of weeds (g m^{-2}) at 90 DAT, WCE and WI of rice

Treatment	Dry Weight of Weeds (g m^{-2}) 90 DAT	Weed Control Efficiency (%)	Weed Index (%)
Butachlor @ 1.5 kg a.i. ha^{-1} (PE)	5.26 (27.25)	65.44	17.15
Pretilachlor @750 g a.i. ha^{-1} (PE)	4.99 (24.50)	66.75	16.05
Bispyribac-Na @ 25 g a.i. ha^{-1} (POE)	4.99 (24.50)	68.90	13.65
Almix @ 4 g a.i. ha^{-1} (POE)	5.08 (25.40)	67.79	14.57
Butachlor @ 1.5 kg a.i. ha^{-1} (PE) *fb* Bispyribac-Na @ 25 g a.i. ha^{-1} (POE)	4.73 (21.90)	72.22	10.51
Butachlor @ 1.5 kg a.i. ha^{-1} (PE) *fb* Almix @ 4 g a.i. ha^{-1} (POE)	4.86 (23.20)	70.56	12.91
Pretilachlor @750 g a.i. ha^{-1} (PE) *fb* Bispyribac-Na @ 25 g a.i. ha^{-1} (POE)	3.38 (10.95)	86.14	1.29
Pretilachlor @750 g a.i. ha^{-1} (PE) *fb* Almix @ 4 g a.i. ha^{-1} (POE)	4.17 (16.88)	78.53	6.27
Bispyribac-Na @ 25 g a.i. ha^{-1} (POE) *fb* Almix @ 4 g a.i. ha^{-1} (POE)	3.89 (14.65)	81.44	2.50
Mechanical weeding (Conoweeder) Two (20/40 DAT)	4.48 (19.60)	75.06	7.93
Weed free (three hand weeding at 20/40/60 DAT)	0.71 (0.0)	100	00
Weedy check	8.91 (79.10)	00	32.28
S.Em±	0.17		
C.D.at 5%	0.50		

Table 3: Effect of weed management treatments on plant height (cm), shoot (m^2), leaf area index and dry matter accumulation (gm^{-2}) of rice

Treatments	Plant Height (cm)	Shoot (m^2)	Leaf Area Index	Dry Matter Accumulation (g m^{-2})
	90DAT	90 DAT	90 DAT	90 DAT
Butachlor @ 1.5 kg a.i. ha^{-1} (PE)	103.50	362.50	4.40	879.38
Pretilachlor @750 g a.i. ha^{-1} (PE)	105.00	375.00	4.46	890.12
Bispyribac-Na @ 25 g a.i. ha^{-1} (POE)	108.50	390.00	4.58	913.45
Almix @ 4 g a.i. ha^{-1} (POE)	107.00	385.00	4.52	904.71
Butachlor @ 1.5 kg a.i. ha^{-1} (PE) *fb* Bispyribac-Na @ 25 g a.i. ha^{-1} (POE)	111.90	425.00	5.05	943.37
Butachlor @ 1.5 kg a.i. ha^{-1} (PE) *fb* Almix @ 4 g a.i. ha^{-1} (POE)	110.00	407.50	4.98	920.18
Pretilachlor @750 g a.i. ha^{-1} (PE) *fb* Bispyribac-Na @ 25 g a.i. ha^{-1} (POE)	119.50	450.00	5.98	1021.90
Pretilachlor @750 g a.i. ha^{-1} (PE) *fb* Almix @ 4 g a.i. ha^{-1} (POE)	115.80	435.00	5.30	979.15
Bispyribac-Na @ 25 g a.i. ha^{-1} (POE) *fb* Almix @ 4 g a.i. ha^{-1} (POE)	117.20	442.50	5.66	994.25
Mechanical weeding (Conoweeder) Two (20/40 DAT)	114.30	426.00	5.20	965.05
Weed free (three hand weeding at 20/40/60 DAT)	123.80	462.50	5.86	1026.06
Weedy check	98.40	325.00	3.28	728.85
S.Em±	4.27	16.10	0.13	41.83
C.D.at 5%	12.53	47.22	0.39	122.69

Table 4: Effect of weed management treatments on grain yield, straw yield and harvest index of rice

Treatment	Grain Yield q ha^{-1}	Straw Yield q ha^{-1}	Harvest Index (%)
Butachlor @ 1.5 kg a.i. ha^{-1} (PE)	44.90	58.56	43.40
Pretilachlor @750 g a.i. ha^{-1} (PE)	45.50	59.22	43.45
Bispyribac-Na @ 25 g a.i. ha^{-1} (POE)	46.80	60.66	43.55
Almix @ 4 g a.i. ha^{-1} (POE)	46.30	60.14	43.50
Butachlor @ 1.5 kg a.i. ha^{-1} (PE) *fb* Bispyribac-Na @ 25 g a.i. ha^{-1} (POE)	48.50	62.48	43.70

Butachlor @ 1.5 kg a.i. ha^{-1} (PE) *fb* Almix @ 4 g a.i. ha^{-1} (POE)	47.20	61.06	43.60
Pretilachlor @750 g a.i. ha^{-1} (PE) *fb* Bispyribac-Na @ 25 g a.i. ha^{-1} (POE)	54.00	66.72	44.73
Pretilachlor @750 g a.i. ha^{-1} (PE) *fb* Almix @ 4 g a.i. ha^{-1} (POE)	50.80	64.39	44.10
Bispyribac-Na @ 25 g a.i. ha^{-1} (POE) *fb* Almix @ 4 g a.i. ha^{-1} (POE)	51.70	65.27	44.20
Mechanical weeding (Conoweeder) Two (20/40 DAT)	49.90	63.64	43.95
Weed free (three hand weeding at 20/40/60 DAT)	54.50	66.81	45.03
Weedy check	36.70	49.05	42.80
S.Em±	1.77	2.03	-
C.D.at 5%	5.15	5.95	-

Conclusion

It is concluded from the results that weed free up to 60th days recorded the highest grain yield, however application of Pretilachlor @ 750 g a.i. ha-1 (Pre) fb Bispyribac-Na @ 25 g a.i. ha-1 (POE) recorded significantly higher grain yield over rest of the herbicides treatments.

References

1. Bhat MA, Hussain A, Ganai MA, Mushki GM. Effect of herbicide use alone and a combination on weeds and transplanted rice under temperate conditions of Kashmir. Applied Biological Research 2011;13(2):75-78.
2. Duary B, Mishra MM, Dash R, Teja KC. Weed management in lowland rice. Indian J Weed Sci 2015;47(3):224-232.
3. Gopinath KA, Kundu S. Evaluation of metsulfuron methyl and chlorimuron ethyl for weed control in direct seed rice (*Oryza sativa* L.). Indian J Agril. Sci 2008;78(5):466-469.
4. Halder J, Patra AK. Effect of chemical weed control methods on productivity of transplanted rice (*Oryza sativa* L.). Indian J Agron 2007;52(3):111-113.
5. Jayadeva HM. Bioefficacy of post emergence herbicides in weed management of transplanted rice (*Oryza sativa* L.). J Crop and Weed 2010;6(2):63-66.
6. Manhas SS, Singh G, Singh D, Khajuriya V. Effect of tank mixed herbicides on weeds and transplanted rice (*Oryza sativa* L.). Ann. Agric. Res.New series 2012;33(1-3): 25-31.
7. Das R, Bera 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 Blackgram. International Journal of Current Microbiology and Applied Science 2015;4(6):681-688.
8. Singh UP, Singh Y, Vinod Kumar. Effect of weed management and cultivars on boro rice (*Oryza sativa* L.) and weeds. Indian J Weed Sci 2016;36:57-59.
9. Suganthi M, Kandasamy OS, Subbian P, Jayakumar R. Relative efficacy of pretilachlor 50 EC for weed control in lowland transplanted rice-rice cropping system. Indian J Weed Sci 2005;37(1/2):105-106.
10. Uma G, Venkata Ramana M, Pratap Kumar Reddy A, Ram Prakash T. Evaluation of low dose herbicides in transplanted rice (*Oryza sativa* L.). International J Appl. Biol. and Pharmaceutical Tech 2014;5(4):96-101.
11. Walia US, Bhullar MS, Nayyar S, Walia SS. Control of complex weed flora of dry-seeded rice (*Oryza sativa* L.) with pre and post emergence herbicides. Indian J Weed Sci 2008;40(3&4):161-164.
12. Yadav DB, Yadav A, Punia SS. Evaluation of bispyribac-Na for weed control in transplanted rice. Indian J Weed Sci 2009;41:23-27.