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Effect of weed management on growth yield and economics in transplanted scented rice under tribal villages of M.P.

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Abstract
Rice (*Oryza sativa* L.) is staple food crop for millions of people in the world. It is extensively cultivated in India in diversified ecologies. The on farm trials were conducted in the area of 100m^2 for all the treatment at farmer's field. The experiment comprised 4 treatments viz. post emergence application of *bispyribac sodium* @ 25g a.i./ha, post emergence application of *azimsulfuron* @ 35g a,i, /ha, pre emergence application of *butachlor* @ 1 kg a.i./ha (farmer's practice-1), and weedy check (farmer's practice-2), were conducted at each farmer's field. According to results of present experiment bispyriback sodium @25g a.i./ha was proves significantly superior over all other herbicides and farmers practices. The application of azimsulfuron @ 35 g a.i./ha was also found second best treatment for weed control in transplanted scented rice in sheopur district of Madhya Pradesh.

Keywords: Rice, chemical weed management, bispyribac sodium and azimsulfuron

Introduction
Rice (*Oryza sativa* L.) is staple food crop for millions of people in the world. It is extensively cultivated in India in diversified ecologies. Globally rice is covering about 160 million ha with 751.9 million tons of production annually (FAO, 2017 [7]. Out of this, Asia accounts for 90% of the production and consumption.

It is common to find different reports in the literature on yield losses for rice crops due to the effects of competition from weed communities. Out of many factors, Weeds are the major yield limiting factor in rice production (Bastiaans *et al*., 1997) [4]. Authors such as Chauhan & Johnson (2011) [6, 11] reported 94% and 96% losses when weeds were not controlled. Globally, actual rice yield losses due to pests have been estimated at 40% out of which weeds account for 32%. In India, unchecked weed competition causes yield losses to the tune of 50-65% in rice (Subbaiah and Sreedevi, 2000) [21]. Barua *et al*. (2008) [3] reported 30 to 60 days after transplanting as critical period of crop weed competition. The prominent weed flora in transplanted rice consists of grasses (Echinochloa colonum, Echinochloa crus-galli, Cynodon dactylon), sedges (Cyperus rotundus, Cyperus difformis and Fimbristylis miliacea) and broad leaved weeds (*Eclipta alba*, Ammannia baccifera, Phyllanthus niruri, Alternanthera paronchioides, Ipomea aquatic, Commelina benghalensis (Venkata Lakshmi, 2005) [23].

Weed control in transplanted rice by mechanical and cultural is an expensive method. Especially at the time of peak period of labour crisis, sometimes weeding becomes delayed causing drastic reduction in grain yield. Normally two manual weeding's done in lowland rice crop. For the two weeding's 50 woman labours are engaged per ha. The amount incurred for manual weeding in low land rice works out around Rs. 1200 million for single crop per year in Tamil Nadu alone (Tajuddin and Fellow, 2009) [22]. Application of effective new herbicides that provide wide-spectrum of weed control would be desirable for effective weed control. Hence, the present investigation was taken up to study the effect of early post emergence herbicide on growth and yield of transplanted scented rice. Initially Participatory Rural Appraisal (PRA) was done to identify causes of low yield of rice. It was found that heavy infestation by weeds particularly *Echinocloa crus-galli, E. colona, Cyperus rotundus, Commelina benghalensis* and *Digitaria sanguinalis,* which pose a serious constraint in the district. Therefore, based on PRA five villages, namely Panwada, Bamhori, Dalarna, Raipura and Bardha of Sheopur district of Madhya Pradesh were selected for on farm trials at farmer's fields during the rainy (*Kharif*) season of 2014-15 and 2015-16.

Materials and Methods

The study on evaluating the different weed management practices was undertaken purposively in five tribal villages namely- Panwada, Bamhori, Dalarna, Raipura and Bardha of Sheopur district of Madhya Pradesh. The on farm trials were conducted in the area of $100m^2$ for all the treatment at farmer's field. The RBD design was followed for statistical analysis and each village (location) were treated as replication.

The average rainfall of district is 822mm most of which occurs during June-September. The soil of the area under study was medium black with medium fertility status. The experiment comprised 4 treatments viz. post emergence application of *bispyribac sodium* @ 25g a.i./ha, post emergence application of *azimsulfuron* @ 35g a,i, /ha, pre emergence application of *butachlor* @ 1 kg a.i./ha (farmer's practice-1), and weedy check (farmer's practice-2), were conducted at each farmer's field. Rice was transplanted during the second fortnight of July. The crop was fertilized with recommended doses of fertilizers vis. 100, 60, 40 kg N, P_2O_5 and K_2O/ha. Whole quantity of P and K and one third of N were applied as basal and remaining N was applied in 2 equal splits. Herbicides were applied manually operated knapsack sprayer delivering a spray volume of 500 l/ha through flat-fan nozzle (*butachlor* at transplanting and *bispyribac* sodium and *azimsulfuron* at 25 days after transplanting). Crop was manually harvested in the first week of November. The yield data were recorded and adjusted to 14% of the moisture content. Economics were computed using the prevailing market price of inputs.

Results and Discussion

Effect on weed flora

The major weed flora observed in the experiment sites included *Echinocloa crus-gelli, E.colena, Cyperus rotundus, Commelina benghalensis and Digitaria sanguinalis.* Post emergence application of both herbicides *bispyribac sodium and azimsulfuron* reduced population of weeds compared to both farmers' practices pre emergence application of *butachlor* and weedy check. It was mainly because of effective weed control. The lowest weed density was observed with post emergence application of *bispyribac sodium* followed by post emergence application of *azimsulfuron* and pre emergence application of *butachlor* respectively. The results are similar to findings of Singh *et al*. (2016) [19].

Number of weed

The weed species were classified as per narrow leaved weed and broad leaved weed the data were presented in table-1. The minimum or significantly lower number of weed of narrow leaf was recorded with the application of Bispyriback sodium 25g a.i./ha (10.72), Broad leaf (4.50) and 6.22 total number of weed population was recorded at 60 DAT crop satge. It was followed by azimsulfuron @35g a.i./ha, butachlor @ 1kg a.i./ha and weedy check. The maximum number of weed was recorded in weedy check and that was significantly superior over all other treatment.

Weed infestation (%)

The weed infestation percent was also calculate to establish the percent proportion of narrow weed and broad leaved weeds in experimental region. The data revealed that the population of narrow leaved weed were ranged in 41 to 42 percent at the 60 DAT crop stage while, the broad leaved population were ranged between 58-59 percent at same growth stage.

Weed index

Weed index was also calculated for the observing the effect of weed on yield of crop under different treatments. The results revealed that the maximum weed index was recorded in weedy check (farmer practice -2) 36.60 while, the minimum were recorded with application of azimsulfuran @35g/ha in comparison to bispyriback sodium @ 25g/ha PoE.

Weed intensity (%)

Weed intensity percent was calculated on the basis of number of weed recorded during the experiment. The minimum weed intensity was recorded under the application bispyriback sodium @ 25g/ha PoE (2.99%) which was followed by azimsulfuron @ 35g/ha PoE (3.43%), Farmers practice-1 (Butachlor @1kg a.i/ha) 4.61% and maximum was recorded in weedy check (farmers practice-2) 15.51%.

Effect of different weed management practices on crop parameter

Growth character

Plant height (cm)

Plant height of rice plant was significantly affected through different weed control treatment. The maximum plant height was recorded in bispyriback sodium @25g a.i./ha at all the growth stages it was significantly superior over all other treatments. It was followed by azimsulfuron@35 g a.i./ha and butachlor@1kg a.i./ha. Significantly inferior plant height (cm) over all other treatments was recorded in weedy check (farmer's practice-2) at all the growth stages.

Number of tillers per meter row length

Number of tillers per meter row length was recorded at 30 and 60 DAT. The data were presented in Table-4. The data revealed that significantly maximum number of tillers were recorded under the application of bispyriback sodium @25g a.i./ha at both the growth stages (55.49 and 78.54). It was followed by azimsulfuron@35 g a.i./ha (46.43 and 75.27) and butachlor@1kg a.i./ha (43.60 and 68.25). Significantly inferior number of tillers over all other treatments was recorded in weedy check (farmer's practice-2) at all the growth stages (38.78 and 59.94).

Number of effective tillers at 90 DAT

Number of effective tillers at 90 DAT were recorded and presented in table-4. The data revealed that significantly maximum number of effective tillers were recorded under the application of bispyriback sodium @25g a.i./ha at both the growth stages (67.44). It was followed by azimsulfuron@35 g a.i./ha (62.03) and butachlor @ 1kg a.i./ha (54.10). Significantly inferior number of tillers over all other treatments was recorded in weedy check (farmer's practice-2) at all the growth stages (49.56).

Yield and yield attributes

Panicle length (cm)

Panicle length (cm) was recorded at harvest and analysed statistically. The mean data were presented in Table-5. The perusal of data pertaining that the maximum panicle length was recorded where the minimum crop weed competition was occurs. Maximum (25.91cm) value of panicle length was recorded in the application of bispyriback sodium @25g a.i./ha however, the minimum was recorded in weedy check (farmers practice-2) 20.26cm.

Panicle weight (g)
Panicle weight is also very promising yield attributing character to perform yield under rice crop. The panicle weight was recorded from 1.78-2.89g/panicle (table-5). However, statistically significant panicle weight was recorded in the application of bispyriback sodium@25g a.i./ha (2.76, 2.89 and 2.82 g) during 2014-15, 2015-16 and pooled analysis. The minimum was recorded in weedy check (farmers practice) where not any weed management was performed. However, all four treatments were differing significantly to each other.

Test weight (g)
Test weight of grains was also affected significantly under farmers field due to different weed management practices (Table-5). Test weight was recorded maximum under bispyribac sodium @25g/ha however it is minimum in weedy check (20.26, 20.87 and 20.57g) during 2014-15, 2015-16 and pooled data.

Grains/panicle
Total number of grains per panicle was recorded manually from selected five panicles in every treatment plot (table-6). The maximum number of grains per panicle was recorded under bispyriback sodium @ 25g a.i./ha (150.34, 152.59 and 151.46 g) during 2014-15, 2015-16 and pooled data respectively. However, the minimum was recorded in weedy check. It is also a matter of fact that all the treatments were found statistically difference to each other. Total number of filled grain per panicle and number of unfilled panicle were also followed the same pattern in both the years of experimentation.

Yield (kg/ha)
Yield of any crop was dependent on the growth and yield attributes of the crop. Yield of rice crop was also recorded and presented in table -7. The maximum and significantly superior grain, straw and biological yield (5447, 9805 and 15055 kg/ha) was recorded under the application of bispyriback sodium @25g a.i./ha, which was followed by azimsulfuron @ 35g a.i./ha and butachlor@1kg a.i./ha. However, significantly inferior and minimum pooled grain, straw and biological yield (3454, 7391 and 10773 kg/ha).

Economics
The economics of the different treatments were calculating on prevailing market price to establish the economic feasibility of the technology (Table-8). The maximum profitable treatment was found bispyriback sodium @25ga.i./ha witch fetches maximum gross (Rs.147630/ha), Net (Rs. 96224/ha) monetary returns with B: C ratio (2.87), however it includes the premium cost of approximate Rs. 500/ha in pooled data of both the year of experiment.

Weeds are the integral part of rice field ecosystem and normally coevolved with rice plant species, and causes severe yield damage. Prolific seed producer, long-term seed dormancy, rapid growth behavior, short seed to seed life duration and ability to grow in disturbed lands are the well-known attributes of weeds, which help them to suppress crop growth. On the other hand, the cultivars that acquire higher initial growth and develop faster canopy, establish themselves rapidly in the composite culture of a crop weed ecosystem and will be less affected by weed competition. In this experiment, inbred rice cultivars allowed highest number of weeds and higher weed dry weight per unit area at any growth stages compare to hybrids. This could be due to higher competitiveness of hybrids against weeds, development of fast and early canopy coverage with higher leaf area index values; higher root growth and crop dry weight (data not shown here). The competitive ability of crops against weeds mainly determine by higher plant height and dry matter accumulation, early canopy closure, enhanced leaf area leading to more light interception and shading over understory plant species, increased nutrient uptake, proliferate root growth, and allelopathic effects (Pavlychenko and Harrington, 1934; Balyan *et al*., 1991; Cousens *et al*., 1991; Cudney *et al*., 1991; Anwar *et al*., 2010; Bajwa *et al*., 2017) [11, 15, 16]. Early-ripening of improved rice cultivars and hybrids have the ability to acquire larger canopy coverage within a short period of time and can suppress the weed growth to a greater magnitude over traditional, open-pollinated, long-duration cultivars (ICAR, 2007; Sardana *et al*., 2017; Mahajan and Chauhan, 2013) [6, 2, 5, 7]. The significant genotypic differences for weed-competitive abilities of rice, cultivated under moderately weedy and completely weed-free environments have also been documented (Mahajan *et al*., 2014) [13, 14]. Due the higher weed suppressive ability, hybrid rice yielded 15–25% more over inbred cultivars. Therefore, through selection of weed competitive cultivars, the weed emergence and its subsequent growth can be suppressed and at the same time reduce the cost of weed management Weeds are the integral part of rice field ecosystem and normally coevolved with rice plant species, and causes severe yield damage. Prolific seed producer, long-term seed dormancy, rapid growth behavior, short seed to seed life duration and ability to grow in disturbed lands are the well-known attributes of weeds, which help them to suppress crop growth. On the other hand, the cultivars that acquire higher initial growth and develop faster canopy, establish themselves rapidly in the composite culture of a crop weed ecosystem and will be less affected by weed competition. In this experiment, inbred rice cultivars allowed highest number of weeds and higher weed dry weight per unit area at any growth stages compare to hybrids. This could be due to higher competitiveness of hybrids against weeds, development of fast and early canopy coverage with higher leaf area index values; higher root growth and crop dry weight (data not shown here). The competitive ability of crops against weeds mainly determine by higher plant height and dry matter accumulation, early canopy closure, enhanced leaf area leading to more light interception and shading over understory plant species, increased nutrient uptake, proliferate root growth, and allelopathic effects (Pavlychenko and Harrington, 1934; Balyan *et al*., 1991; Cousens *et al*., 1991; Cudney *et al*., 1991; Anwar *et al*., 2010; Bajwa *et al*., 2017) [14, 17, 16, 14, 11]. Early-ripening of improved rice cultivars and hybrids have the ability to acquire larger canopy coverage within a short period of time and can suppress the weed growth to a greater magnitude over traditional, open-pollinated, long-duration cultivars (Zhao, 2006; ICAR, 2007; Sardana *et al*., 2017; Mahajan and Chauhan, 2013) [11, 14, 12, 7]. The significant genotypic differences for weed- competitive abilities of rice, cultivated under moderately weedy and completely weed-free environments have also been documented (Anwar *et al*., 2010; Mahajan *et al*., 2014) [14]. Due the higher weed suppressive ability, hybrid rice yielded 15–25% more over inbred cultivars (Walker *et al*., 2008; Dass *et al*., 2017). Therefore, through selection of weed competitive cultivars, the weed emergence and its subsequent growth can be suppressed and at the same time reduce the cost of weed management Weeds are the integral part of rice field ecosystem and normally coevolved with rice plant species, and causes severe yield damage.

Prolific seed producer, long-term seed dormancy, rapid growth behavior, short seed to seed life duration and ability to grow in disturbed lands are the well-known attributes of weeds, which help them to suppress crop growth. On the other hand, the cultivars that acquire higher initial growth and develop faster canopy, establish themselves rapidly in the composite culture of a crop weed ecosystem and will be less affected by weed competition. In this experiment, inbred rice cultivars allowed highest number of weeds and higher weed dry weight per unit area at any growth stages compare to hybrids. This could be due to higher competitiveness of hybrids against weeds, development of fast and early canopy coverage with higher leaf area index values; higher root growth and crop dry weight (data not shown here). The competitive ability of crops against weeds mainly determine by higher plant height and dry matter accumulation, early canopy closure, enhanced leaf area leading to more light interception and shading over understory plant species, increased nutrient uptake, proliferate root growth, and allelopathic effects (Cudney *et al*., 1991; Bajwa *et al*., 2017). Early-ripening of improved rice cultivars and hybrids have the ability to acquire larger canopy coverage within a short period of time and can suppress the weed growth to a greater magnitude over traditional, open-pollinated, long-duration cultivars. The significant genotypic differences for weed-competitive abilities of rice, cultivated under moderately weedy and completely weed-free environments have also been documented. Due the higher weed suppressive ability, hybrid rice yielded 15–25% more over inbred cultivars. Therefore, through selection of weed competitive cultivars, the weed emergence and its subsequent growth can be suppressed and at the same time reduce the cost of weed management.

Discussion

Weeds are the integral part of rice field ecosystem and normally coevolved with rice plant species, and causes severe yield damage. Prolific seed producer, long-term seed dormancy, rapid growth behavior, short seed to seed life duration and ability to grow in disturbed lands are the well-known attributes of weeds, which help them to suppress crop growth.

In this experiment season long weed free condition resulted the highest total crop highest yield increase over control (213.8), weed control efficiency (100%), gross return loss (0.0%). Similar types of findings were also reported by many other researchers around the world (Anwar *et al*., 2012; Jaya Suria *et al*., 2013) [2, 11]. But in the farmers' fields, it is quite impossible to practice season long weed free condition, as it is most laborious and costly method. On the other hand, traditional method of weed control (2-3 weedings) also become difficult now a days because of labor crisis at the peak period, which results in drastic yield loss due to Mahajan and Chauhan, 2011; Anwar *et al*., 2013; 2014 [11]; Mahajan and Chauhan, 2013; Dass *et al*., 2017). Whereas, Lemerle *et al*. (1996) and Mahajan and Chauhan (2013) reported a higher weed control in combination system of herbicides with crop species or genotypes of superior competitiveness. Zhao *et al*., 2006; Rao *et al*., 2007; Mahajan and Chauhan, 2011; Anwar *et al*., 2013; 2014; Mahajan and Chauhan, 2013; Dass *et al*., 2017) [11]. Whereas, Lemerle *et al*. (1996) and Mahajan and Chauhan (2013) reported a higher weed control in combination system of herbicides with crop species or genotypes of superior competitiveness.

The efficacy of the post emergence application of bispyribac-sodium against diverse weed flora, including sedges and narrow-leaved and broad-leaved weeds, and the subsequent improvement in the yield, economic returns and water productivity of transplanted rice imply that this herbicide can be effectively sprayed for the successful control of weeds. The maximum productivity of rice, as observed in the application of bispyribac-sodium, was attributed to a sizeable improvement in all of the yield related traits, like the number of productive tillers and grains per panicle and the filled grain per panicle. The improvement in the yield-related traits was positively associated with reduced weed density and biomass because of efficient weed control. As a result of the weed-free environment, the rice plants enjoyed a competition-free environment, with a larger availability of water, essential nutrients, solar radiation and shade, while a high level of weed infestation caused an ~57% yield reduction as a consequence of the reduction in the number of productive tillers, grains per panicle, 1000-grain weight and the increase in the number of unproductive tillers, related to severe competition with the weeds (Johnson *et al*. 2004; Razzaq *et al*. 2012) [12, 17]. There are many reports that are available that highlight the role of herbicide application in improving the yield and yield-related traits of several crops, like rice, wheat, mung bean, canola and maize, because of efficient weed control and a shift in competition in favor of the crops (Jabran *et al*. 2008; Razzaq *et al*. 2010; Farooq *et al*. 2011) [16, 9]. In this experiment Bispyriback sodium @25g a.i./ha, resulted the highest total crop biomass and highest yield increase over weedy check, weed parameters, gross return and lowest relative yield loss. Similar types of findings were also reported by many other researchers around the world (Anwar *et al*., 2012; Jaya Suria *et al*., 2013) [2, 11]. But in the farmers' fields, it is quite impossible to practice season long weed free condition, as it is most laborious and costly method. It has been widely accepted by researchers that herbicides have the potential to reduce labour inputs (Ahmed *et al*., 2001) [1].

According to the obtained results, the application of bispyribac-sodium notably enhanced the net income and CBR over the control (weedy check) and the post-emergence application of bispyribac sodium seemed to be the most valuable. Similar results were also recorded by Jabran *et al*. (2012) [10].

However, in general, all the plots where herbicides, cultural and mechanical (Alone or with herbicide) method applied to control weeds accumulated the higher dry matter of rice than un-weeded control. The possible reason of higher accumulation of dry matter of rice was the effect of herbicides on weeds so rice plant received more space, moisture, light and nutrient for their proper growth and this favoured the higher dry matter accumulation of rice per unit area. The higher dry matter accumulation also associated with the higher height and number of tillers. The increasing foliage might have enhanced the photosynthesis due to which plant dry matter accumulation was higher under these treatments. This is in accordance with the findings of Khaliq (2013) [13].

Table 1: Effect of chemical weed management practices on weed dynamics under transplanted scented rice Var. Pusa-1121

Treatment	Number of weed /m2			Number of Broad Leaved weed/m^2			Number of Broad Leaved weed/m^2		
	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled
Bispyribac sodium @ 25g/ha (POE)	10.8	10.64	10.72	4.54	4.47	4.50	6.26	6.17	6.22
Azimsulfuron @ 35 g/ha (POE)	12.2	11.53	11.86	5.12	4.84	4.98	7.08	6.68	6.88
Farmer Practics-1 (Butachlor @ 2 kg/ha (PE))	14.6	14.67	14.63	6.13	6.16	6.15	8.47	8.51	8.49
Farmers Practice-2 (No Weed Management)	48.8	48.94	48.87	20.49	20.55	20.52	28.30	28.38	28.34
SEm+_	0.301	0.581	0.463	0.126	0.244	0.065	0.174	0.337	0.089
CD@5%	0.865	1.672	1.331	0.363	0.702	0.186	0.502	0.970	0.257

Table 2: Effect of chemical weed management practices on plant Height (cm) under transplanted scented rice Var. Pusa-1121

Treatment	Plant Height (cm) at 30 DAT			Plant Height (cm) at 60 DAT			Plant Height (cm) at Harvest		
	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled
Bispyribac sodium @ 25g/ha (POE)	26.48	26.87	26.67	59.79	62.78	61.28	110.72	108.50	109.61
Azimsulfuron @ 35 g/ha (POE)	25.78	25.91	25.84	53.03	56.21	54.62	102.78	103.29	103.03
Farmer Practics-1 (Butachlor @ 2 kg/ha (PE))	26.19	26.06	26.12	50.44	52.46	51.45	98.57	102.01	100.29
Farmers Practice-2 (No Weed Management)	23.30	23.23	23.26	49.94	51.44	50.69	91.62	92.36	91.99
SEm+_	0.348	0.348	0.348	0.997	1.034	0.339	1.449	1.463	0.485
CD@5%	1.003	1.002	1.003	2.870	2.976	0.975	4.170	4.211	1.397

Table 3: Effect of chemical weed management practices on number of tillers per meter row length at 30 and 60 DAT and Number of effective tillers per meter row length at harvest in transplanted scented rice Var. Pusa-1121\

Treatment	Number of tiller per m row length at 30 DAT			Number of tiller per m row length at 60 DAT			Number of Effective tiller per m row length at harvest		
	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled
Bispyribac sodium @ 25g/ha (POE)	55.08	55.90	55.49	76.51	80.33	78.42	66.94	67.94	67.44
Azimsulfuron @ 35 g/ha (POE)	46.32	46.55	46.43	73.08	77.46	75.27	61.88	62.19	62.03
Farmer Practics-1 (Butachlor @ 2 kg/ha (PE))	43.71	43.49	43.60	66.91	69.58	68.25	54.24	53.97	54.10
Farmers Practice-2 (No Weed Management)	38.84	38.72	38.78	59.05	60.82	59.94	49.63	49.48	49.56
SEm+_	1.213	1.225	1.219	1.291	1.345	0.440	1.306	1.317	1.311
CD@5%	3.490	3.525	3.507	3.716	3.872	1.265	3.758	3.791	3.774

Table 4: Effect of chemical weed management practices on grain yield (kg/ha) and yield attributes of transplanted scented rice Var. Pusa-1121

Treatment	Panicle Length (cm)			Test Weight (g)			Panicle Weight (g)		
	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled
Bispyribac sodium @ 25g/ha (POE)	22.15	23.25	22.70	25.91	27.21	26.56	2.76	2.89	2.82
Azimsulfuron @ 35 g/ha (POE)	20.65	21.89	21.27	24.35	25.81	25.08	2.10	2.22	2.16
Farmer Practics-1 (Butachlor @ 2 kg/ha (PE))	19.06	19.82	19.44	22.48	23.38	22.93	2.07	2.16	2.11
Farmers Practice-2 (No Weed Management)	16.97	17.48	17.23	20.26	20.87	20.57	1.78	1.83	1.80
SEm+_	0.219	0.229	0.075	0.514	0.542	0.176	0.044	0.046	0.045
CD@5%	0.629	0.659	0.215	1.480	1.560	0.507	0.125	0.131	0.128

Table 5: Effect of chemical weed management practices on grain characters of transplanted scented rice Var. Pusa-1121

Treatment	Total Grains/panicle			Filled grains/panicle			Unfilled Grains/panicle		
	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled
Bispyribac sodium @ 25g/ha (POE)	150.34	152.59	151.46	128.32	134.74	131.53	14.72	14.42	14.57
Azimsulfuron @ 35 g/ha (POE)	124.77	125.40	125.08	99.17	105.11	102.14	26.81	26.94	26.87
Farmer Practics-1 (Butachlor @ 2 kg/ha (PE))	118.54	117.94	118.24	78.69	81.84	80.27	35.49	36.73	36.11
Farmers Practice-2 (No Weed Management)	103.84	103.53	103.69	62.03	63.89	62.96	46.00	46.37	46.19
SEm+_	0.687	0.689	0.688	1.248	1.303	0.425	0.434	0.439	0.146
CD@5%	1.976	1.982	1.979	3.591	3.751	1.224	1.250	1.262	0.419

Table 6: Effect of chemical weed management practices on grain yield (kg/ha), straw Yield (kg/ha) and Biological yield (kg/ha) of transplanted scented rice Var, Pusa – 1121

Treatment	Grain yield (Kg/ha)			Straw Yield (Kg/ha)			Biological Yield (kg/ha)		
	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled
Bispyribac sodium @ 25g/ha (POE)	5314.75	5580.49	5447.62	9566.55	10044.88	9805.71	14881.30	15228.84	15055.07
Azimsulfuron @ 35 g/ha (POE)	4531.00	4802.86	4666.93	8472.97	8981.35	8727.16	13003.97	13413.85	13208.91
Farmer Practics-1 (Butachlor @ 2 kg/ha (PE))	4311.75	4484.22	4397.99	8192.33	8520.02	8356.17	12504.08	12843.42	12673.75
Farmers Practice-2 (No Weed Management)	3403.00	3505.09	3454.05	7282.42	7500.89	7391.66	10685.42	10862.51	10773.97
SEm+_	55.591	58.875	57.256	103.282	109.361	35.455	158.848	177.595	56.161
CD@5%	159.986	169.438	164.780	297.237	314.734	102.037	457.153	511.104	161.627

Table 7: Effect of chemical weed management practices on cost of cultivation (Rs/ha), Gross return (rs/ha) and Net Return (rs/ha) and B:C ratio of transplanted scented rice Var, Pusa – 1121

Treatment	Cost of cultivation (rs/ha)			Gross return (Rs/ha)			Net Return (kg/ha)			B: C Ratio		
	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled
Bispyribac sodium @ 25g/ha (POE)	51253	51561	51407	141372	154022	147630	90119	102461	96224	2.76	2.99	2.87
Azimsulfuron @ 35 g/ha (POE)	50780	51085	50932	121159	133231	127127	70379	82147	76195	2.39	2.61	2.50
Farmer Practics-1 (Butachlor @ 2 kg/ha (PE))	49066	49360	49213	115555	124661	120065	66489	75301	70852	2.36	2.53	2.44
Farmers Practice-2 (No Weed Management)	47985	48273	48129	92834	99124	95953	44849	50851	47825	1.93	2.05	1.99
SEm+_	-	-	-	-	-	-	-	-	-	-	-	-
CD@5%	-	-	-	-	-	-	-	-	-	-	-	-

Table 8: Effect of chemical weed management practices on weed index, weed intensity and weed infestation per cent of narrow and broad leaved weed under transplanted scented rice var, Pusa – 1121

Treatment	Weed Index			Weed Intensity (%)			Weed infestation % of Narrow Leaved Weed			Weed infestation % of Broad Leaved Weed		
	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled	2014-15	2015-16	Pooled
Bispyribac sodium @ 25g/ha (POE)	-	-	-	3.08	2.90	2.99	42.037	42.011	41.978	57.963	57.989	58.022
Azimsulfuron @ 35 g/ha (POE)	14.75	13.93	14.33	3.62	3.24	3.43	41.967	41.977	41.990	58.033	57.936	58.010
Farmer Practics-1 (Butachlor @ 2 kg/ha (PE))	18.87	19.64	19.27	4.68	4.53	4.61	41.986	41.990	42.037	58.014	58.010	58.031
Farmers practice-2 (No weed management)	35.97	37.19	36.60	15.69	15.34	15.51	41.988	41.990	41.989	57.992	57.989	57.991
SEm+_	-	-	-	-	-	-	-	-	-	-	-	-
CD@5%	-	-	-	-	-	-	-	-	-	-	-	-

Conclusion

According to results of present experiment bispyriback sodium @25g a.i./ha was proves significantly superior over all other herbicides and farmers practices. The application of azimsulfuron @ 35 g a.i./ha was also found second best treatment for weed control in direct seeded rice in sheopur district of Madhya Pradesh.

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