Effect of pyrazosulfuron and azimsulfuron in combination with other herbicides on weeds species, growth and yield of transplanted rice in typic ustochrept Soil

Article · September 2017

CITATIONS
2

READS
250

9 authors, including:

Rk Naresh
Sardar Vallabhbhai Patel University of Agriculture and Technology
222 PUBLICATIONS **708** CITATIONS
SEE PROFILE

Dr Kautilya Chaudhary
CCS Haryana Agricultural University
7 PUBLICATIONS **2** CITATIONS
SEE PROFILE

Vineet Singh
Botanical Survey of India
96 PUBLICATIONS **125** CITATIONS
SEE PROFILE

Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2017; 6(4): 1550-1556
Received: 03-05-2017
Accepted: 05-06-2017

Arun Kumar
Department of Agronomy, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut-250110, U.P., India

Vivek
Department of Agronomy; Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, U.P., India

RK Naresh
Department of Agronomy; Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut-250110, U.P., India

Robin Kumar
ICAR-Indian Institute of Farming Systems Research, Modipuram-250110,Meerut, U.P., India

PC Ghasal
ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut, U.P., India

Kautilya Chaudhary
ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut, U.P., India

Vineet Singh
Department of Agronomy, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, U.P., India

Sunil Kumar
ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut, U.P., India

Correspondence
Arun Kumar
Department of Agronomy, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut-250110, U.P., India

Effect of pyrazosulfuron and azimsulfuron in combination with other herbicides on weeds species, growth and yield of transplanted rice in *typic ustochrept* Soil

Arun Kumar, Vivek, RK Naresh, Robin Kumar, PC Ghasal, Kautilya Chaudhary, Vineet Singh and Sunil Kumar

Abstract
A field experiment was conducted with the aim to know effects of different weed management on weed density, growth, yield and yield attributes of transplanted rice in *typic ustochrept* soil during *Kharif* 2016 at Crop Research Centre of Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, U. P. (India). The experimental site was sandy loam in texture, low in organic carbon and available N, medium in available P and K and slighty alkaline in reaction. The experiment was laid out in randomized complete block design with three replications comprising twelve weed management treatments. The results indicated that the highest plant height, number of tillers (m^{-2}), dry matter accumulation, leaf area index, protein content, 1000-grain weight, and grain yield (46.20 q ha^{-1}) were recorded with the application of Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) followed by Pyrazosulfuron fb Azimsulfuron (150 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE) treatments. Grain and biological yield of rice was registered 37.66 and 34.93 per cent higher under Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1}PE fb 25g a.i ha^{-1} POE) treatment in comparison to weedy check treatment, respectively. This shows that Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1}PE fb 25g a.i ha^{-1} POE) can be applied in transplanted rice for effective weed control, higher growth and productivity.

Keywords: Grain yield, herbicide, transplanted rice, and weed management.

Introduction
The 21stcentury world is facing many challenges, often in an agricultural context. It is still prominent concern for feeding an ever growing population with safe and healthy food from limited resources. This is urgently needed to management of natural resources such as land, water, nutrients and energy etc. in sustainable manner. This is posing a serious problem to even maintain the food grain production and leaving only the option of increasing the productivity of grain crops. Rice is second most important food crops of the world after wheat. Rice is major staple crop of the world to diet of 2.7 billion people and it contain 7-8% protein, 3% fat and 3% fiber. In India, rice occupies an area of 43.95 mha with production and productivity of 106.65 mt and 2.4 tonnes ha^{-1}, respectively **(**Anonymous, 2015-16). In India weeds were reported to contribute to highest crop yield losses as high as 37 % in *kharif* season. Monocotyledonous weed density is inversely correlated with crop yield, whereas the correlations between transplanted rice yield and dicotyledonous and sedge weed densities are not significant. Heavy weed infestation is one of the major constraints in transplanted rice causing severe yield losses (Kabdal, *et al.* 2014) [3]. Weeds emerge simultaneously with germination rice seedling resulting in severe competition for nutrient, light, and space. Weeds by virtue of their high adoptability and faster growth dominate the crop habitat reduce the yield potential (Hossain, *et al.* 2014) [2]. The degree of rice – weed competition depends on crop factor i.e. cultivar, crop density, crop age, plant spacing etc. Effective weed control in transplanted rice is one of the major limitations hindering its wide spread cultivation. Hand pulling or hand weeding is time consuming, cumbersome and costly alternative. Hence for transplanted rice, the chemical method of weed management is most suited as it takes care of weeds right from beginning of crop growth and is cost effective (Shivaji, *et al.* 2015) [9]. Most of the herbicide recommended for rice is generally applied as pre-emergence to take care of weed during initial period. However, to have minimum competition between weeds and rice the weeds need to be kept below threshold level especially during critical weed competition period.

Keeping all these point in mind a field experiment was conducted with different weed management treatments including application of pre-emergence and post-emergence herbicides as sole and in combination to find out its effect on growth and productivity of transplanted rice in Indo-Gangetic Plain Zones of Western Uttar Pradesh.

Materials and Methods

Experimental Site

The experimental site has a semi-arid and sub-tropical climate characterized by hot summers and severe cold winters. The mean maximum temperature was noticed in the month of June, which is the hottest month of the year, ranges from 40° to 45°C. The mean annual rainfall is about 850 mm, of which nearly 80 per cent is received in the monsoon period from July to September and the remaining in the period between Octobers to May. Mean relative humidity attains the maximum value (70 to 77% or even more) during the monsoon season and the minimum (30 to 45%) during the summer months.

Treatments detail

The study was undertaken at Crop Research Centre of Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut during *Kharif* season 2016. The experiment was conducted in randomized complete block design (RCBD) with three replications comprising twelve weed management treatments namely, T_1-Weedy check, T_2- two hand weeding,T_3- Butachlor (1.5 kg a.i ha^{-1}) fb One hand weeding, T_4-Pyrazosulfuron (150 g a.i ha^{-1}PE), T_5-Azimsulfuron (30 g a.i ha^{-1}POE), T_6-Oxidiargyl (100 g a.i ha^{-1}PE) fb one hand weeding, T_7-Anilophos fb Bispyribac Sodium (400 g a.i ha^{-1}PE fb 25g a.i ha^{-1}POE),T_8- Pyrazosulfuron (150 g a.i ha^{-1}) fb one hand weeding, T_9-Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1}PE fb 25g a.i ha^{-1}POE), T_{10}-Anilophos fbAzimsulfuron (400 g a.i ha^{-1}PE fb 30 g a.i ha^{-1}POE),T_{11}-Azimsulfuron (30 g a.i ha^{-1}) fb one hand weeding and T_{12}-Pyrazosulfuron fb Azimsulfuron (150 g a.i ha^{-1}PE fb 30 g a.i ha^{-1}POE). The soil of the experimental field was sandy loam in texture, low in organic carbon and available N, medium in available P and K and slightly alkaline in reaction. Rice cv. Pusa basmati 1 was transplanted during second fortnight of July, 2016 at 20 cm ×10 cm spacing and harvested in second fortnight of October, 2016. Recommended package and practices were followed for the cultivation of rice except weed management. The herbicides were applied as per treatment details. The required quantity of herbicide were applied with manually operated knapsack sprayer fitted with flat-fan nozzle using a spray volume of 500 litre water / ha.

Observations Recorded

The number of individual weed present in the field was recorded at 30, 60 and 90 DAT. Different weed species present within three randomly selected 0.5 m x 0.5 m quadrate in each net plot area were counted and converted to number of weeds m^{-2} before subjecting to statistical analysis. Data on weed density and biomass were subjected to square-root transformation. The five plants were tagged at random in each plot and height of the shoot was measured at harvest. The height of each plant was measured from the base of the plant to the tip of the highest fully developed leaf before heading and up to tip of the panicle after heading. Number of tillers was recorded by using a quadrate of one square meter from three places in each plot at harvest stage, average of three places was taken for analyses. Leaves are the primary photosynthetic organs of the plant. Leaf area index, area of leaf per unit area of soil surface was measured with the helf of PAR/LAI ceptometer (Accu PAR model LP-80). The leaf area index was calculated based on the above canopy measurement along with other variables. Dry matter accumulation was recorded by selecting five hills randomly from observation row of each plot. Selected hills were cut carefully closed to the ground surface at harvest stage. After sun drying these samples were collected in paper bags by cutting in small pieces and were put in an electric oven at 60 ± 1 ^{0}C till constant weight. After this the weight was recorded on electronic balance and expressed as dry matter accumulation in g m^{-2}.It was worked out through the standard procedures described by Hunt (1978) as under:

$$CGR = SA \times \frac{Wii - Wi}{Tii - Ti}$$

Where, Wi and Wii are dry weight (g $hill^{-1}$) at time Ti and Tii, respectively.

Results

Effect on weed parameters

Total weed density

Density of total weeds was affected significantly by various treatments involving weed management practices (Fig 1). Among weed control treatments significantly highest total weed density at 30, 60 and 90 DAT (16.63, 17.33 and 16.39 m^{-2}, respectively) was found under weedy check treatment. The lowest weed density (5.0 m^{-2}) was recorded in Pyrazosulfuron fb Bispyribac Sodium at 30 DAT. At 60 and 90 DAT significantly lower weed density (6.19 and 5.86 m^{-2}) observed with two hand weeding. Among the different herbicidal treatments lowest density of total weeds was found with the application of Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) and found at par with Pyrazosulfuron fb Azimsulfuron (150 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE) and Anilophos fb Bispyribac Sodium (400 g a.i ha^{-1} PE fb25g a.i ha^{-1} POE).

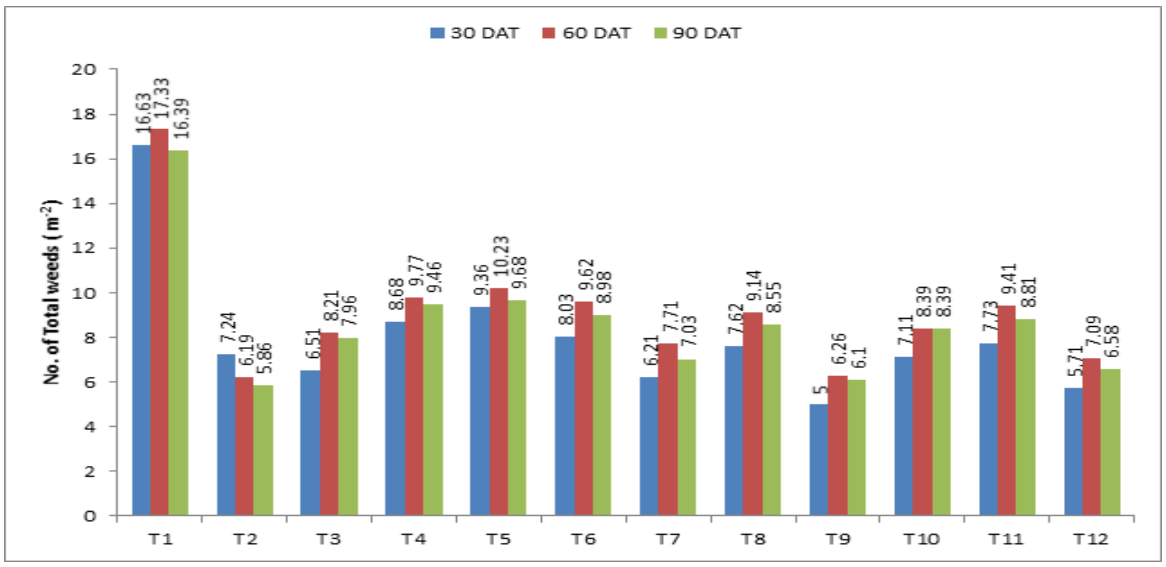

Fig 1: Effect of weed management treatment on total weeds (m^{-2}) in rice at different stages

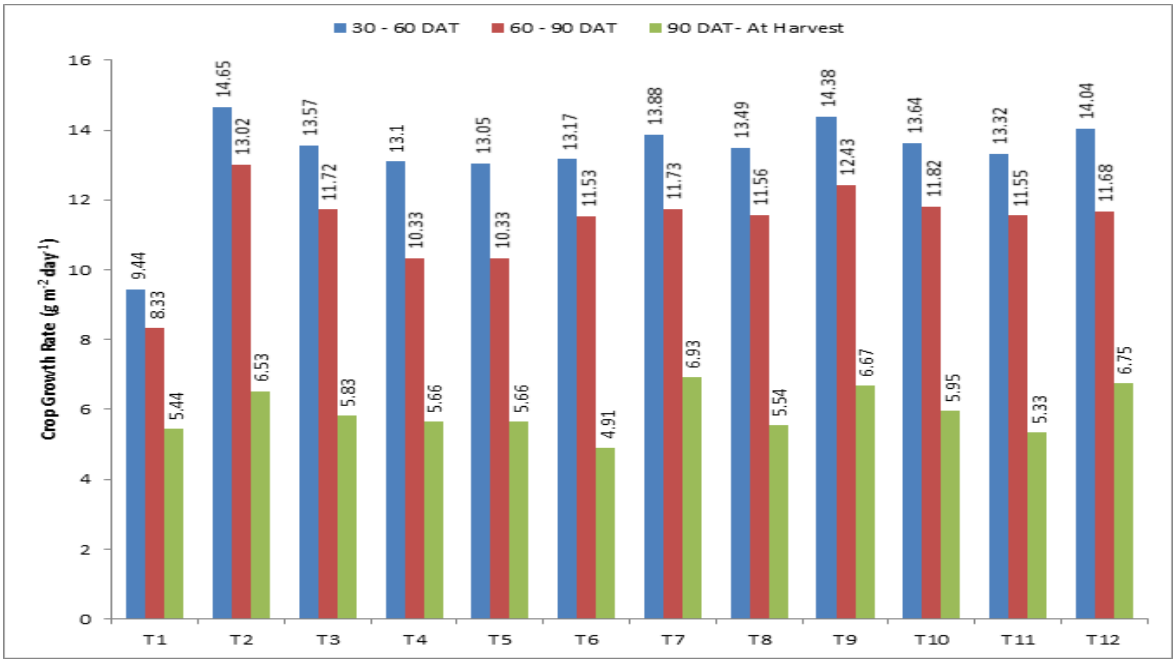

Fig 2: Effect of weed management treatment on crop growth rate at different intervals

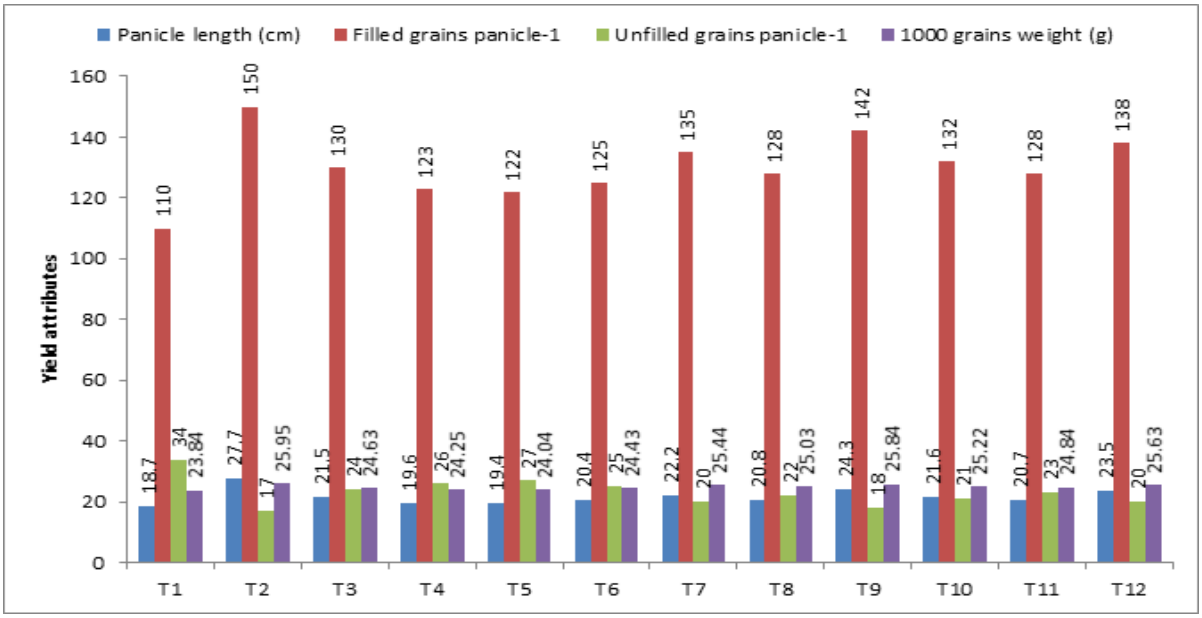

Fig 3: Effect of weed management treatment on yield attributes of rice

Density of *Echinocloacolona*

Density of *Echinochloa colona* was affected significantly by various treatments involving weed management practices. Among weed control treatments significantly highest density of *Echinochloa colona* 6.54, 6.32 & 5.76 m^{-2} at 30, 60, 90 DAT respectively was found in weedy check. However, the lowest weed density (2.00 m^{-2}) at 30 DAT found in Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) was at par with Pyrazosulfuron fb Azimsulfuron (150 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE) 2.09 m^{-2}. Among herbicide lowest weed density at 60 & 90 DAT 2.86 & 2.73 m^{-2} recorded in Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) was found at par with Pyrazosulfuron fb Azimsulfuron (150 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE) 3.08 & 2.79 m^{-2}.

Density of *Caesulia axillaris* (m^{-2})

Density of *Caesulia axillaris* was affected significantly by various treatments involving weed management practices. Among weed control treatments significantly highest density of *Caesulia axillaris*4.74, 5.24 & 4.48 m^{-2} at 30, 60 and 90 DAT, respectively was found in weedy check. Among the herbicide at 30 DAT, the significantly minimum density of *Caesulia axillaris* density 1.92 m^{-2} found in Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) was at par with Butachlor fb hand weeding 2.00 m^{-2}, Pyrazosulfuron fb Azimsulfuron (150 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE) 2.07 m^{-2} and Oxidiargyl (100 g a.i ha^{-1} PE) fb one hand weeding 2.09 m^{-2}. At 60 DAT *Caesulia axillaris* density 2.12 m^{-2} significantly lowest in Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) was at par to Anilophos fb Bispyribac Sodium (400 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) 2.21 m^{-2} while at 90 DAT, the significantly minimum density of caesulia axillaris 2.04 m^{-2} found under Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) was at parPyrazosulfuron fb Azimsulfuron (150 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE) 2.19 m^{-2}.

Density of *Cyprus iria* (m^{-2})

Among weed control treatments significantly highest density of *Cyprus iria*6.78, 6.80 & 7.02 m^{-2} at 30, 60 and 90 DAT respectively was found in weedy check. Among the herbicide at 30 DAT, lowest density of C*yprus iria* weeds 2.25 m^{-2} found under Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) was at par with Anilophos fb Bispyribac Sodium (400 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) 2.58 m^{-2}. At 60 DAT, the lowest density of C*yprus iria*2.23 m^{-2} found in Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) was at par with Pyrazosulfuron fb Azimsulfuron (150 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE). While at 90 DAT the lowest density of Cyprus iria 2.28 m^{-2} was found in Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE).

Effect on crop growth

Plant height, no of tillers and dry matter accumulation tended to increase with advancement in crop age, irrespective of the weed management practices. At harvest stage the significantly highest plant height, no of tillers and dry matter accumulation recorded in Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) was at par with Pyrazosulfuron fb Azimsulfuron (150 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE) and Anilophos fb Bispyribac Sodium (400 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) and significantly higher than the remaining treatments. Under weedy check plot lowest plant height, no of tillers and dry matter accumulation at 90 DAT and harvest stage recorded.

Effect on yield attributes and yield

The highest panicle length, filled grain, unfilled grain and test weight of grain was found in two hand weeding. Among the herbicides the highest panicle length, filled grain, unfilled grain and test weight of grain recorded with the Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) was at par with Pyrazosulfuron fb Azimsulfuron (150 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE) significantly higher than the rest of the treatments. The lowest panicle length, filled grain, unfilled grain and test weight of grain was found in weedy check.

Grain yield

The highest grain yield 47.88 q ha^{-1} was found in two hand weeding and significantly higher to other treatments (Table 5). Among the herbicides the highest grain yield 46.20 q ha^{-1} recorded with the application of Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) was at par with Pyrazosulfuron fb Azimsulfuron (150 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE). Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) recorded 37.66% higher grain yield over weedy check.

Table 5: Effect of weed management treatment on yield, protein content and harvest index

Treatments		Grain yield (q ha^{-1})	Biological yield (q ha^{-1})	Protein content in grain (%)	Harvest index (%)
T_1	Weedy check	28.80	75.8	6.65	37.99
T_2	Two hand weeding (20 & 40 DAT)	47.88	119.7	7.64	40.00
T_3	Butachlor (1.5 kg a.i ha^{-1}) fb One hand weeding	40.24	103.9	6.95	38.73
T_4	Pyrazosulfuron (150 g a.i ha^{-1} PE)	38.10	99.0	6.78	38.48
T_5	Azimsulfuron (30 g a.i ha^{-1} POE)	36.12	95.0	6.67	38.02
T_6	Oxidiargyl (100 g a.i ha^{-1} PE) fb one hand weeding	39.76	103.0	6.84	38.60
T_7	AnilophosfbBispyribac Sodium (400 g a.i ha^{-1} PE fb 25 g a.i ha^{-1} POE)	43.44	110.6	7.41	39.27
T_8	Pyrazosulfuron (150 g a.i ha^{-1}) fb one hand weeding	41.47	106.30	7.18	39.01
T_9	PyrazosulfuronfbBispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE)	46.20	116.50	7.59	39.65
T_{10}	AnilophosfbAzimsulfuron (400 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE)	42.10	107.85	7.30	39.03
T_{11}	Azimsulfuron (30 g a.i ha^{-1}) fb one hand weeding	40.53	104.00	7.07	38.97
T_{12}	PyrazosulfuronfbAzimsulfuron (150 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE)	45.77	116.00	7.53	39.45
	CD (P= 0.05)	1.13	4.02	0.12	1.03

Biological yield

The highest biological yield 119.70 q ha^{-1} found in two hand weeding was statistically at par with Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) and Pyrazosulfuron fb Azimsulfuron (150 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE). Among the herbicides the highest biological yield 116.50 q ha^{-1} recorded with the application of Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) was at par with Pyrazosulfuron fb Azimsulfuron (150 g a.i ha^{-1} PE fb 30g a.i ha^{-1} POE) 116.0 q ha^{-1} and significantly higher than the rest treatments. Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) recorded 34.93 % higher biological yield over weedy check.

Protein content in grain

The protein content in grains ranged from 6.65 to 7.64 % under various treatments. The highest protein content 7.64 % found in two hand weeding. Among the herbicides the highest protein content 7.59% recorded with the application of Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) was at par with Pyrazosulfuron fb Azimsulfuron(150 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE) and significantly higher than the rest of the treatments. Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) recorded 12.38 % protein content over weedy check.

Harvest index

Weed control treatments the lowest harvest index 37.99% was found in weedy check while the highest harvest index 40.0% in two hand weeding. Among the herbicides the highest harvest index 39.65% recorded with the application of Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) was statistically at par with Pyrazosulfuron fb Azimsulfuron (150 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE), Anilophos fb Bispyribac Sodium (400 g a.i ha^{-1} PE fb25g a.i ha^{-1} POE), Anilophos fb Azimsulfuron (400 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE), Pyrazosulfuron (150 g a.i ha^{-1}) fb one hand weeding, Azimsulfuron (30 g a.i ha^{-1}) fb one hand weeding and Butachlor (1.5 kg a.i ha^{-1}) fb One hand weeding. Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) recorded 4.18% higher harvest index over weedy check.

Table 1: Effect of weed management treatments on density of No. of *Echinochloacolona* (m^{-2}) at different stages

Treatments		No. of *Echinochloacolona* (m^{-2})		
		30 DAT	60 DAT	90 DAT
T_1	Weedy check	6.54 (42.0)	6.32 (39.1)	5.76 (32.2)
T_2	Two hand weeding (20 & 40 DAT)	2.86 (7.2)	2.84 (7.1)	2.54 (5.5)
T_3	Butachlor (1.5 kg a.i ha^{-1}) fb One hand weeding	2.62 (5.9)	3.74 (13.0)	3.46 (11.0)
T_4	Pyrazosulfuron (150 g a.i ha^{-1} PE)	3.43 (10.9)	4.12 (16.0)	3.87 (14.0)
T_5	Azimsulfuron (30 g a.i ha^{-1} POE)	3.55 (11.7)	4.35 (18.0)	4.12 (16.0)
T_6	Oxidiargyl (100 g a.i ha^{-1} PE) fb one hand weeding	3.28 (9.8)	4.06 (15.5)	3.83 (13.7)
T_7	AnilophosfbBispyribac Sodium (400 g a.i ha^{-1} PE fb 25 g a.i ha^{-1} POE)	2.64 (6.0)	3.46 (11.0)	2.86 (7.2)
T_8	Pyrazosulfuron (150 g a.i ha^{-1}) fb one hand weeding	2.99 (8.1)	3.97 (14.8)	3.56 (11.7)
T_9	PyrazosulfuronfbBispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE)	2.00 (3.0)	2.86 (7.2)	2.73 (6.5)
T_{10}	AnilophosfbAzimsulfuron (400 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE)	2.94 (7.7)	3.63 (12.2)	3.53 (11.5)
T_{11}	Azimsulfuron (30 g a.i ha^{-1}) fb one hand weeding	3.06 (8.5)	3.87 (14.0)	3.74 (13.0)
T_{12}	PyrazosulfuronfbAzimsulfuron (150 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE)	2.09 (3.4)	3.08 (8.5)	2.79 (6.8)
	SEm±	0.16	0.09	0.05
	CD (P= 0.05)	0.47	0.28	0.17

Original values in parenthesis. Values are square root $\sqrt{(X+1.0)}$

Table 2: Effect of weed management treatments on density of No. of *Caesuliaaxillaris*(m^{-2}) at different stages

Treatments		No. of *Caesuliaaxillaris*(m^{-2})		
		30 DAT	60 DAT	90 DAT
T_1	Weedy check	4.74 (21.6)	5.24 (26.6)	4.98 (24.0)
T_2	Two hand weeding (20 & 40 DAT)	2.34 (4.5)	2.00 (3.0)	1.92 (2.7)
T_3	Butachlor (1.5 kg a.i ha^{-1}) fb One hand weeding	2.00 (3.0)	2.23 (4.0)	2.34 (4.5)
T_4	Pyrazosulfuron (150 g a.i ha^{-1} PE)	2.34 (4.5)	2.82 (7.0)	2.64 (6.0)
T_5	Azimsulfuron (30 g a.i ha^{-1} POE)	2.94 (7.7)	2.94 (7.7)	2.73 (6.5)
T_6	Oxidiargyl (100 g a.i ha^{-1} PE) fb one hand weeding	2.09 (3.4)	2.64 (6.0)	2.54 (5.5)
T_7	AnilophosfbBispyribac Sodium (400 g a.i ha^{-1} PE fb 25 g a.i ha^{-1} POE)	2.28 (4.2)	2.21 (3.9)	2.30 (4.3)
T_8	Pyrazosulfuron (150 g a.i ha^{-1}) fb one hand weeding	2.32 (4.4)	2.62 (5.9)	2.44 (5.0)
T_9	PyrazosulfuronfbBispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE)	1.92 (2.7)	2.12 (3.5)	2.04 (3.2)
T_{10}	AnilophosfbAzimsulfuron (400 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE)	2.23 (4.0)	2.48 (5.2)	2.44 (5.1)
T_{11}	Azimsulfuron (30 g a.i ha^{-1}) fb one hand weeding	2.16 (3.7)	2.66 (6.1)	2.68 (6.2)
T_{12}	PyrazosulfuronfbAzimsulfuron (150 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE)	2.07 (3.3)	2.28 (4.2)	2.19 (3.8)
	SEm±	0.06	0.10	0.11
	CD (P= 0.05)	0.18	0.22	0.33

Original values in parenthesis. Values are square root $\sqrt{(X+1.0)}$

Table 3: Effect of weed management treatments on density of No. of *Cyprus iria* (m^{-2}) at different stages

Treatments		No. of *Cyprus iria* (m^{-2})		
		30 DAT	60 DAT	90 DAT
T_1	Weedy check	6.78 (45.1)	6.80 (45.5)	7.02 (44.7)
T_2	Two hand weeding (20 & 40 DAT)	3.14 (9.0)	2.47 (5.1)	2.54 (5.5)
T_3	Butachlor (1.5 kg a.i ha^{-1}) fb One hand weeding	3.08 (8.5)	2.96 (7.8)	3.08 (8.5)
T_4	Pyrazosulfuron (150 g a.i ha^{-1} PE)	3.59 (12.0)	3.78 (13.4)	3.75 (13.1)
T_5	Azimsulfuron (30 g a.i ha^{-1} POE)	3.63 (12.3)	3.96 (14.8)	3.70 (12.7)
T_6	Oxidiargyl (100 g a.i ha^{-1} PE) fb one hand weeding	3.36 (10.4)	3.66 (12.5)	3.37 (10.4)
T_7	AnilophosfbBispyribac Sodium (400 g a.i ha^{-1} PE fb 25 g a.i ha^{-1} POE)	2.58 (5.7)	2.96 (7.8)	2.88 (7.3)
T_8	Pyrazosulfuron (150 g a.i ha^{-1}) fb one hand weeding	3.19 (9.3)	3.47 (11.1)	3.37 (10.4)
T_9	PyrazosulfuronfbBispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE)	2.25 (4.1)	2.23 (4.0)	2.28 (4.2)
T_{10}	AnilophosfbAzimsulfuron (400 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE)	3.04 (8.3)	3.23 (9.5)	2.99 (8.0)
T_{11}	Azimsulfuron (30 g a.i ha^{-1}) fb one hand weeding	3.19 (9.3)	3.61 (12.1)	3.46 (11.0)
T_{12}	PyrazosulfuronfbAzimsulfuron (150 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE)	2.79 (6.8)	2.38 (4.7)	3.04 (8.3)
	SEm±	0.17	0.14	0.05
	CD (P= 0.05)	0.52	0.41	0.16

Original values in parenthesis. Values are square root $\sqrt{(X+1.0)}$

Table 4: Effect of weed management treatment on plant height, number of tillers (m^{-2}), Dry matter accumulation (DMA) at harvest stage.

Treatments		Plant height	Number of tillers	DMA
T_1	Weedy check	80.3	192	929.90
T_2	Two hand weeding (20 &40 DAT)	109.4	338	1326.53
T_3	Butachlor (1.5 kg a.iha^{-1}) fb One hand weeding	100.3	273	1223.21
T_4	Pyrazosulfuron (150 g a.i ha^{-1} PE)	98.6	250	1163.21
T_5	Azimsulfuron (30 g a.iha^{-1} POE)	96.5	247	1153.21
T_6	Oxidiargyl (100 g a.i ha^{-1} PE) fb one hand weeding	99.6	253	1173.21
T_7	AnilophosfbBispyribac Sodium (400 g a.i ha^{-1}PE fb25g a.i ha^{-1} POE)	105.0	280	1256.54
T_8	Pyrazosulfuron (150 g a.i ha^{-1}) fb one hand weeding	103.0	276	1206.54
T_9	PyrazosulfuronfbBispyribac Sodium (150 g a.i ha^{-1}PE fb 25g a.i ha^{-1} POE)	107.7	312	1303.20
T_{10}	AnilophosfbAzimsulfuron (400 g a.i ha^{-1}PE fb 30 g a.i ha^{-1}POE)	101.5	278	1233.21
T_{11}	Azimsulfuron (30 g a.i ha^{-1}) fb one hand weeding	102.4	270	1193.21
T_{12}	PyrazosulfuronfbAzimsulfuron (150 g a.i ha^{-1}PE fb 30 g a.i ha^{-1}POE)	106.0	310	1269.87
	CD (P= 0.05)	2.74	13.4	35.51

Discussion

The different chemical controls the weeds effectively as compared to weedy check. Significantly the lowest total weed population under two hand weeding treatment because two hand weeding treatment was kept of weeds free by hand weeding. Highest total weed density and number of different weeds species were recorded in weedy check plots due to un checked growth of weeds which compete for all the resources up to maturity with crop. Two hand weeding plot proved to be the best treatment. Among the herbicides Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) found the best was at par with Pyrazosulfuron fb Azimsulfuron (150 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE) to control weeds.

The maximum plant height, number of tillers m^{-2} and dry matter accumulation were recorded under two hand weeding treatment at different growth stage during experimentation. Among herbicides treatment Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) was recorded the maximum plant height. This may be due to lower dry weight of weed in Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) applied plots followed by Pyrazosulfuron fb Azimsulfuron (150 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE), which resulted in less crop-weed competition. Furthermore, increased infestation of weeds showed negative influence on the crop growth as reflected in terms of lower initial plant height and plant biomass due to poor resource utilization (like nutrients uptake) at the critical period of crop-weed competition period *i.e*. 15-60 DAT. The possible reason of the maximum plant height in these treatments might be due to congenial and longer weed free environment during crop growth period provided better opportunity for overall growth and development of rice plants lead to maximum plant height. Sharma *et al.* (2003) noted that application of ethoxysulfuron was as effective as weed free treatment, hand weeding to produce plant height. This is in accordance with finding of Narwal *et al.* (2002); Mukherjee *et al*. (2008). 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 favored 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).

Panicle length, filled grins panicle^{-1}and test weight, was significantly influenced due to various weed management practices. Treatment Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) was found superior as compared to all other weed management plots except Pyrazosulfuron fb Azimsulfuron (150 g a.i ha^{-1} PE fb 30 g a.i ha^{-1} POE). Due to reduced crop-weed competition and better sink capacity performed more number of panicle^{-1}, filled grains, panicle length and test weight. The yield attributes are decided by genetic makeup of the crop and variety, but the agronomic manipulation also affects them to a great extent. The reproductive growth depends on vegetative growth of plant. More vegetative growth increases the photosynthetic area and supply of photosynthetic toward sink which decided the yield attributes and ultimately the yield. The higher values of yield attributes were due to increased synthesis and translocation of metabolites for the panicle development and grain formation. Besides, thousand grain weights were also maintained because of high mobilization of photo-synthesis from source to sink. However, this is quite possible because these combinations of herbicides might have been very effective to reduce the mixed weeds density and their growth resulting better and congenial environment favored the rice plant to utilize nutrients, light, space luxuriantly and grew well to produce more number of fertile tillers. Rest of the treatments of weed management also proved to be significantly effective in producing higher number of effective tillers as compared to un-weeded control under which the minimum tiller m^{-2} was recorded. Similar results were noted by Bhowmick and Ghosh (2006) and Sharma *et al.* (2003) also confirmed the same.

Higher grain and biological yield was due to more accumulation of dry matter m^{-2} along with highest plant height, and number of tillers plant^{-1}.Treatment two hand weeding produced 2.11% higher biological over Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) due to better vegetative growth and more dry matter accumulation. The application of Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) was recorded.

Conclusion

Based on the results of experimentation, it seems that all weed control practices proved effective in controlling the weeds in transplanted rice and gave significantly higher grain yield over weedy. The application ofPyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE)most effective control different weeds species very effectively resulted into higher value of weed control efficiency. Highest growth parameters, yield attributes and yield of rice was noticed with the application of Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE). Among weed management treatments Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE)found excellent to control weed population and increase yield attributes, growth parameter and yield,. Thus the application of Pyrazosulfuron fb Bispyribac Sodium (150 g a.i ha^{-1} PE fb 25g a.i ha^{-1} POE) found better for higher productivity and profitability of rice crop**.**

Acknowledgement

This study has been executed at the Crop research centre of SardarVallabhbhai Patel University of Agriculture & Technology, Meerut, Uttar Pradesh, India under the Department of Agronomy during *kharif* 2016. I would like to thank the Department of Agronomy for offering me the necessary facilities during this period.

References

1. Ghosh P, Bhowmick RK. Bio-efficacy and phototoxicity of clomazone + 2, 4-DEE for weed control in transplanted rice. Indian J Weed Sci. 2005; 37(1-2):107-108.
2. Hossain A, Mondal DC. Weed management by herbicide combinations in transplanted rice. Indian Journal of Weed Science. 2014; 46(3):220-223.
3. Kabdal P, Pratap T, Singh VP, Singh R, Singh SP. Control of complex weed flora in transplanted rice with herbicide mixture. Indian Journal of Weed Science. 2014; 46(1):377-379.
4. Khaliq A, Matloob A, Ihsan MZ, Abbas RN, Aslam Z, Rasul F. Supplementing herbicides with manual weeding improves weed control efficiency, growth and yield of direct seeded rice, International Journal of Agriculture & Biology. 2013; 15(2):191-199.
5. Narwal S, Singh S, Malik RK, Panwar KS. Effect of Acetachlor and ready mix of anilofos + ethoxysulfuron on divergent weed flora in transplanted rice Indian Journal of Weed Science. 2002; 34(1-2):28-31.
6. Nayak SBN, Khan M, Md Mosha K, Rani PP. Effect of plant population and weed control treatments on weed population, NPK uptake in direct wet seeded rice *Oryza sativa* L. sown through drum seeder. International Journal of Scientific & Engineering Research. 2014, 5.
7. Rao AS. Effect of pre & post emergence herbicides on *Echinochloa* spp. Control on rice nursery, 2005.
8. Absts First International weed seminar, Organized by WBWSS & BCKV at Kolkata, India, 8.
9. Singh, Shivaji, Singh SP, Neupane MP, Meena RK. Effect of NPK levels, BGA and FYM on growth and yield of rice *Oryza sativa* L. Environment and Ecology. 2015; 32(1A):301-303.
10. Yadav DB, Yadav A, Punia SS, Balyan RS. Evaluation of azimsulfuron for the control of complex weed flora in transplanted rice. Indian Journal of Weed Science. 2009; 40(3-4):132-136.