Effect of Weed Management Practices on Weed Flora, Growth Attributes and Yield of Direct Seeded Rice (Oryza Sativa L.)

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Abstract

A Field Experiment entitled "Effect of Weed Management Practices on Growth and Yield of Direct Seeded Rice (Oryzasativa L.)" was conducted at Agronomy Research Farm of Narendra Deva University of Agriculture And Technology, Kumarganj, Faizabad (U.P.) During Kharif season of 2015-16 and 2016-17 with twelve treatments in three teplications. The Density of BLWs, narrow leaved weeds and sedges as well as the total weed density and dry weight were recorded significantly less With weedy check as compared to rest of the treatments. All the growth and yield attributes Viz. Plant height, dry matter, LAI, panicle length, test weight as well as grain and straw yield were significantly higher in Pendimethalinefbbispyribac-Na + HW 40 DAS. With respect to economics, maximum net return was recorded with Pendimethalinefbbispyribac-Na + HW 40 DAS and B:C ratio with Pendimethalinefbbispyribac-Na + HW 40 DAS. Significantly higher and lower values of yield attributes and yield, as well as lower and higher values of density and dry matter of weeds were recorded with weed free and weedy treatment, respectively. Pendimethalinefbbispyribac-Na + HW 40 DAS proved superior with respect to weed control efficiency and crop yield and economics followed by Pendimethalinefbbispyribac-Na 1000 Fb 25 G and Oxadiragylfbpretilachlor 100 Fb 1000g.

Keyword: direct seeded, BLWs, LAI, grain yield, density and weedy check

Introduction

Rice (Oryzasativa L.) is the staple food of more than 60% of world population. It is globally grown in 155.62 m ha area with the production of 432.41 m tones (Anonymous, 2015). India ranks first in acreage with 43.81 m ha, but second in production with 96.43 m t, after China.

Uttar Pradesh is the largest rice growing state after West Bengal but its productivity is very low. It might be due to late sowing & improper weed management factors. Most of the increase in rice production was due to higher yields, which increased at an annual average rate of 1.74%, compared with an annual average growth rate of 0.49% for area harvested. In absolute terms, paddy yields increased at an annual average rate of 51.1 kg/ha per year, although this rate of increase has declined in both percentage and absolute terms. In Uttar Pradesh rice is grown over an area of about 5.19 m ha with a production of 16.24 m tones and productivity of about 3.13 tones ha^{-1}(Anonymous, 2015).

Thus, relatively aerobic systems (unpuddled) are being tried over timely sowing and early maturity (7-10 days) of crop and reduced production cost, improves soil physical conditions for the succeeding crops with less methane emission (Mohantyet al.,2001). Therefore the direct seeded rice may solve the problems of existing practices. The condition for higher productivity is more

conducive in direct seeded and transplanting in puddled beds, but they are labour intensive, energy demanding and cumbersome.

Among the various factors for low productivity of paddy proper weed management particular in direct seeded rice is more important. Direct seeding is a good alternative of transplanting and yield potential of direct seeded rice is equivalent to transplanting rice under proper water management and weed control (Awanet al, 1989). Weeds pose a serious threat to the direct seeded rice crop by competing for nutrients, light, space and moisture throughout the growing season. Ramzan (2003), Reported that yield reduction up to 48%, 53% and 74% in transplanted, direct seeded in flooded conditions and direct seeded in dry soils, respectively. Therefore, an effective and economical weed control strategy is to be required to meet the demand of staple food for increasing population.

Heavy weed infestation is one of the major constraints in direct seeded rice causing severe yield losses. Weeds emerge simultaneously with germination rice seedling resulting in sever competition for nutrients, light, moisture and space. Research work done at few places including Kumarganj has shown that by direct seedling (unpuddled) same productivity of rice can be achieved as from transplanted crop. The key issue with the system is the management of the weeds was to the tune of 32.0% (Moorthy and Sahaet al., 2002) or it varied from 40-100% in direct seeded rice (Choubeyet al., 2001) only less than 5 percent (2 m/ha) of total rice cultivated area in India is treated with herbicides (Bhowmick, 1999).

The traditional methods of weed control in rice include hand-weeding by hoe or hand pulling, are effective but this is becoming less common because of labour scarcity at critical time of weeding and increasing labour costs (Chauhan, 2012 and Kumar and Ladha, 2011). Moreover, seedlings of some grassy weeds such as *Echinochloacrusgalli* (L.) look similar to rice seedlings, making hand weeding more tedious, difficult, and less effective. However, adoption of DSR technology usually leads to shift in weed flora composition towards difficult-to-control weeds (Singh et al., 2013). In this situation, use of herbicides is to control weeds in DSR will be more effective, easy to apply, provide selective control, saves on labour and cost effective.

Weed management in direct seeded rice can be accomplished by mechanical, cultural and chemical methods. The mechanical method of weed control consisted of repeated weeding and hoeing using "Khurpi" is though effective but labour intensive and reduce the benefit: cost ratio. Hence, for direct seeded rice, the chemical method of weed management is best suited as can take care of weeds right from beginning of crop growth and is cost effective.

Effective weed management in direct seeded rice is one of the major limitations hindering its wide spread cultivation. Most of the herbicides recommended for aerobic rice are generally applied as pre-emergence to take care of weeds during initial period. However, to have minimum competition between weeds and rice, the weeds need to be kept below threshold level, especially during sever weed competition period. Therefore, a combination of herbicide may be more effective for this purpose with the changing environment, varying dates of sowing may be effective in weed management practices.

Farmers generally apply herbicides by mixing them in sand for easy operation and prefer to use either single application of pre or post herbicides which fails to control diverse weed flora observed in DSR (Chauhan, 2012 and Chauhan and Opeña, 2012). However, it is important to use a broad-spectrum herbicide program including pre and post herbicides for season-long effective weed control and to avoid shifts toward problematic weed species and evolution of herbicide-resistant weed biotypes. Keeping above facts in view, the present investigation entitled **"Effect of weed management practices on growth and yield of direct seeded rice (Oryzasativa L.)"** proposed to conduct a field experiment at agronomy research farm, Narendra Deva University of Agriculture & technology, Kumarganj, Faizabad (U.P.) with the following objectives:

1. To find out the suitable weed management practices on growth yield and yield attribute of direct seeded rice,

2. to assess the losses in yield of rice caused due

to weeds,

Materials and Methods

The experiment was laid out during *kharif*, 2015-16 and 2016-17 at Agronomy Research Farm of Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad (Uttar Pradesh), India. The field was well levelled having good soil condition. Geographically, Faizabad (Kumarganj) falls in sub-tropical climate and it is situated at 26.47 ^{o}N latitude and 82.12 ^{o}E longitude with an altitude of 113 meters above mean sea level. The experiment site is situated in main campus of the university, about 42 km away from Faizabad district.Geographically, this region falls under sub-tropical zone of Gangatic alluvium of eastern Utter Pradesh (India). The annual rainfall of this region is about 1001 mm, of which normally 80-90 % occurs during June to September. The onset of monsoon is between 20th to 25th June in the region.

However, occasional showers are also not uncommon during winter. The winter months are cold, dry and quite often frost occurs during this period. The mean relative humidity remains almost 80-90 % from

mid-June to October end. The hot wind blows from south-west during summer. Weekly mean minimum and maximum temperatures during the crop period ranged from 11.1°C to 39°C and 11.1°C to 50.9°C, respectively. The maximum rainfall 280 mm was recorded in the third week of July during 22015-16 and 168.5 mm during 2016-17.The relative humidity was highest 74.7% in the second week of July and lowest 43.3% recorded of second week of November (2015-16). The sunshine hours were observed minimum (2.0 hrs.) in the last week of June and highest with (7.8 hrs) in the third week of June during 2015-16 and sunshine hours were observed minimum 0.0 hour in the third week of July and highest with 7.7 hr in September first week during 2016-17. The soil of the experimental field was silt loam, having pH 8.31 in 2015-16 & 8.62 in 2016-17, organic carbon (%) 0.382 in 2015-16 & 0.391 in 2016-17; available N, P and K values to the tune of 132.62, 14.25 and 240.37 kg ha^{-1} in 2015-16 and 137.5, 15.65 and 246.25 kg ha^{-1} in 2016-17 respectively. The soil of experimental field was low in available nitrogen and phosphorus, medium in potassium and slightly alkaline in reaction.

The field experiment was laid out in RBD with three replications, having 12 number of treatments *viz*. Bispyribac-Na 25 g, PendimethalinefbBispyribac-Na 1000 fb 25 g, PyrazosulfuronfbBispyribac-Na 20 fb 25 g, Bispyribac-Na + almix 25 g + 4 g, PendimethalinefbBispyribac-Na + HW 40 DAS, OxadiragylfbPretilachlor 100 fb 1000g, PendimethalinefbPretilachlor 100 fb 1000 g, Pendimethalinefb HW 20 DAS, along with Hand Weeding, Weed Free and Weedy Check. The herbicide treatments were applied at 1 DAS and 20 DAS as pre & Post emergence to weeds, respectively. The crop was direct seeded on 2 July, 2015-16 and 5 July, 2016-17 of rice variety NDR-97. A recommended dose of nutrients of N, P, K and Zn at 60:30:30:15 kg/ha, respectivelywere applied in the crop.

Results and discussion

Studies on weeds:

Weed flora of the experimental field:

The weed density in weedy check plot increased up to 75th day and decreased thereafter, while concerning the species wise weeds, all the weed species increased up to 75th day stage. Among narrow leaved, Echinochloacrusgalli was the most dominant weed in the weedy check while in broad leaved weeds; C. auxillaris was one of the most dominant weed species during crop growing period. However, some other BLWs e.g. Phylanthus niruri and Sedges like Cyperus rotundus and Cyprus iria were also present. By and large, dominancy of BLWs was more over narrow leaved weeds.

Weed density:

All The Weed Control Treatments Signifioantly Decreased The Weed Density Per Unit Area Over Weedy Check At Harvest Stage.The Application Of Pendimethalin (Pre) *Fb*bispyribac (1000 *Fb* 25g Ha^{-1}) (Poe) $T_2$was More Effective In Reducing The Density Of Weeds As Compared To Treatments. Reduction The Weed Density Maily Due To Bispyribac-Na Poe Controls The Grassy Weeds As Well As Pendimethalin Pre Which Is The Control The Grassy And Blws More Effectively On Weed Emergence. However, Sequential Application Of Herbicide Pre After Poe Was Effectively Also Control All The Weed Species To Fairly Compare Than Alone Application.Similar Result Were Found That By Madhavi *Et Al* 2016 And Yadav *Et Al.* (2009).

Weed dry matter accumulation:

The dry matter of total weed species increased with advancement of crop age and found maximum at 75th day stage, thereafter, decreased at harvest stage of the crop. The rate of increase in dry weight accumulation showed up and down trend. The up and down trend in the rate of dry matter production might be due to emergence of the new weed species and senescence of the Echinochloa crusgalli, Echinochloa colona, Phylanthus niruri C. auxillaris and Cyperus rotandus in different phases. At harvest stage, total dry weight of weeds was reduced in all the treatments due to more competition with the crop as well as the senescence of the different weed species. Weed dry matter accumulation reduced appreciably due to the different treatments as compared to weedy check at all the stages of crop growth; it was the fact of all the treatments executed in rice field controlled the weeds effectively and reduced the weed dry weight to a greater extent. Treatment effect varied depending on the time of application. Treatment Pendimethalin (Pre) fb Bispyribac (1000 fb 25g ha^{-1}) (PoE) T_2: was recorded lowest dry matter accumulation being at par with Pendimethalin (Pre) fb Bispyribac + HW (40 DAS) T_6: and Oxidiragyl (Pre) fbBispyribac (100 fb 25 g ha^{-1}) (PoE) T_3: treatments. These treatments were significantly superior in respect of reducing dry matter production of weeds during 2015-16 and 2016-17, respectively. However, other treatments Pendimethalin (Pre) fb HW (20 DAS) T_9: being at par with Hand Weeding (20, 40, DAS) T_{10}: also declined the weed dry weight fairly as compared to other treatment and Bispyribac + Almix T_5: was effectively control grassy and broad leaf weeds however, Bispyribac-Na 25 g ha^{-1} (PoE) applied as sole herbicide could not control the full spectrum of weeds up to the critical growth stages as well as grassy weeds e.g. Echinochloacolonaand Echinochloacrusgalli controlled as both of these have been reported to control the Echinochloacrusgalli controlled more effectively but BLWs and sedges did not applied to BLWs and Cyperusspecies. It required

some supplementary application of BLWs killer herbicide of superimposing manual weeding very effective and showed the superior results during experimental years 2015-16 and 2016-17, respectively. These results were also in conformity with the work of Singh et al., 2013.

This might be due to fact that Pendimethalin (Pre) fb Bispyribac + HW (40 DAS) T_6 control the sages and broad leaf weed only. The possible reason behind the effectively of these herbicides to reduce the dry matter accumulation has been described in detail in case of weed density as affected by herbicide.These results were also in conformity with the work of Madhaviet al. 2016, Pinjari et al. 2016, Kauret et al. 2014 and Yadavet al. 2014.

Weed control efficiency and weed index:

As far as the weed control efficiency (W.C.E. %) was concerned; it was also affected due to various weed control treatments. The maximum weed control efficiency was recorded in T_6: Pendimethalin (Pre) *fb* Bispyribac + HW (40 DAS) (81.92 and 84.50 %) followed by T_2: Pendimethalin (Pre) *fb*Bispyribac (1000 *fb* 25g ha^{-1}) (PoE) (77.99 and 80.49 %) and T_3: Oxidiragyl (Pre) *fb*Bispyribac (100 *fb* 25 g ha^{-1}) (PoE) (75.97 and 78.48 %) as compare to other herbicide treatment during first and second year study. While, highest weed control efficiency was weed free plot (100%) and lower in weedy check plot (00.00%). T_6: Pendimethalin (Pre) *fb* Bispyribac + HW (40 DAS) was found much effective to control the both type of weeds and resultant to this gave higher value of W.C.E. %. Alone herbicide was observed less effective to weeds due to minimum W.C.I. %. When T_6: Pendimethalin (Pre) *fb* Bispyribac + HW (40 DAS) enhanced its bio efficacy to control the grassy and BLWs also and recorded the lowest value of weed index (1.82 and 3.88 %) *fb*T_2: Pendimethalin (Pre) *fb*Bispyribac (1000 *fb* 25g ha^{-1}) (PoE) (6.36 and 8.33 %). It means minimum reduction in grain yield was recorded with T_6: Pendimethalin (Pre) *fb* Bispyribac + HW (40 DAS) *fb* T_2: Pendimethalin (Pre) *fb*Bispyribac (1000 *fb* 25g ha^{-1}).

However, highest grain yield was recorded with weed free and lowest with weedy check treatments as there was no competition and 100% competition between crop and weeds during first and second year, respectively.

Weed control efficiency		Weed index		Weed dry matter accumulation	
2015	2016	2017	2018	915.75	951.27
69.01	71.53	12.50	14.33	973.17	1010.92
77.99	80.49	6.36	8.33	943.51	980.12
75.97	78.48	9.09	11.00	927.86	963.85
71.95	74.49	11.14	13.00	900.92	935.86
70.00	72.53	14.32	16.11	1016.88	1056.33
81.97	84.50	1.82	3.88	941.92	978.45
74.01	76.61	10.00	11.89	760.06	789.63
65.99	68.52	19.32	21.01	864.06	897.58
61.95	64.47	17.73	19.45	870.21	903.96
59.96	62.49	17.05	18.78	1032.14	1072.19
100.00	100.00	0.00	0.00	746.52	775.46
0.00	2.50	30.00	31.47	35.00	38.90
				102.17	113.53

Growth attributes

4.4.1: Initial plant population

The data pertaining to initial plant population (m^{-2}) revealed that the initial plant population was recorded at 15 days stage of the crop growth did not affected significantly due to different weed management practices under weed management practices in direct seeded rice during both the year.

5.4.2: Plant height (cm)

At 25 DAS stage of the crop growth the plant height was did not influenced significantly affect due to under weed management practices in direct seeded rice during both the years, respectively,

At 25 DAS stage of the crop growth the plant height did not influenced of the significantly affected due to crop growth stages during both the years, respectively.

At 50 DAS stage, treatments Weedy free (T_{11}) highest number of shoot (m^{-2}) 408.00 and 420.32 recorded highest number of shoot (m^{-2}) excluding Weedy check (T_{12}). This treatment was significantly higher over rest of the treatments during both the years, respectively.

Same trend was also observed both at 50 DAS, 75 DAS and at harvest stage with respect of weed management practices excluding Weedy free (T_{12}) treatment. However, Weedy free (T_{11}) was recoded highest plant being at par with Pendimethalin (Pre) fbBispyribac + HW (40 DAS) (PoE) (T_6), Pendimethalin (Pre) fbBispyribac (1000 fb 25g ha^{-1}) (PoE) (T_2) and Oxadiragyl (Pre) fbPretilachlor (100 fb 1000g) (PoE) (T_7). However, the lowest plant population was observed under (T12) during both the years (2015-16 and 2016-17), respectively. This might be due to the fact that both type of weed that is broad leaf and narrow leaf weed controlled to a regnableabsent, resulting very less competition of various weed species with crop plants and ultimately found more plant height over weedy check.

5.4.3 Number of shoot (m^{-2})

Same trend was also observed both at 75 DAS and at harvest stage with respect of weed management practices excluding Weedy check (T_{12}) treatment. However, the highest number of shoot (m^{-2}) under treatment under Weedy check (T_{11}), which being was recoded at par with Pendimethalin (Pre) fbBispyribac + HW (40 DAS) (PoE) (T_6), Pendimethalin (Pre) fbBispyribac (1000 fb 25g ha^{-1}) (PoE) (T_2) and Oxadiragyl (Pre) fbPretilachlor (100 fb 1000g) (PoE) (T_7).

Plant height		Plant population		No. of shoot	
2015-16	2016-17	2015-16	2016-17	2015-16	2016-17
92.40	96.10	**135.00**	**142.50**	381.63	392.89
98.88	102.84	145.00	153.00	401.38	413.43
96.00	99.84	144.50	152.00	392.60	404.30
93.84	97.59	139.00	146.70	386.02	397.46
90.48	94.10	138.00	145.60	375.78	386.81
103.68	107.83	147.50	155.00	416.01	428.65
95.04	98.84	140.00	147.70	389.67	401.26
85.20	88.61	136.00	143.50	359.68	370.07
86.88	90.36	135.00	142.50	364.80	375.40
87.60	91.10	134.50	142.00	367.00	377.68
105.60	109.82	151.50	159.80	421.86	434.73
73.92	76.88	132.50	139.80	325.30	334.31
3.31	3.96	6.11	5.90	15.40	15.45
9.65	11.57	NS	NS	44.96	45.09

These treatments were significantly superior rest of the treatments respectively, during both the years. It might be causes to fact of the both type of weed that is broad leaf and narrow leaf controlled weed, so this factor may be regnable due to which highest number of shoots were achieved.That density and dry weight of weeds was significantly low due to the weed control treatments which have a very close negative

correlation between the weed density and dry weight with crop growth and yield contributing characters and yield. These results are in conformity with the work done at Jena et al. (2002)

5.4.4: Dry matter accumulation (g m^{-2})

Different weed management practices At 25 DAS stage of the crop growth the plant height did notinfluenced of the significantly affected due to weed management practices in direct seeded rice during both the years, respectively.

The dry matter accumulation brought significant differences at 50, 75and at harvest crop growth stages. However, highest dry matter

accumulation was recorded Weedy check (T_{11}) (408.00 and 420.22 g) and (337.16 and 364.65 g) and (325.30 and 325.30) which being at par with Pendimethalin (Pre) fbBispyribac + HW (40 DAS) (PoE) (T_6), Pendimethalin (Pre) fbBispyribac (1000 fb 25g ha^{-1}) (PoE) (T_2) and Oxadiragyl (Pre) fbPretilachlor (100 fb 1000g) (PoE) (T_7).

This might be due to the effective control of BLWs and seges weeds also. However, Pendimethalin (Pre) fbBispyribac + HW (40 DAS) control the BLWs and segesPendimethalin (Pre) fbBispyribac (1000 fb 25g ha^{-1}) control the BLWs as well as the seges also. The infestation of Echinochloacolonum and other BLWs and seges weeds was not too much severs and crop growth and yield was mainly affected due to the BLWs especially Echinichloacrusgalli. These results are in conformity with the work done at.

These treatments were significantly superior rest of the treatments respectively, during both the years.

5.4.5 Leaf area index:

The data pertaining to leaf area index by the different treatments under weed management practice in direct seeded rice at various stages of crop growth are summarized.

At 25 DAS crop growthstage, the leaf area index was recorded no significant difference weed management practices among the herbicide all treatments under direct seeded rice respectively, during both the years.

Same trend was also observed both at 50 DAS and 75 DAS stage with respect of weed management practices excluding Weedy check (T_{12}) treatment. However, highest leaf area index was recorded under Weedy check T_{11} (4.36 and 4.53) and (4.44 and 4.62) which was being *at par* with Pendimethalin (Pre) fbBispyribac + HW (40 DAS) (PoE) T_6, Pendimethalin (Pre) *fb*Bispyribac (1000 *fb* 25g ha^{-1}) (PoE) T_2 and Oxadiragyl (Pre) *fb*Pretilachlor (100 *fb* 1000g) (PoE) T_7, which were found significantly superior rest of the treatments respectively, during both the year. Although, the lowest leaf area index was noticed under treatment Weedy check T_{12} at all the stages during both the years.

Dry matter accumulation		Leaf area index	
2015-16	2016-17	2015-16	2016-17
915.75	951.27	3.89	4.04
973.17	1010.92	4.16	4.33
943.51	980.12	4.04	4.20
927.86	963.85	3.95	4.11
900.92	935.86	3.81	3.96
1016.88	1056.33	4.36	4.54
941.92	978.45	4.00	4.16
760.06	789.63	3.59	3.73
864.06	897.58	3.66	3.80
870.21	903.96	3.69	3.83
1032.14	1072.19	4.44	4.62
746.52	775.46	3.11	3.23
35.00	38.90	0.15	0.17
102.17	113.53	0.44	0.49

LAI was recorded higher with Weedy check. It might be because of fact that this formulation control the control the BLWs as well as sages effectively without damaging the crop which gave better crop growth also and on the other Pendimethalin (Pre) fbBispyribac + HW (40 DAS) showed lowest LAI because herbicide applied in this treatment might be under dose of which could not controlled the weed effectively and ultimately

resulted the lower LAI as comparison to other herbicides.

Yield

Grain yield (q ha^{-1})

The data pertaining to from grain yield (q ha-1) by the crop under different treatments at various stages of crop growth in direct seeded rice are summarized.

Various weed management practices influence the grain yield (q ha-1) excluding Weedy check (T12) treatment during both the years (2015-16) and (2016-17), respectively. However, the highest grain yield (q ha-1) was recoded under Weedy check T11 (44.90 and 46.69) which was being at par with Pendimethalin (Pre) fbBispyribac + HW (40 DAS) (PoE) T6, Pendimethalin (Pre) fbBispyribac (1000 fb 25g ha-1) (PoE) T2 and Oxadiragyl (Pre) fbPretilachlor (100 fb 1000g) (PoE) T7, which were found significantly superior rest of the treatments respectively, during both the years. Although, the lowest grain yield (q ha-1) (31.43 and 32.69) was noticed under treatment Weedy check T12 during both the years. Singh and Sharma (1994),

Straw yield (q ha^{-1})

The data pertaining to various weed management practices as influencethe straw yield (q ha^{-1}) excluding Weedy check (T_{12}) treatment during both the years. However, the highest straw yield(q ha^{-1}) was recoded under Weedy check T_{11} (58.32 and 60.53) which was being at par with Pendimethalin (Pre) fbBispyribac + HW (40 DAS) (PoE) T_6, Pendimethalin (Pre) fbBispyribac (1000 fb 25g ha^{-1}) (PoE) T_2 and Oxadiragyl (Pre) fbPretilachlor (100 fb 1000g) (PoE) T_7, which were found significantly superior rest of the treatments respectively, during both the years. Although, the lowest strawyield (q ha^{-1}) (43.22 and 44.86) was noticed under treatment Weedy check T_{12} during both the years. Ranaet.al.(2016).

5.4.7.3 Harvest index (%)

The data pertaining to harvest index (%) by the crop under different treatments at various stages of crop growth weed management practices in direct seeded rice summarized.

Various stages of crop growth in weed management practices under direct seeded ricin did not influenced significant effect between differences all the treatment during both the years, respectively. However, the highest harvest index (%) wasrecoded under Weedy check T_{11} (43.50 and 43.55) which was at par with Pendimethalin (Pre) fbBispyribac + HW (40 DAS) (PoE) T_6, Pendimethalin (Pre) fbBispyribac (1000 fb 25g ha^{-1}) (PoE) T2 and Oxadiragyl (Pre) fbPretilachlor (100 fb 1000g) (PoE) T_7, which were found significantly superior rest of the treatments respectively, during both the years. Although, the lowest harvest index (%) (42.10 And 42.15) was noticed under treatment Weedy check T_{12} during both the years.

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