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Short Communication

Efficacy of herbicidal weed management practices on weed dynamics in direct seeded upland rice of Himachal Pradesh

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Abstract

A field experiment was conducted during *kharif* 2021 at the Research Farm of Department of Agronomy, College of Agriculture, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur, to study the effectiveness of a new post-emergence broad-spectrum herbicide GOD H008 (Bispyribac sodium 5% SC+ Pyrithiobac sodium 12.5% SG) to control mixed weed flora in direct-seeded upland rice (*Oryza sativa* L). The experiment was laid out in Randomized Block Design with three replications and seven weed control treatments. The treatments consisted of three doses of GOD H008 (Bispyribac sodium 5% SC+ Pyrithiobac sodium 12.5% SG) *viz.* 375ml/ha, 500ml/ha and 625ml/ha, bispyribac sodium 250ml/ha, pyrithiobac sodium 625ml/ha, hand weeding (weed free) and untreated check respectively. The predominant weed flora present in the experimental field was *Ageratum conyzoides, Cyperus rotundus, Commelina benghalensis, Echinochloa colona, Digitaria sanguinalis* and *Synedrella nodiflora*. Application of new herbicide combination product GOD H008 (Bispyribac sodium 5% SC+ Pyrithiobac sodium 12.5% SG) 500ml/ha being statistically at par with GOD H008 (Bispyribac sodium 5% SC+ Pyrithiobac sodium 12.5% SG) 625ml/ha and bispyribac sodium 250ml/ha resulted in significantly lower total weed count, total weed dry weight and highest weed control efficiency as compared to other weed control treatments. Significantly highest grain and straw yield were recorded with the application of GOD H008 (Bispyribac sodium 5% SC+ Pyrithiobac sodium 12.5% SG) 500ml/ha at harvest and this treatment was closely followed by GOD H008 (Bispyribac sodium 5% SC+ Pyrithiobac sodium 12.5% SG), 625 ml/ha.

Key words: GOD H008 (Bispyribac sodium 5% SC+ Pyrithiobac sodium 12.5% SG), weed control, direct seeded rice

Direct seeding of rice has emerged as a viable alternative to the detrimental technique of puddling and nursery transplanting. Higher water productivity, lower labor and energy inputs, lower methane emissions and early crop maturity are some of the linked benefits. Despite its many advantages, direct-seeded rice production has been limited by number of factors, the most significant of which is severity of weeds infestation (Chauhan 2012). Gaire *et al*. (2013) reported that the primary problem is the severe infestation of weeds in direct-seeded which resulted in yield losses up to 90%. Low plant population due to a lack of irrigation water and inadequate weed control, particularly in direct-sown rice, are two of the most important constraints contributing to low productivity of rice in Himachal Pradesh.

Herbicide usage has gained popularity for efficient weed management in direct-seeded upland rice as an alternative to mechanical and manual weed control measures. In the recent past, a number of pre- and post-emergence herbicides have been recommended for controlling weeds in direct-seeded rice, the most common of which are butachlor as a pre-emergence herbicide and bispyribac sodium as a post-emergence herbicide. However, repeated use of the same herbicide over time can lead to the development of

herbicide resistance in weeds. Keeping these facts in mind, present investigation was conducted to study the efficacy of new herbicide GOD H008 (Bispyribac sodium 5% SC+ Pyrithiobac sodium 12.5% SG) for effective control of weeds in direct-seeded rice.

A field experiment was conducted during *kharif* 2021 at the Research Farm of Department of Agronomy CSKHPKV Palampur. The experimental site is situated at 32° 6′ N latitude, 76° 3′ E longitude and at an altitude of 1290.8 metres above mean sea level in the North-West Himalayan region. The soil of the experimental field was silty clay loam in texture, acidic in reaction (pH 5.18), low in available nitrogen (237.1 kg ha^{-1}), medium in available phosphorus (17.82 kg ha^{-1}) and potassium (159 kg ha^{-1}).The crop was sown on 12th June 2021 and was harvested on 14th October 2021. Application of 90 kg N, 40 kg P_2O_5, and 40 kg K_2O per hectare was applied through urea (46% N), single super phosphate (16% P_2O_5) and muriate of potash (60% K_2O), respectively. The treatments consisted of three doses of GOD H008 (Bispyribac sodium 5% SC+ Pyrithiobac sodium 12.5% SG) *viz*. 375ml/ha, 500 ml/ha and 625ml/ha, bispyribac sodium 250ml/ha, pyrithiobac sodium 625ml/ha, hand weeding (weed free) and untreated check. All the post-emergence herbicides were applied by knapsack sprayer fitted with flat fan nozzle using spray volume of 750 liters. Data on weed count and weed dry weight were recorded from two spots using a quadrat of 0.50 x 0.50 m and expressed as number and g/m^2, respectively. Weed count and dry weight data showed wide variation, therefore data were subjected to square root transformation ($\sqrt{x+1}$). Weed control efficiency of different treatments was worked out based on weed dry weight as per formula given by Mishra and Tosh (1979).

$$\text{Weed control efficiency} = \frac{\text{DWC-DWT}}{\text{DWC}} \times 100$$

DWC = weed dry weight (g/m^2) in control plot and
DWT = weed dry weight (g/m^2) in treated plot

The experimental field was severely infested with weeds *viz* grasses, broadleaf and sedges. The predominant weed flora present in the experimental field was *Ageratum conyzoides, Cyperus rotundus, Commelina benghalensis, Echinochloa colona, Digitaria sanguinalis* and *Synedrella nodiflora.* Kumar *et al.* (2011) reported similar weed species as the major weed flora in direct seeded rice at Palampur, Himachal Pradesh.

Total weed count

Different weed control treatments significantly influenced the total weed density at different stages of crop (Table 1). Significantly highest total weed count was recorded in untreated check and lowest in hand weeding. Amongst the herbicide treatments, GOD

Table 1. Effect of weed management treatments on total weed count (No./m^2)at different stages of observation

Treatment	Commercial dose(ml/ha)	Total weed count (No./m^2)			
		30DAS	60DAS	90DAS	At harvest
GOD H008 (Bispyribac sodium + Pyrithiobac sodium)	375.00	6.88(46.67)	7.72(58.67)	7.17(50.67)	7.28(52.00)
GOD H008 (Bispyribac sodium+ Pyrithiobac sodium)	500.00	2.61(8.00)	3.73(13.33)	4.10(16.00)	3.95(14.67)
GOD H008 (Bispyribac sodium+ Pyrithiobac sodium)	625.00	2.61(8.00)	3.58(12.00)	3.73(13.33)	3.73(13.33)
Bispyribac Sodium	250.00	2.71(8.00)	3.73(13.33)	4.32(18.67)	4.28(17.33)
Pyrithiobac Sodium	625.00	4.72(21.33)	4.84(22.67)	5.38(28.00)	5.22(26.67)
Hand Weeding (Weed free)	—	1.00(0.00)	1.00(0.00)	1.00(0.00)	1.00(0.00)
Untreated Check	—	10.11(101.33)	10.18(102.67)	10.81(116.00)	11.12(122.67)
S.Em ±	—	0.71	0.33	0.40	0.29
LSD (p=0.05)	—	2.20	1.03	1.24	0.89

Values given in parentheses are the mean of original values, Data subjected to square root transformation, DAS: Days after spray

H008 (Bispyribac sodium 5% SC+ Pyrithiobac sodium 12.5% SG) 500ml/ha, behaving statistically similar with GOD H008 (Bispyribac sodium 5% SC+ Pyrithiobac sodium 12.5% SG) 625ml/ha and bispyribac sodium 250ml/ha, resulted in significantly lower density of total weeds as compared to other weed control treatments. GOD H008 (Bispyribac sodium 5% SC+ Pyrithiobac sodium 12.5% SG) is a ready-mix application of bispyribac sodium and pyrithiobac sodium has proved effective in controlling weeds, possibly due to their synergistic effect. These results are in close conformity with the findings of Khaliq *et al.*(2012) and Hussain *et al.* (2008).

Total weed dry weight

Total weed dry weight also followed the similar trend as the total weed count. Highest weed dry matter was recorded in untreated check and lowest in hand weeding (Table 2). All the weed control treatments significantly influenced the total dry matter accumulation at different stages of crop. Application of GOD H008 (Bispyribac sodium 5% SC+ Pyrithiobac sodium 12.5% SG) 500ml/ha resulted in significantly lower total dry matter of weeds and this treatment behaved statistically alike with GOD H008 (Bispyribac sodium 5% SC+ Pyrithiobac sodium 12.5% SG) 625 ml/ha and bispyribac sodium 250 ml/ha at all the stages of observation. These results are in close conformity with the findings the Veeraputhiran and Balasubramanian (2013).

Weed control efficiency

Weed control efficiency was significantly influenced by the different weed control treatments (Table 3). All the weed control treatments recorded

Table 2. Effect of weed management treatments on total weed dry matter accumulation (g/m^2)at different stages of observation

Treatment	Commercial dose(ml/ha)	Total weed dry matter accumulation(g/m^2)			
		30DAS	60DAS	90DAS	At harvest
GOD H008 (Bispyribac sodium+ Pyrithiobac sodium)	375.00	2.61(5.85)	2.94(7.64)	2.58(5.66)	2.38(4.66)
GOD H008 (Bispyribac sodium+ Pyrithiobac sodium)	500.00	1.36(0.98)	1.84(2.46)	1.75(2.06)	1.74(2.04)
GOD H008 (Bispyribac sodium+ Pyrithiobac sodium)	625.00	1.34(0.91)	1.79(2.25)	1.70(1.93)	1.67(1.85)
Bispyribac Sodium	250.00	1.38(1.01)	1.84(2.43)	1.85(2.43)	1.79(2.25)
Pyrithiobac Sodium	625.00	2.11(3.46)	2.41(4.82)	2.20(3.86)	2.16(3.66)
Hand Weeding (Weed free)	—	1.00(0.00)	1.00(0.00)	1.00(0.00)	1.00(0.00)
Untreated Check	—	3.68(12.53)	3.99(14.96)	4.07(15.55)	3.84(13.78)
S.Em ±	—	0.17	0.11	0.09	0.10
LSD (p=0.05)	—	0.54	0.33	0.26	0.31

Values given in the parentheses are the means of original values, Data subjected to square root transformation, DAS: days after spray

Table 3. Effect of weed management treatments on weed control efficiency (%)

Treatment	Commerical dose(ml/ha)	Weed control efficiency (%)			
		30DAS	60DAS	90DAS	At harvest
GOD H008 (Bispyribac sodium+ Pyrithiobac sodium)	375.00	53.33	48.94	63.58	66.17
GOD H008 (Bispyribac sodium+ Pyrithiobac sodium)	500.00	92.21	83.55	86.74	85.18
GOD H008 (Bispyribac sodium+ Pyrithiobac sodium)	625.00	92.72	84.95	87.60	86.54
Bispyribac Sodium	250.00	91.93	83.74	84.34	83.63
Pyrithiobac Sodium	625.00	72.35	67.79	75.17	73.44
Hand Weeding (Weed free)	—	100.00	100.00	100.00	100.00
Untreated Check	—	0.00	0.00	0.00	0.00

significantly higher weed control efficiency over untreated check at all the stages of rice crops. Highest WCE was reported in hand weeding. Among weed control treatments GOD H008 (Bispyribac sodium 5% SC+ Pyrithiobac sodium 12.5% SG)625 ml/ha resulted in highest efficiency at all the stages of observation. This treatment was closely followed by GOD H008 (Bispyribac sodium 5% SC+ Pyrithiobac sodium 12.5% SG) 500ml/ha and bispyribac sodium 250ml/ha. The reason for higher weed control efficiencies of GOD H008 (Bispyribac sodium 5% SC+ Pyrithiobac sodium 12.5% SG) 500ml/ha and 625ml/ha is due to the conjoint effect of its constituent herbicides. The higher weed control efficiencies achieved by herbicides were due to significant reduction in dry weights of weeds through effective control over the untreated check. These results are collaborated with the findings of Kumar *et al.* (2013).

Grain and straw yield

Data pertaining to grain yield, straw yield and harvest index of rice has been presented in Table 4. All the weed control treatments were significantly superior to the untreated check in terms of grain and straw yield. Application of GOD H008 (Bispyribac sodium 5% SC+ Pyrithiobac sodium 12.5% SG) 500ml/ha behaving statistically similar to GOD H008 (Bispyribac sodium 5% SC+ Pyrithiobac sodium 12.5% SG) 625ml/ha resulted in significantly higher grain and straw yield indicating the superiority of this herbicide in managing weeds in direct-seeded rice GOD H008 (Bispyribac sodium 5% SC+ Pyrithiobac sodium 12.5% SG) 500 ml/ha and GOD H008 (Bispyribac sodium 5% SC+ Pyrithiobac sodium 12.5% SG) 625ml/ha recorded an increase of 55.29 and 51.70 percent higher grain yield of rice over untreated check which was followed by bispyribac sodium 250 ml/ha. Untreated check treatment has resulted in a loss of 35.60 per cent loss in grain yield of rice.

Conclusions

The study indicated that weeds in direct seeded rice can be controlled effectively with GOD H008 (Bispyribac sodium 5% SC+ Pyrithiobac sodium 12.5% SG) 500ml/ha in direct seeded rice which further improved the yield contributing characters and yield.

Table 4. Effect of weed management treatments on grain, straw yield (q/ha) and harvest index of rice

Treatment	Commerical dose(ml/ha)	Grain yield(q/ha)	Straw yield (q/ha)	Harvest index
GOD H008 (Bispyribac sodium+ Pyrithiobac sodium)	375.00	21.27	40.18	0.34
GOD H008 (Bispyribac sodium+ Pyrithiobac sodium)	500.00	25.53	46.89	0.35
GOD H008 (Bispyribac sodium+ Pyrithiobac sodium)	625.00	24.94	46.04	0.35
Bispyribac Sodium	250.00	23.20	43.64	0.35
Pyrithiobac Sodium	625.00	18.87	36.71	0.34
Hand Weeding (Weed free)	—	24.76	46.09	0.35
Untreated Check	—	16.44	33.20	0.33
S.Em ±	—	0.75	1.06	0.72
LSD (p=0.05)	—	2.32	3.25	NS

Conflict of interest: The authors have no conflict of interest.

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