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Efficacy of different herbicidal formulation and its effect on soil microflora in transplanted rice of eastern Uttar Pradesh

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Abstract
An experiment was conducted at Crop Research Station, Masodha (NDUAT), Dabhasemer, Faizabad, Uttar Pradesh to evaluate the bioefficacy of different herbicidal formulations viz. Butachlor (50 EC) @ 1500 g ai ha^{-1} at 5-7 DAT, Flucetosulfuron 10% WG @ 20 g ai ha^{-1} at 2-3 DAT, Flucetosulfuron 10% WG @ 25 g ai ha^{-1} at 2-3 DAT, Penoxsulam (1.02% W V^{-1}) + Cyhalofop –butyl (5.1% W W^{-1}) @120 g ai ha^{-1}, Flucetosulfuron 10% WG + Bispyribac-sodium 10% SC @ 20 + 25 g ai ha^{-1} at 2-3 DAT followed by 15-20 DAT, Bispyribac-sodium 10% SC @ 25 g ai ha^{-1} at 4 - 6 leaf stage of weeds (15-20 DAT) against mechanical and need based hand weeding in sandy loam soil during kharif 2013 and 2014. The experimental findings shows that the major weed flora of transplanted rice during *Kharif* season included grasses *Echinochloa colonum, Echinochloa crusgalli*, *Paspalum distichum* sedges like *Cyperus rotundus, Cyperus iria* and broad leaf weeds *Eclipta alba* and *Ammenia baccifera*. Among different herbicidal formulatiuons Flucetosulfuron 10% WG + Bispyribac-sodium 10% SC @ 20 + 25 g ai ha^{-1} at 2-3 DAT followed by 15-20 DAT was most effective to control all types of weeds and check their growth in transplanted rice crop. This herbicidal combination also shows no phytotoxicity on rice crop. Therefore, Flucetosulfuron 10% WG + Bispyribac-sodium 10% SC @ 20+25 g ai ha^{-1} at 2-3 DAT followed by 15-20 DAT may be recommended to replace the tedious, time consuming and expensive hand weeding practices of weed control in transplanted *Kharif* rice.

Keywords: Efficacy, Herbicides, Weed, a.i. (active ingredient), DAT

1. Introduction

Rice (*Oryza sativa L.*) is the major cereal crop of the Uttar Pradesh with an annual rice production of 144.64 lac metric tones. In the state area under rice production is about 5.9 mha of the total cultivated area and it was grown in almost all the district of eastern Uttar Pradesh due to very congenial environment and highly fertile soil of Indo Gangetic plain. In eastern Uttar Pradesh about 76.2% area of the total area under rice production is irrigated and transplanting is the main crop establishment technique for rice production. Weeds are one of the most important limiting biotic factors affecting rice production and productivity in eastern Uttar Pradesh. The method of crop establishment and monsoon pattern influence the intensity and nature of weed problem. Infestation of weeds in transplanted rice not only results in yield reduction but quality of produce is also impaired. Due to competition between rice crop and weeds for nutrients, light and water, yield loss upto the extent of 15-20% was estimated in transplanted rice in India (Singh *et al*., 2011) [10]. Living or decaying weeds also negatively affects rice crop due to secretion of toxins. Weeds also provides a natural habitat for growth of various insect pests and pathogens, which adversely affect the productivity of the rice variety. Less rainfall coupled with high temperature and dry tillage practices during kharif creates congenial environment for the growth and propagation of weeds resulted in a serious threat to rice production as compared to other rice growing seasons. Weed flora of eastern U.P. under transplanted rice is diverse and consists of grasses, sedges and broad leaf weeds causing considerable yield loss. The major economic weeds of the rice in eastern Uttar Pradesh are *Cyperus iria, C. rotundus, Cloeme viscosa, Echinochloa crusgalli, Eclipta alba, E. colona, Paspalum distichum* and *Fimbristylis dichotomy.* Various weed control measures like cultural, mechanical, biological and chemicals are used to control the weeds in transplanted rice. Use of herbicides to keep the crop weed free at critical crop growth stages will help in minimizing the cost of weeding as well as managing the weeds below the threshold level. Hand weeding is very easy and eco-friendly but tedious and highly labour intensive. Farmers very often fail to remove weeds due to unavailability of labour at peak periods and high labour wages. The final choice of any weed control measures will depend largely on its effectiveness and economics

Among these the chemical weed control is becoming popular among the farmers due to its high weed control efficiency coupled with low cost.

The present study was undertaken to evaluate the efficacy of different herbicidal formulation and its effects of soil micro flora in transplanted kharif rice of eastern Uttar Pradesh.

2. Materials and Methods

A field experiment was conducted during kharif 2013 and 2014 at Crop Research Station, Masodha (NDUAT), Faizabad U.P to evaluate the bioefficacy of different herbicial formulations in transplanted rice. The experimental site is located at 26^0 47' N latitude, 82^0 08' E Longitude and 113 m altitude above mean sea level. The soil of the experimental field is sandy loam, pH-7.5 and low in organic carbon i.e. 0.42%. The available nitrogen in the soil was found 200 kg ha^{-1} while soil is deficient in phosphorous (available P_2O_5 (kg ha^{-1}) - 24). The experiment was laid out in randomized block design with three replications and consist of 9 herbicidal treatments viz. T1 - Butachlor (50 EC) @ 1500 g ai ha^{-1} at 5-7 DAT, T2- Flucetosulfuron 10% WG @ 20 g ai ha^{-1} at 2-3 DAT, T3- Flucetosulfuron 10% WG @ 25 g ai ha^{-1} at 2-3 DAT, T4- Flucetosulfuron 10% WG + Bispyribac-sodium 10% SC @ 20+25 g ai ha^{-1} at 2-3 DAT followed by 15-20 DAT, T5- Penoxsulam (1.02% W V^{-1}) + Cyhalofop –butyl (5.1% W W^{-1}) @120 g ai ha^{-1} at 15-20 DAT, T6- Bispyribac-sodium 10% SC @ 25 g ai ha^{-1} at 4 - 6 leaf stage of weeds (15-20 DAT), T7- Mechanical weeding, T8-Need based hand weeding and T9 - Non weeded control. The most popular rice variety of the eastern U.P. i.e. Sarjoo 52 was used as test variety. The nursery of the experiment was sown in the 1st week of June. Transplanting of 30 days old seedlings was done by line X line method with the spacing of 20 x 15 cm, keeping two seedlings/hill. The plot size of the experimental block was 20 m^2. The weedicides were sprayed as per the treatment schedule. The recommended fertilizer dose of 120+60+60+20 kg N, P_20_5, K_2O ha^{-1} and $ZnSO_4$ was applied to provide essential nutrients for the proper crop growth. Full dose of P_20_5, K_2O, $ZnSO_4$ and half dose N was applied as basal and mixed into the soil before transplanting. Remaining half dose nitrogen was applied in two equal splits at tillering and panicle initiation stages of crop growth. Weed density and weed dry weight were recorded at harvesting stage. The herbicides were applied as per treatment by Knapsack sprayer fitted using 500 litres water ha^{-1}. Weed density of major economic weeds were recorded after 10 days of herbicide application. The weed biomass from different plots under all the treatment was recorded at harvest. The sun dried weeds were kept in paper bags and dried in oven at 50^0 C for 48 hours and dry weight was recorded till constant weight was achieved. The data pertaining to yield and ancillary characters were recorded and tabulated in table-2. Weed control efficiency has been calculated with the formula given below:

$$WCE\ (\%) = \frac{X - Y\ X\ 100}{X}$$

Where, X =Weed dry weight in control in control plot i.e. Non weeded control plot.

Y=weed dry weight in treated plots.

Microbial population: Soil samples from the experimental plots were collected on different dates viz. initial (Before application of herbicides), 15 days after herbicidal application (Daha), 30 Daha and 60 Daha from randomly selected 4-6 places at 0–15 cm soil depth. These soil samples were pooled (treatment wise) and requisite amount of composite soil samples of each treatment were taken for microbial analysis with help of standard methods. Soil solutions were prepared in sterile distilled water by constant shaking with the help of horizontal shaker and plating was done separately in replicates in specific media i.e. Thornton's agar medium at 10^{-6} dilutions. Plates were incubated at 30 °C. The counts were taken at the 3rd day of incubation. The enumeration of the microbial population was done as per serial dilution technique and pour plate method (Pramer and Schmidt, 1965) [7] (Figure-2).

3. Result and Discussion

Effect on weeds

The major economic weeds observed in the experimental plots were *Cyperus iria, C. rotundus, Cloeme viscosa, Echinochloa crusgalli, Eclipta alba, E. colona,* and *Fimbristylis dichotoma.* Data presented in table-1 shows that weed density (no./m^2) and weed biomass (g/m^2) varied with the treatments. Significantly lowest weed density and weed biomass was recorded with the treatment no. – 8 (Need based hand weeding) while highest was noted in the treatment no. -9 (None weeded check). All the weed control treatments recorded significantly lower total weed population (Sedges and grasses) than non weeded control. Flucetosulfuron 10% WG + Bispyribac-sodium 10% SC @ 20 + 25 g a.i. ha^{-1} at 2-3 DAT fb 15-20 DAT showed significantly lower weed population. Among all the chemical weed control treatments the highest weed control efficiency were recorded by Flucetosulfuron 10% WG + Bispyribac-sodium 10% SC @ 20+25 g a.i. ha^{-1} at 2-3 DAT fb 15-20 DAT (83.13%) followed by Flucetosulfuron 10% WG @ 25 g ai ha^{-1} at 2-3 DAT (76.75%). In all the herbicidal treatments lower dry weight of weeds was recorded as compared to the non weeded control plot.

Effect on grain yield and attributes

Results presented in Table – 2 revealed that the significantly higher grain yield (6.05 t ha^{-1}) were recorded with Flucetosulfuron 10% WG + Bispyribac-sodium 10% SC @ 20+25 g a.i. ha^{-1} at 2-3 DAT fb 15-20 DAT followed by Flucetosulfuron 10% WG @ 25 g ai ha^{-1} at 2-3 DAT (5.88 t ha^{-1}) where as check butachlor 50 EC @ 1500 g ai ha^{-1} at 5-7 DAT resulted grain yield 4.51 t ha^{-1} only. In all herbicidal treatments higher grain yield was recorded due to better control of weeds at critical crop growth stages thus providing the favourable environment for better growth and development which leads to enhanced grain yield. Need based hand weeding was the best treatment as compared to herbicidal treatments and recorded highest grain yield (6.35 t ha^{-1}). The productivity of rice is considerably affected by weed intensity at crop growth stages. Singh and Singh (2004) [11] reported that the grain yield reduction in rice is directly related to increasing weed density, dry weight and intensity of weed interference throughout the crop period. Due to heavy competition of weeds for nutrients, space, water and light lower grain yield was recorded in non weeded control plot (3.32 t ha^{-1}) Yield contributing characters viz. Panicle No. m^{-2} and panicle weight (g) also varied with the treatments.

Microbial properties: The effects of different herbicidal formulation on soil micro-flora (total bacteria was recorded at different crop growth stages viz. initial (before the application of herbicides) 15, 30 and 60 DAHA). Initially, there was no

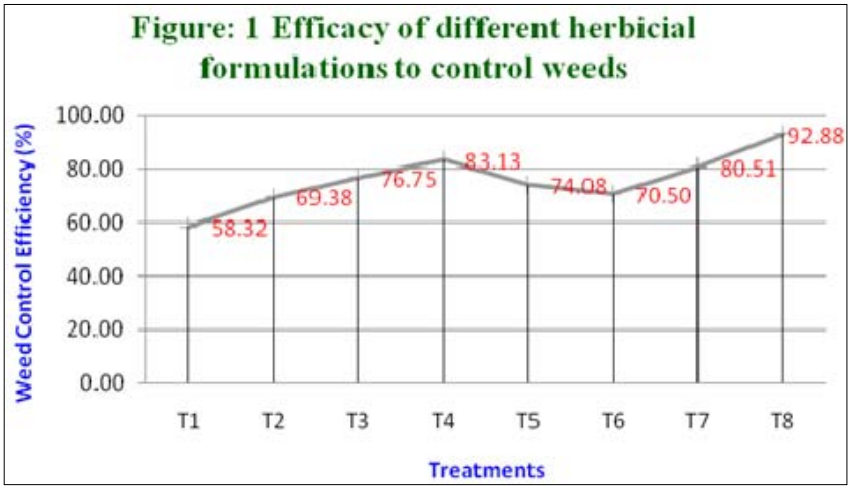
significant variation was observed in the population of total bacteria (10^6 cfu g^{-1}) in the soil of experimental plots while the significant variation in total bacterial population was observed after the application of herbicidal formulations. The total bacterial population decreased up to 15 Daha. After 30 Daha, the population increased considerably in the herbicidal treated plots as compared to mechanical weeding, hand weeding and non-weeded control plots (Fig. 2). As the herbicides have toxic effects on microorganisms; they reduce their abundance, activity and consequently, the diversity of their communities before degradation. Immediately after application, the toxicity of herbicides is very high as as their concentration in soil is highest. With advancement of time, microorganisms degraded the herbicides and carbon released from degraded organic herbicide leads to an increase of the soil microflora i.e. total bacterial population (Bera and Ghosh, 2013) [3].

Table 1: Effect of herbicides on weed dry matter, weed density and weed control efficiency in transplanted rice (Pooled data)

Treatments details (g a.i. ha^{-1})	Time of application (DAT)	After 10 days of herbicide application Weed density (No./m^2)			Weed biomass (g/m^2)
		Grasses	Sedges	BLW	
T1 - Butachlor (50 EC) @ 1500 g ai ha^{-1}	5-7	15.65	21.20	10.60	45.35
T2- Flucetosulfuron 10% WG @ 20 g ai ha^{-1}	2-3	11.60	14.10	7.35	33.32
T3- Flucetosulfuron 10% WG @ 25 g ai ha^{-1}	2-3	5.05	4.50	3.90	25.30
T4- Flucetosulfuron 10% WG + Bispyribac-sodium 10% SC @ 20+25 g ai ha^{-1}	2-3 fb 15-20	3.20	2.70	1.45	18.35
T5- Penoxsulam (1.02% W V^{-1}) + Cyhalofop – butyl (5.1% W W^{-1}) @120 g ai ha^{-1}	15-20	9.10	13.25	5.50	28.20
T6- Bispyribac-sodium 10% SC @ 25 g ai ha^{-1}	4 - 6 leaf stage of weeds (15-20 DAT)	10.25	11.60	4.65	32.10
T7- Mechanical Weeding	-	6.15	6.37	4.75	21.21
T8- Need based hand weedings	-	1.35	2.15	0.80	7.75
T9 - Non weeded control	-	28.45	39.15	17.40	108.80
C.D. (0.5%)		0.72	0.55	0.50	5.25
C.V. (%)		9.55	11.60	9.70	10.55

Table 2: Yield and yield contributed characters as influenced by herbicidal application in transplanted rice (Pooled Data)

Treatments details (g a.i. ha^{-1})	Time of application (DAT)	Panicle No./ m^2	Panicle weight (g)	Grain yield (t ha^{-1})
T1 - Butachlor (50 EC) @ 1500 g ai ha^{-1}	5-7	291	3.15	4.51
T2- Flucetosulfuron 10% WG @ 20 g ai ha^{-1}	2-3	322	3.25	5.15
T3- Flucetosulfuron 10% WG @ 25 g ai ha^{-1}	2-3	352	3.40	5.88
T4- Flucetosulfuron 10% WG + Bispyribac-sodium 10% SC @ 20+25 g ai ha^{-1}	2-3 fb 15-20	360	3.47	6.05
T5- Penoxsulam (1.02% W V^{-1}) + Cyhalofop –butyl (5.1% W W^{-1}) @120 g ai ha^{-1}	15-20	345	3.33	5.60
T6- Bispyribac - Sodium 10% SC @ 25 gai ha^{-1}	4 - 6 leaf stage of weeds (15-20 DAT)	332	3.30	5.50
T7- Mechanical Weeding	-	365	3.50	5.75
T8- Need based hand weedings	-	370	3.55	6.35
T9 - Non weeded control	-	260	2.97	3.32
C.D. (0.5%)		6.25	0.30	0.90
C.V. (%)		9.35	5.05	8.75



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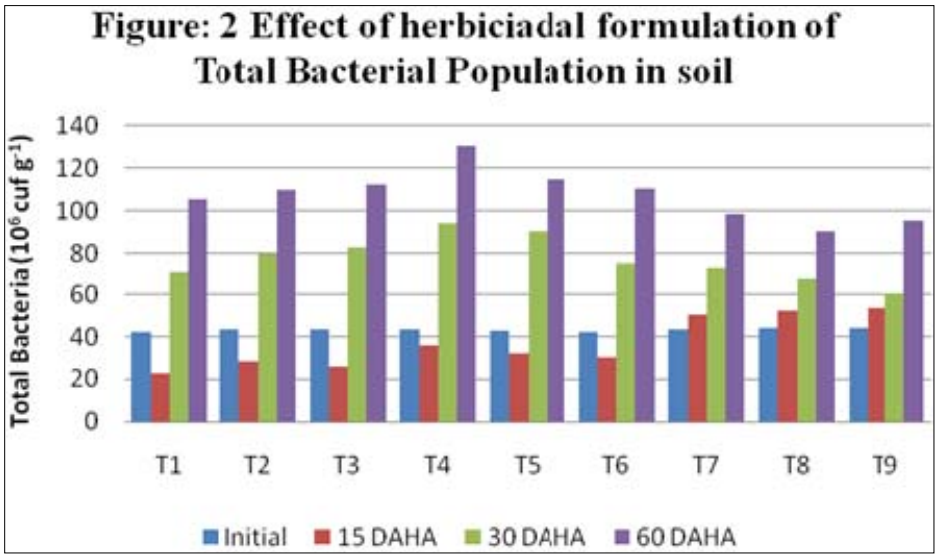

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4. Conclusion

On the basis of above observations, it was concluded that Flucetosulfuron 10% WG + Bispyribac-sodium 10% SC @ 20+25 g a.i. ha^{-1} at 2-3 DAT fb 15-20 DAT will effectively control the weed infestation in the transplanted rice which subsequently resulted in higher grain yield. Due to high weed control efficiency of its very low dose, use of Flucetosulfuron 10% WG + Bispyribac-sodium 10% SC @ 20+25 g a.i. ha^{-1} at 2-3 DAT fb 15-20 DAT is economical to control the weeds in transplanted rice.

5. References

1. Anonymous. Directorate of Economics and Statistics. Department of Agriculture and Cooperation. Ministry of Agriculture, Government of India, 2013.
2. Bera S, Pal D, Ghosh RK. Bio-efficacy and phytotoxicity of new molecule herbicides for weed management in soybean. J. Crop Weed. 2012; 8(2):113-116.
3. Bera S, Ghosh RK. Soil physico-chemical properties and microflora as influenced by bispyribac sodium 10% SC in transplanted kharif rice. Rice Sci. 2013; 20(5). DOI: 10.1016/S1672-6308(13)60148-1.
4. Gomez KA, Gomez AA. Statistical procedures for Agricultural Research. A Willey Interscience Publication, J. Willey and Sons, New York, 1984, 108-127.
5. Halder J, Patra AK. Effect of chemical weed control methods on productivity of productivity of transplanted rice (Oryza sativa). Indian Journal of Agronomy. 2007; 52:111-113.
6. Nandi M, Bhattacharya S, Mukherjee A, Nanda MK, Mukherjee AK. Evaluation of new herbicides in transplanted summer rice. Oryza. 2006; 43(3):213-215.
7. Pramer D, Schmidt EL. Experimental Soil Microbiology. Minneapolis: Burgess Publication Company, 1965.
8. Sapundjieva K, Kalinova S, Kartalska Y, Naydenov M. Influence of pendimetalin herbicide upon soil microflora. Pochvoznanie, Agrokhimiya I Ekologiya. 2008; 42:49-55.
9. Singh VP, Singh G, Singh RK, Singh SP, Kumar A, Dhyani VC *et al*. Effect of Herbicide alone and in Combination on Direct Seeded Rice. Indian Journal of Weed Science. 2005; 37(3-4):197-201.
10. Singh Y, Singh VP, Singh G, Yadav DS, Sinha RKP, Johnson DE *et al*. The implications of land preparation, crop establishment method and weed management on rice yield variation in the rice-wheat system in the Indo-Gangetic plains. Field Crops Research. 2011; 121(1):64-74.
11. Singh VP, Singh M. Effect of Bispyribac sodium on transplanted rice and associated weeds. Indian Journal of Weed Science, 2004; 36:190-192.
12. Singh VP, Panwar KS. Performance of acetachlor and anilofos + ethoxysulfuron for transplanted rice (Oryza sativa) Indian Journal of Agronomy. 2004; 52:111-113.