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BIO-EFFICACY OF SULFONYLUREA HERBICIDES IN CONTROLLING WEEDS OF WHEAT

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ABSTRACT

Experiment conducted during the *rabi* season of 1997-98, on weed management of wheat at the Instructional Farm (22.93°N, 88.53°E) of Bidhan Chandra Krishi Viswavidyalaya, West Bengal clearly indicated that hand weeding twice showed the best performance in giving the maximm grain yiels as compared to herbicide treated plots due to the fact that the treatment kept the weed population under control during active tillering stage. Among the herbicidal treatments, combination of Metsulfuron methyl + 2, 4-D Na Salt @ (0.004+0.500) kg a.i. ha^{-1} was the best in reducing the weed population and weed dry weight without showing and phytotoxicity to the crop. This herbicidal treatment, though record the highest grain yield, it did not differ significantly with the hand weeding treatment, Metsulfuron methyl + 2, 4-D Na Salt @ (0.004+0.250) kg a.i. ha^{-1} 2, 4-D Na Salt @ 0.500 kg a.i. ha^{-1}, Metsulfuron methyl +2, 4-D Na Salt @ (0.002+0.250) kg a.i. ha^{-1} + 0.2% surfactant and Metsulfuron methyl @ 0.004 kg a.i. ha^{-1}. Among the herbicidal treatments, Metsulfuron methyl @ 0.002 kg a.i. ha^{-1} + 0.2% surfactant recorded the lowest grain yield.

Keywords: **Metsulfuron methyl, Weed Control Efficiency, Weed Index, Wheat**

INTRODUCTION

Wheat (*Triticum aestivum*) is the world's most widely cultivated food crop. Weeds pose severe problem in wheat causing serious loss in yield and quality of the produce. Weed infestation during the early growth stage of crop causes tremendous damage resulting heavy loss in crop yield. Use of high yielding varieties with more fertilizers and ample irrigation helps the weeds to grow more vigorously. Intercultural operation to destroy weeds is very difficult due to the damage of roots of wheat. Weeds not only compete with wheat for light, moisture, nutrient and space, but also serve as alternate host for many diseases and insects. Depending on the weed intensity 15-30% loss in yield is quite normal (Gill and Brar, 1972).

Hand weeding keeps the weeds under control in wheat field, but due to steep rise in labour cost hand weeding proves uneconomic. In modern approach of using the herbicide is to reduce the total volume of the product without hampering the effectiveness of the herbicide in reducing the total dry weight of the weeds. The low

volume herbicide has also been found to be economically sound (Ray, *et al.*, 1996). With this background, a trial on weed management of wheat through sulfonylurea herbicide was conducted during the *rabi* season of 1997-98.

MATERIALS AND METHODS

The experiment was conducted during *rabi* season of 1997-98 in a medium land having average soil fertility of the Instructional Farm (22.93°N, 88.53°E) of Bidhan Chandra Krishi Viswavidyalaya, West Bengal with eleven treatments and three replications fitting in Randomised Block Design. The treatment combinations were, T_1 : Metsulfuron methyl 2 g a.i. ha^{-1} + 0.2% surfactant, T_2 : Metsulfuron methyl 4 g a.i. ha^{-1}, T_3 : Metsulfuron methyl 2 g a.i. ha^{-1} + 2, 4-D Na salt 250 g a.i. ha^{-1} + 0.2% surfactant, T_4 : Metsulfuron methyl 4 g a.i. ha^{-1} + 2, 4-D Na salt 250 g a.i. ha^{-1}, T_5 : Metsulfuron methyl 2 g a.i. ha^{-1} + 2, 4-D Na salt 500 g a.i. ha^{-1} + 0.2% surfactant, T_6 : Metsulfuron methyl 4 g a.i. ha^{-1} + 2, 4-D Na salt 500 g a.i. ha^{-1}, T_7 : 2, 4-D Ethyl Ester 250 g a.i. ha^{-1} + 0.2% surfactant, T_8 : 2, 4-D Ethyl Ester 500 g a.i. ha^{-1}, T_9 : 2, 4-D Na salt 500 g a.i. ha^{-1}, T_{10} : Hand weeding at 25 and 45 DAS and T_{11} : Unweeded control. All the herbicides were applied at 30 DAS.

Wheat variety UP 262 was sown on first week of December in plots measuring 5m × 3m with the fertilizer dose of 80 kg N +40 kg P_2O_5 + 40 kg K_2O ha^{-1}. Other cultural practices and plant protection measures were taken equally for all plots. The crop was harvested during third week of March.

Weed population per m^2 was recorded by using a quadrate at three places at random in each plot at 40, 60, 80 DAS and at harvest. Weed dry weight per m^2 for each plot was recorded keeping the weeds in hot air oven until a constant weight was attained. Length of ear head and yield components of wheat was recorded in each plot at the time of harvest. After harvesting, threshing and drying, the grain yield was recorded. Weed Index (reduction in yield due to presence of weeds in comparison with weed-free situation) value was calculated.

RESULTS AND DISCUSSION

Weed flora recorded in the experimental field during the crop growth period were *Cyperus rotundus*, *Chenopodium album*, *Melilotus alba*, *Cynodon dactylon*, *Vicia hirsuta*.

Effects on weeds :

During the entire crop growth period the lowest weed population was recorded in hand weeded plots. Among the herbicidal treatments Metsulfuron methyl + 2, 4-D Na Salt @ (0.004 + 0.500) kg a.i. ha^{-1} recorded the lowest weed population at 40, 60, 80 DAS and at harvest, which did not differ significantly with the treatment Metsulfuron methyl + 2, 4-D Na Salt (0.004+0.250) kg a.i. ha^{-1}. Unweeded control treatment recorded the highest weed population throughout the crop growth period (Table 1).

In all the observations, the same trend was also followed in case of weed dry weight (Table 1).

The highest weed control efficiency was recorded in the hand weeding treatment in all the growth stages, while among the herbicidal treatments, it was highest in the treatment Metsulfuron methyl + 2, 4-D Na Salt @ (0.04+0.500) kg a.i. ha^{-1} (Table

Table 1. Effect of treatments on weed population, weed dry weight and weed control efficiency

Treatments	Weed population m^{-2}				Weed dry weight (gm^{-2})				Weed control efficiency			
	40 DAS	60 DAS	80 DAS	Harvest	40 DAS	60 DAS	80 DAS	Harvest	40 DAS	60 DAS	80 DAS	Harvest
T_1	33.66	80.33	185.66	277.33	5.75	19.90	76.10	57.15	71.95	43.63	49.90	74.22
T_2	28.00	64.33	161.33	252.33	5.30	18.50	69.05	51.55	74.15	47.59	54.54	76.75
T_3	25.66	64.00	148.33	233.33	4.95	17.30	62.80	46.25	75.85	50.99	58.66	79.14
T_4	13.66	52.00	139.33	221.00	2.25	14.15	53.55	41.10	89.02	59.91	64.75	81.46
T_5	26.33	62.66	154.00	237.00	4.80	17.15	63.60	46.15	76.58	51.42	58.13	79.18
T_6	11.33	49.00	135.33	212.66	1.90	13.10	48.30	35.20	90.73	62.89	68.20	84.12
T_7	27.66	67.66	151.33	235.66	5.25	17.80	67.20	49.78	79.02	55.38	60.70	79.07
T_8	26.00	64.66	151.33	231.00	4.30	15.75	59.70	46.40	74.39	49.57	55.76	77.55
T_9	20.00	57.00	143.66	221.33	2.40	13.75	62.00	44.20	88.29	61.04	59.18	80.06
T_{10}	10.33	10.33	119.66	189.66	0.90	1.50	32.65	27.05	95.61	95.75	78.50	85.09
T_{11}	73.33	144.66	253.00	343.66	20.50	35.30	151.90	206.70	-	-	-	-
S.Em(±)	2.78	5.51	6.32	7.49	0.96	1.36	5.40	8.49	-	-	-	-
CD at 5%	8.20	16.26	18.64	22.10	2.85	4.01	15.95	25.05	-	-	-	-

Table 2. Effect of treatments on yield components and grain yield of wheat

Treatment	No. of effective tillers m^{-2}	Length of ear head (cm)	No. of filled grains per ear head	1000 grain weight (g)	Grain yield (q ha^{-1})	Increase of grain yield over unweeded control (%)	Weed Index
T_1	220	10.68	31.15	38.65	19.83	13.90	29.60
T_2	249	10.89	32.36	38.96	24.80	42.45	11.96
T_3	252	10.90	33.45	39.15	25.20	44.74	10.54
T_4	258	10.93	33.85	39.55	26.15	50.20	7.17
T_5	244	10.86	32.15	38.84	23.59	35.50	16.25
T_6	262	10.96	34.50	39.71	27.82	50.80	1.24
T_7	240	10.85	32.00	38.76	22.85	31.25	18.88
T_8	247	10.87	32.29	38.87	24.20	39.00	13.84
T_9	256	10.91	32.65	39.26	25.76	47.96	8.55
T_{10}	264	10.98	35.60	39.80	28.17	61.80	-
T_{11}	205	10.48	30.00	38.60	17.41	-	38.20
S.Em(±)	2.12	0.19	0.64	0.44	1.25	-	-
CD at 5%	6.25	NS	1.89	NS	3.68	-	-

Effect on wheat crop :

No phytotoxicity symptoms were recorded with the applications of herbicides during any stage of the crop growth.

Hand weeding (twice at 25 and 45 DAS) treatment computed the maximum tillering which was followed by Metsulfuron methyl + 2, 4-D Na Salt @ (0.004+0.500) kg a.i. ha^{-1} and Metsulfuron methyl + 2, 4-D Na Salt @ (0.004+0.250) kg a.i. ha^{-1}. Number of filled grain per ear head was the maximum in hand weeding treatment, which was at *par* with Metsulfuron methyl + 2, 4-D Na Salt @ (0.004+0.500) kg a.i. ha^{-1} and Metsulfuron methyl + 2, 4–D Na Salt @ (0.004 + 0.250) kg ha^{-1}. No significant difference among the treatments in case of length of ear head and thousand grain weight, were recorded (Table 2).

The highest grain yield was recorded with the hand weeding treatment, which was at *par* with Metsulfuron methyl + 2, 4-D Na Salt @ (0.004+0.500) kg a.i. ha^{-1}, Metsulfuron methyl + 2, 4-D Na Salt @ (0.004+0.250) kg a.i. ha^{-1}, 2, 4-D Na Salt @ 0.500 kg a.i. ha–1 and Metsulfuron methyl +2, 4-D Na Salt @ (0.002+0.250) kg a.i. ha^{-1} + 2% surfactant treatments. The lowest grain yield was recorded in unweeded treatment, may be due to severe competition from different categories of weeds. The treatments, T_{10}, T_6 and T_4 recorded increased yield over unweeded control by 61.80%, 50.80% and 50.20%, respectively. Among the chemical treatments, T6 computed the lowest weed index followed by T4 (Table 2).

It can, therefore, be concluded that laborious and time consuming hand weeding can easily be replaced by applying the chemicals like Metsulfuron methyl + 2, 4-D Na Salt @ (0.004+0.500) kg a.i. ha^{-1} or Netsulfuron methyl + 2, 4-D Na Salt @ (0.004 + 0.250) kg a.i. ha^{-1} without hampering the crop growth and grain yield.

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