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Short Article

Bio-efficacy of tiafenacil 70 WG alone or in combination with adjuvant against mixed weed flora in non-cropped land

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Abstract

A field experiment consisted of twelve weed control treatments was conducted during *kharif* 2023 at Palampur to evaluate the bio-efficacy of the tiafenacil 70 WG alone or in combination with adjuvant against mixed weed flora in non-cropped land following Randomized Complete Block Design with three replications that included tiafenacil 70 WG at 100, 150, 200 & 250 g/ha with or without adjuvant, glyphosate 3000 g/ha, paraquat 3000 ml/ha, hand weeding and untreated control. *Ageratum conyzoides, Parthenium hysterophorus, Euphorbia hirta, Cynodon dactylon, Commelina benghalensis, Digitaria sanguinalis, Eleusine indica* and *Cyperus rotundus* were the major weed flora in the area. The hand weeding was superior among all the treatments while, in case of herbicides, tiafenacil 70 WG at 250 g/ha with adjuvant and tiafenacil 70 WG at 200 g/ha along with adjuvant were quite effective in reducing total weed count and total dry weight with higher weed control efficiency.

Key words: Tiafenacil 70 WG, adjuvant, non-cropped land.

Weeds are disagreeable plants that obstruct the growth of the desired plant species or adversely effect human interest at a particular place. They can grow under adverse climatic conditions, interfering with the utilization of natural resources and become prolific, persistent, competitive, harmful and even poisonous in nature (Patel *et al*. 2018). Open areas around inhabitation, lawns, tea gardens, forests, orchards, pastures, wastelands and banks of streams and rivers, those are not extensively resorted to crop cultivation, are also enclosed under non-cropped land (Rana *et al*. 2015). India has 70.0 million hectare area under non-crop, which is badly infested with perennial as well as monocot, dicot and sedge weeds (Chaudhary *et al*. 2022). In Himachal Pradesh, this category of land occupies most of the geographical area (about 80%) due to unique physiographical features of the state (Rana *et al*. 2015). The presence of the weeds not only reduces the aesthetic value of land but also causes a serious threat for the ecology of the region. The weeds infesting non-crop land results in shrinkage of the area for animal grazing and fodder production. The control of weeds through herbicides is an effective method to control them, as mechanical and tillage methods do not provide satisfactory control of such obnoxious weeds. Glyphosate and paraquat are the predominant herbicides employed in non-cropped areas for the eradication of undesirable vegetation. Nevertheless, there is a pressing need to develop and endorse innovative products to broaden the array of weed control alternatives available. Active ingredient of tiafenacil 70 WG is rapidly absorbed by emerged, actively growing, and susceptible green plant tissue. Once tiafenacil 70 WG is absorbed by green plant tissue, inhibition of protoporphyrinogen oxidase (PPO) results in rapid disintegration and drying of plant tissue. In view of above facts, the present investigation was conducted to evaluate the efficacy of tiafenacil 70 WG against mixed weed flora in non-cropped land.

A field investigation was carried out at the Experiment Farm of Department of Agronomy of CSK HPKV, Palampur (32° 6' N, 76° 3' E) during *kharif* 2023. The experimental site was an established

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wasteland, the soil was silty clay loam in texture, acidic in reaction (5.58), low in available nitrogen (240.2), medium in available phosphorus (16.65) and available potassium (156.3). Twelve weed control treatments *viz*., tiafenacil 70 WG at 100 g/ha + 2 ml/l adjuvant, tiafenacil 70 WG at 150 g/ha + 2 ml/l adjuvant, tiafenacil 70 WG at 200 g/ha + 2 ml/l adjuvant, tiafenacil 70 WG at 250 g/ha + 2 ml/l adjuvant, tiafenacil 70 WG at 100 g/ha, tiafenacil 70 WG at 150 g/ha, tiafenacil 70 WG at 200 g/ha, tiafenacil 70 WG at 250 g/ha, glyphosate 3000 g/ha, paraquat 3000 ml/ha, hand weeding and untreated control (UTC) were evaluated in randomized complete block design with three replications. Herbicide were applied using spray volume of 750 litres of water/ha with a flat-fan nozzle attached to a knapsack sprayer. Weed count and weed dry weight were recorded from two spots using a quadrate of 50cm x 50 cm and expressed as number and g/m^2, respectively. The data on weed count and weed dry weight were subjected to square root transformation before statistical analysis ($\sqrt{x+1}$).

Weed control efficiency of different treatments was calculated as per the following formula given by Mishra and Tosh (1979).

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

Where,

DWC = weed dry weight (g m^{-2}) in control plot and

DWT = weed dry weight (g m^{-2}) in treated plot

The major weed flora in the experiment area were *Ageratum conyzoides, Commelina benghalensis, Euphorbia hirta, Parthenium hysterophorus, Eleusine indica, Digitaria sanguinalis*, *Cynodon dactylon* and *Cyperus rotundus*. A similar weed composition in non-cropped areas has been documented by Angiras (2014), Pooja *et al*. (2021) and Thakur *et al*. (2022) under Palampur conditions of Himachal Pradesh. Different weed control treatments significantly influenced the total weed count at all the stages of observation. (Table 1). The significantly highest weed count of total weeds was recorded in untreated control, while hand weeding resulted in a significantly lowest

Table 1. Effect of Tiafenacil 70 WG + Adjuvant application on total weed count at periodic intervals in non – cropped areas during *kharif* 2023

Treatment	Before application	Total weed count (Number m^{-2})				
		7 DAA	14 DAA	21 DAA	28 DAA	35 DAA
T_1: Tiafenacil 70 WG + Adjuvant	12.19 (147.60)	9.59 (91.00)	7.38 (53.50)	8.22 (66.50)	9.43 (88.00)	10.47 (108.70)
T_2: Tiafenacil 70 WG + Adjuvant	11.89 (140.60)	8.13 (65.10)	6.29 (38.60)	6.77 (44.86)	7.65 (57.60)	8.61 (73.10)
T_3: Tiafenacil 70 WG + Adjuvant	12.32 (151.00)	7.12 (49.80)	5.35 (27.70)	5.84 (34.20)	6.68 (43.70)	7.54 (55.90)
T_4: Tiafenacil 70 WG + Adjuvant	11.94 (141.68)	6.55 (41.90)	4.71 (21.20)	5.22 (27.30)	6.05 (35.70)	6.10 (36.30)
T_5: Tiafenacil 70 WG	12.46 (154.40)	10.54 (110.20)	8.43 (70.20)	9.50 (89.30)	10.83 (116.30)	11.47 (130.70)
T_6: Tiafenacil 70 WG	12.26 (149.47)	9.04 (80.74)	7.45 (54.60)	8.12 (65.00)	9.13 (82.40)	10.08 (100.77)
T_7: Tiafenacil 70 WG	12.36 (152.00)	8.58 (72.64)	6.63 (43.00)	6.25 (51.60)	8.19 (66.10)	9.15 (82.80)
T_8: Tiafenacil 70 WG	12.34 (151.30)	8.04 (63.70)	5.93 (34.20)	6.64 (43.20)	8.03 (63.60)	8.56 (72.40)
T_9: Glyphosate 71% SG	12.49 (155.20)	10.69 (113.30)	8.80 (76.50)	8.29 (67.77)	9.55 (90.27)	10.56 (110.50)
T_{10}: Paraquat dichloride 24%SL	12.45 (154.10)	8.50 (71.30)	8.86 (77.60)	10.27 (104.50)	11.27 (126.10)	12.48 (154.80)
T_{11}: Hand weeding	12.37 (152.40)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)
T_{12}: UTC	12.48 (154.80)	13.76 (188.5)	13.87 (191.40)	14.61 (212.52)	15.26 (232.00)	16.37 (267.20)
SEm+	0.59	0.46	0.49	0.50	0.52	0.55
CD (P=0.05)	NS	1.35	1.44	1.47	1.52	1.61

Values given in the parenthesis are the means of original values, Data subjected to ($\sqrt{x+1}$) square root transformation, DAA-Days after application

weed count of total weeds. Among herbicide treatments, tiafenacil 70 WG at 250 g/ha along with adjuvant resulted in significantly lower weed density of total weeds at all the stages of observation, though this treatment was statistically at par with tiafenacil 70 WG at 200 g/ha with adjuvant. These results are in close conformity with the findings of Datta *et al* (2018), Pooja *et al*. (2021) and Kaur *et al*. (2020).

Total weed dry weight also followed the similar trend as that of total weed count, with hand weeding treatment resulting in lowest dry weight at all the stages of observation, while weedy check had the highest total weed dry weight (Table 2). Amongst the herbicide treatments, tiafenacil 70 WG at 250 g/ha with adjuvant had significantly lowest total weed dry weight at all the stages of observation, though this treatment was statistically alike with tiafenacil 70 WG at 200 g/ha with adjuvant. This is because of the effective control of weeds with this new herbicide which reduced the species wise weed density as well as dry weight which ultimately resulted in significantly lower total weed count and weed dry matter. Similar results were reported by Corbett *et al*. (2004) and Thakur *et al*. (2022).

Weed control efficiency also followed the same trend as that of weed dry matter with hand weeding resulted in highest weed control efficiency (Table 3). However, among different weed control treatments tiafenacil 70 WG at 250 g/ha along with adjuvant resulted in highest weed control efficiency. This treatment was followed by tiafenacil 70 WG at 200 g/ha along with adjuvant. The higher weed control efficiencies achieved by different herbicides treatments were due to significant reduction in the dry

Table 2: Effect of Tiafenacil 70 WG + Adjuvant application on total dry matter at periodic intervals in non – cropped area during *kharif* 2023

Treatment	Before application	Total weed dry matter (g m^{-1})				
		7 DAA	14 DAA	21 DAA	28 DAA	35 DAA
T_1: Tiafenacil 70 WG + Adjuvant	7.03	5.23	4.17	4.55	5.18	5.85
	(48.44)	(26.38)	(16.39)	(19.72)	(25.87)	(33.24)
T_2: Tiafenacil 70 WG + Adjuvant	7.21	4.52	3.51	3.87	4.29	4.79
	(51.09)	(19.47)	(11.37)	(13.98)	(17.39)	(21.94)
T_3: Tiafenacil 70 WG + Adjuvant	7.15	4.02	2.99	3.31	3.68	4.13
	(50.22)	(15.16)	(7.99)	(9.97)	(12.58)	(16.06)
T_4: Tiafenacil 70 WG + Adjuvant	7.14	3.61	2.51	2.85	3.32	3.72
	(49.99)	(12.03)	(5.3)	(7.15)	(10.02)	(12.84)
T_5: Tiafenacil 70 WG	7.16	5.89	4.85	5.13	5.99	6.66
	(50.34)	(33.70)	(22.52)	(25.32)	(34.88)	(43.35)
T_6: Tiafenacil 70 WG	7.11	5.19	4.17	4.58	5.13	5.67
	(49.61)	(25.94)	(16.40)	(19.98)	(25.31)	(31.15)
T_7: Tiafenacil 70 WG	7.18	4.78	3.77	4.11	4.65	5.22
	(50.59)	(21.92)	(13.25)	(15.89)	(20.62)	(26.26)
T_8: Tiafenacil 70 WG	7.15	4.15	3.39	3.76	4.35	4.87
	(50.12)	(16.27)	(10.53)	(13.19)	(17.93)	(22.72)
T_9: Glyphosate 71% SG	7.17	5.82	4.71	4.52	5.26	5.86
	(50.52)	(32.95)	(21.19)	(19.44)	(26.69)	(33.34)
T_{10}: Paraquat dichloride 24%SL	7.24	4.79	4.96	5.60	6.24	6.94
	(51.48)	(21.99)	(23.66)	(30.40)	(37.93)	(47.16)
T_{11}: Hand weeding	7.04	1.00	1.00	1.00	1.00	1.00
	(48.66)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
T_{12}: UTC	7.15	7.46	7.66	8.09	8.51	9.24
	(50.12)	(54.78)	(57.80)	(64.52)	(71.42)	(84.38)
SEm+	0.32	0.23	0.21	0.22	0.24	0.26
CD (P=0.05)	NS	0.70	0.64	0.66	0.72	0.79

Values given in the parenthesis are the means of original values, Data subjected to ($\sqrt{x+1}$) square root transformation, DAA-Days after application

Table 3: Effect of Tiafenacil + Adjuvant application on total weed control efficiency at periodic intervals in non – cropped area during *kharif* 2023

Treatment	Total weed control efficiency (%)				
	7 DAA	14 DAA	21 DAA	28 DAA	35 DAA
T_1: Tiafenacil 70 WG + Adjuvant	51.84	71.64	69.43	63.77	60.60
T_2: Tiafenacil 70 WG + Adjuvant	64.46	80.33	78.33	75.65	73.99
T_3: Tiafenacil 70 WG + Adjuvant	72.32	86.17	84.55	82.38	80.96
T_4: Tiafenacil 70 WG + Adjuvant	78.04	90.83	88.92	85.97	84.78
T_5: Tiafenacil 70 WG	38.48	61.04	60.75	51.16	48.62
T_6: Tiafenacil 70 WG	52.64	71.62	69.03	64.56	63.08
T_7: Tiafenacil 70 WG	59.98	77.07	75.37	71.11	68.87
T_8: Tiafenacil 70 WG	70.29	81.78	79.55	74.89	73.07
T_9: Glyphosate 71% SG	39.85	63.34	69.87	62.63	60.48
T_{10}: Paraquat dichloride 24%SL	59.85	59.06	52.88	46.89	44.11
T_{11}: Hand weeding	100	100	100	100	100
T_{12}: UTC	-	-	-	-	-

DAA- Days after application

weight of weeds through effective control over untreated control. Similar results were reported by Sridhara *et al*. (2019).

Conclusion

Weeds in non-cropped areas can be effectively controlled along with the application of tiafenacil 70 WG at 250 g/ha and 200 g/ha with adjuvant as these treatments demonstrated potential effectiveness in managing weeds in non-cropped land.

Conflict of interest: The authors declare that there is no conflict of interest among the authors in this research paper.

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