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Short Communication

Weed control in potato with *ethalfluralin* under mid hill conditions of Himachal Pradesh

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Abstract

A field experiment was conducted during *rabi* season of 2018-19 at Palampur, Himachal Pradesh. Pre-plant incorporation of ethalfluralin 720 g/ha gave effective control of weeds and gave potato tuber yield similar to ethalfluralin 810 g/ha, oxyfluorfen 200 g/ha, metribuzin 525 g/ha and hand weeding (weed free). Ethalfluralin at 540-1440 g /ha was safe for the succeeding maize crop.

Key words: Ethalfluralin, potato, oxyfluorfen, metribuzin and pre-plant incorporation.

Potato (*Solanum tuberosum* L.), is cultivated in approximately 150 countries spread across both temperate and tropical regions. It is one of the major cash crops of Himachal Pradesh. Winter planted crop of potato generally takes longer time for its emergence from the soil and hence, leading to slow initial growth. Therefore, it faces a severe weed infestation right from the initial phase and, water and nutrients provide congenial environment for the growth of weeds. Weeds could reduce the potato yield by upto 74% (Singh and Bhan 1999; Ahuja *et al*.1999). Hence, weed management is an important component of potato production, and herbicides are the most economical and effective tool for weed control. The efficacy of ethalfluralin and its effect on potato yield has been investigated in the present study.

The field investigation was carried out during winter seasons of 2018-19 at Palampur (32º6´N; 76º3´E). The experimental site was silty clay loam, acidic with pH 5.6, have 242 kg available N ha^{-1}, 18.8 kg P ha^{-1} and available K 182.1 kg ha^{-1}. Treatments consisting of ethalfluralin at five rates (540, 630, 720, 810 and 1440 g/ha), metribuzin at 525 g *a.i.*/ha, oxyfluorfen at 200 g *a.i.*/ha, hand weeding (weed free) and weedy check were tested in Randomized Block Design with three replications. Ethalfluralin was incorporated before sowing, other herbicides were applied as pre-emergence, one day after sowing. Herbicides were applied with backpack power sprayer with 600 l water ha^{-1}. Potato (var. Kufri Jyoti) was planted on 16 Dec. 2018 and harvested on 25 May 2019. The crop was fertilized with 120 kg N, 80 kg P_2O_5 and 60 kg K_2O ha^{-1} through urea, single superphosphate and muriate of potash, respectively. All phosphorus, potash and half nitrogen were applied at sowing in furrows and covered partially with soil and then tubers were planted. The data on growth, developmental aspects, weeds, crop toxicity and potato yield were recorded. Phytotoxicity rating was given to potato crop as per Rao (1986) and to the next indicator crop i.e. maize, based on visual indices. Rating in scale was from 0-10, where '10' meant complete phytotoxicity and '0' meant no phytotoxicity**.**

Growth studies

The emergence of potato did not vary significantly indicating that all herbicides were safe to the crop. (Table 1). Hand weeding treatment had significantly taller plants than all other treatments. All herbicidal treatments had higher crop plant height than weedy check. Pre-plant ethalfluralin 720 g/ha had similar plant height to metribuzin 525 g, oxyfluorfen 200 g, ethalfluralin 810 g/ha and hand weeding.

All weed control treatments had higher leaf numbers than weedy check; leaf number increased from 60 to 120 DAP and then decreased due to senescence of potato leaves. Ethalfluralin 720 g/ha behaved similar to oxyfluorfen 200 g/ha, hand weeding, ethalfluralin 810 g/ha and metribuzin 525 g/ha and had significantly higher number of leaves per plant compared to other

Table 1. Effect of different weed control treatments on growth studies of potato

Treatment	Growth studies											
	Emergence count (No./m^2)	Plant height (cm)				No. of leaves (No./plant)				Dry matter accumulation (g/m^2)			
		60 DAP	90 DAP	120 DAP	150 DAP	60 DAP	90 DAP	120 DAP	150 DAP	60 DAP	90 DAP	120 DAP	150 DAP
Ethalfluralin 540 g/ha (PPI)	10.7	8.83	12.40	28.67	30.17	6.13	9.87	13.38	8.03	8.27	60.05	103.22	103.59
Ethalfluralin 630 g/ha (PPI)	10.7	9.13	13.00	29.33	31.00	6.20	9.93	13.92	8.35	8.89	69.66	106.30	110.00
Ethalfluralin 720 g/ha (PPI)	11.1	9.53	14.33	30.67	32.40	6.27	10.60	15.50	9.30	10.03	89.17	142.44	141.85
Ethalfluralin 810 g/ha (PPI)	11.1	9.40	14.33	30.13	32.07	6.27	10.27	15.28	9.24	9.29	86.78	135.19	134.44
Metribuzin 525 g/ha (Pre)	11.1	9.60	14.53	30.67	32.47	6.27	10.40	15.35	9.23	9.85	88.85	137.41	140.00
Oxyfluorfen 200 g/ha (Pre)	10.7	9.67	14.67	30.80	32.87	6.40	10.60	16.10	9.66	10.67	100.67	160.37	161.85
Ethalfluralin 1440 g/ha (PPI)	10.0	4.73	10.67	24.87	26.37	4.67	8.67	12.78	7.67	2.96	44.40	100.74	100.74
Hand weeding (weed free)	11.1	10.8	16.27	32.47	33.97	6.53	11.00	16.35	9.81	11.10	104.48	163.33	163.33
Weedy check	11.1	8.53	12.27	27.60	29.10	6.07	9.60	13.20	7.92	5.44	42.93	71.48	72.59
SE(m±)	0.3	0.49	0.90	0.79	0.70	0.11	0.33	0.60	0.20	0.62	6.02	9.94	9.95
LSD(P=0.05)	NS	1.47	2.71	2.37	2.10	0.32	0.99	1.79	0.61	1.85	18.05	29.81	29.82

treatments.

In case of dry matter accumulation, hand weeding resulted in significantly higher dry matter than other treatments. Among weed control treatments, ethalfluralin 720 g/ha was similar to oxyfluorfen 200 g/ha, ethalfluralin 810 g/ha, metribuzin 525 g/ha and weed free. Malawad (2002) also reported that the dry matter increased from initial growth stages till harvest and total dry matter was significantly high in weed-free check as compared to others.

Developmental studies

Ethalfluralin at all the doses had higher number of days for emergence compared to oxyfluorfen 200 g/ha and metribuzin 525 g/ha (Table 2). Whereas, days to maturity were not significantly influenced by different treatments.

Phyto-toxicity rating

Crop phytotoxicity was not observed in the crop and even in the next indicator crop (i.e. maize) which was grown after potato crop (Table 2).

Effect on weeds

Hand weeding had lower total weed density than other treatments. Among herbicides, ethalfluralin 720 g/ha behaving statistically similar with ethalfluralin 810 g/ha, metribuzin 525 g/ha and oxyfluorfen 200 g/ha resulted in significantly lower total weed count as compared to other treatments at all stages of observation.

Results for metribuzin, oxyfluorfen and hand weeding in reducing the total weed count were in conformity with the findings of Kumar *et al*. (2012) and Kumar *et al*. (2008). The total weed count in ethalfluralin treatments was high due to *Coronopus didymus* presence. The highest total weed count was observed in weedy check at all stages of observation (Table 2).

Table 2. Effect of different weed control treatments on developmental studies, phytotoxicity, total weed count, total weed dry weight and yield of potato

Treatment	Developmental studies		Phyto-toxicity on crop (0-10 scale)	Total weed count (No./m^2)	Total weed dry matter (g/m^2)	Yield (q/ha)
	Days to emergence	Days to maturity				
Ethalfluralin 540 g/ha (PPI)	85	159	0	8.9 (78.7)	13.7 (188.9)	177.34
Ethalfluralin 630 g/ha (PPI)	85	160	0	8.0 (62.7)	12.6 (157.4)	196.57
Ethalfluralin 720 g/ha (PPI)	85	159	0	5.8 (33.3)	10.0 (99.7)	254.26
Ethalfluralin 810 g/ha (PPI)	87	159	0	5.8 (33.3)	10.1 (101.9)	246.80
Metribuzin 525 g/ha (Pre)	79	159	0	5.0 (25.3)	6.1 (36.3)	247.03
Oxyfluorfen 200 g/ha (Pre)	81	159	0	4.3 (17.3)	4.0 (19.9)	254.27
Ethalfluralin 1440 g/ha (PPI)	96	160	0	5.5 (30.7)	9.6 (92.3)	216.60
Hand weeding (weed free)	80	159	0	1.0 (0.0)	1.0 (0.0)	260.68
Weedy check	83	158	0	10.5 (109.3)	15.9 (256.1)	143.16
SE(m±)	1.4	0.4	-	0.7	2.1	10.26
LSD(P=0.05)	4.3	NS	-	2.2	6.3	30.76

Data transformed to square root transformation ($\sqrt{x+1}$); Values given in parenthesis are the means of original values.

The dry matter increased consistently upto 150 DAP in weedy check due to the presence of both *kharif* and *rabi* weeds. Similar to weed count, weed control treatments significantly decreased total weed dry weight as compared to weedy check at all the stages of observation. Significantly, lowest total weed dry weight was recorded with hand weeding (weed-free) treatment at all the stages of observation. Among herbicide treatments, oxyfluorfen 200 g/ha behaving statistically alike with ethalfluralin 720 g/ha, ethalfluralin 810 g/ha and metribuzin 525 g/ha resulted in significantly lower total weed dry weight as compared to other treatments at all the stages of observation. Results for metribuzin, oxyfluorfen and hand weeding in reducing the total weed count were in conformity with the findings of Thakral *et al*. (1988), Kumar *et al.* (2012) and Kumar *et al.* (2008). However, the total weed dry weight in ethalfluralin treatments was high due to *Coronopus didymus* presence. Significantly highest total weed dry weight was recorded in weedy check at all the stages of observation.

Effect on crop

Hand weeding had the highest potato tuber yield and it was 45% higher than weedy check. Ethalfluralin 720 g/ha had similar yield to ethalfluralin 810 g/ha, oxyfluorfen 200 g/ha, metribuzin 525 g/ha and hand weeding treatment. Similar results have also been reported by Kumar *et al.* (2012).

Conclusion

Pre plant incorporation of ethalfluralin 720 g/ha could be adopted for weed control in potato and this herbicide is safe for the succeeding crop of maize.

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

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