Himachal Journal of Agricultural Research 34 (1):22-24, 2008

Bioefficacy of herbicides to control weeds in potato

Suresh Kumar, N.N. Angiras, S.S. Rana and Neelam Sharma
Department of Agronomy
CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur -176 062, India.

Abstract

A field experiment was carried out to evaluate different herbicides in potato during spring seasons of 2001 and 2002 at Palampur. Prometryn 1.00 and 1.50 kg/ha, metribuzin 0.30 and 0.50 kg/ha, pendimethalin 1.50 kg/ha, paraquat 0.60 kg/ha, atrazine 1.0 kg/ha, isoproturon 1.50 kg/ha, napropamide 1.00 kg/ha, oxyflourfen 0.15 kg/ha, farmers practice and weedy check were evaluated for weed control and tuber yield. Oxyflourfen, atrazine and metribuzin resulted in significantly lower count of *Phalaris minor*. All herbicides except atrazine and prometryn each at 1.0 kg/ha were effective against *Lolium temulentum*. *Anagallis arvensis* was effectively controlled by oxyflourfen 0.15, metribuzin 0.30 and 0.50, pendimethalin 1.50 and prometryn 1.0 kg/ha. Pendimethalin 1.50 kg/ha effectively controlled *Echinochloa* and *Panicum*. Metribuzin 0.30 and 0.50 kg/ha, atrazine 1.0 kg/ha and oxyflourfen 0.15 kg/ha were effective against *Polygonum alatum*. Mean potato tuber yield was significantly higher with pendimethalin 1.50 kg/ha and prometryn 1.50 kg/ha. Weed management index (WMI), Agronomic management index (AMI), and Integrated weed management index (IWMI) and net return were highest for pendimethalin 1.50 kg/ha followed by prometryn 1.50 kg/ha. Pendimethalin and prometryn each at 1.50 kg/ha and metribuzin 0.50 kg/ha increased net return by 129.5, 93.8 and 56.1 per cent, respectively over the farmers practice i.e. hand weeding twice and earthing up. Uncontrolled weed growth reduced potato tuber yield by 54.0 per cent.

Key words: Bio-efficacy, herbicides, weeds, yield, potato.

Introduction

Potato, being slow growing at the initial stages and taking long time for germination, faces severe weed problem. Being a heavy feeder crop its frequent demand for irrigation provides congenial conditions for the growth of weeds. Weeds interfere with the development of potato tubers thereby reduce the tuber yield to the extent of 40-65 per cent (Tripathi *et al.*, 1989). Manual weeding, no doubt is effective, but is time consuming, tedious, costly and many a times causes tuber injury. Chemical weed control thus would be more efficient, easy and economical. Therefore, different herbicides have been evaluated with varying rates in the present investigation.

Material and Methods

A field experiment was conducted during the spring seasons of 2001 and 2002 at the Research Farm of Department of Agronomy, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur. The soil of the experimental field was silty clay loam in texture, acidic in reaction (pH 5.5), medium in organic carbon (0.56%), low in available N (226.2 kg/ha), medium in available P (17.8 kg/ha) and high in available K (306.5 kg/ha). Potato variety 'Kufri Jyoti' was planted at 60 x 20 cm spacing on 27 January, 2001 and 11 January, 2002. Twelve treatments *viz.* prometryn at 1.0 and 1.5 kg/ha, pendimethalin 1.5 kg/ha, metribuzin at 0.3 and 0.5 kg/ha, paraquat 0.6 kg/ha, atrazine 1.0 kg/ha, isoproturon 1.5 kg/ha, napropamide 1.0 kg/ha, oxyfluorfen 0.15 kg/ha, farmers practice and weedy check (Table 1) were evaluated in randomized block design with 3 replications. Metribuzin and isoproturon were applied at 30 days after planting and paraquat was applied as pre emergence to crop but post emergence to weeds. The remaining herbicides were applied as pre-emergence spray. The herbicides were sprayed with knap sack sprayer fitted with flat fan nozzle using 700 litres water/ha. Except weed control, the crop was raised in accordance with the recommended package of practices. The data on density and total dry weight at harvest stage of crop growth was recorded from two randomly selected quadrates (0.25 m^2) and

expressed as number and g/m^2, respectively. Yields were harvested from net plot. Economics of the treatments was computed based upon prevalent market prices. WMI (weed management index), AMI (Agronomic management index) and IWMI (Integrated weed management index) were worked out as per the methods outlined by Walia (2003).

Results and Discussion

The experimental field was infested with both Rabi (53.0%) and Kharif (47.0%) weeds. The important Rabi weeds growing in association with potato crop were *Phalaris minor* (47.3%), *Lolium temulentum* (17.0%), *Anagallis arvensis* (13.2%), *Coronopus didymus* (11.0%), *Vicia sativa* (7.7%) and *Ranunculus arvensis* (3.8 %). The Kharif weeds were *Echinochloa colona* (61.7 %), *Panicum dichotomiflorum* (14.9 %), *Polygonum alatum* (21.0 %) and *Gallinsoga parviflora* (2.4%).

The treatment effects were significant on the count of *P. minor*, *L. temulentum*, *A. arvensis*, *E. colona*, *P. dichotomiflorum* and *P. alatum* (Table 1). Oxyflourfen 0.15 kg/ha, atrazine 1.0 kg/ha and metribuzin 0.5 kg/ha resulted in significantly lower count of *P. minor*. Isoproturon 1.5 kg/ha, metribuzin 0.30 kg/ha, pendimethalin 1.50 kg/ha and farmers practice were as effective as the above herbicidal treatments in reducing the count of *P. minor*.

Table 1. Effect of treatments on density and dry weight of weeds at harvest

Treatments	Dose (kg/ha)	Time of application	Weed count* (No/m^2)						Weed dry weight (g/m^2)		
			Ph	*Lo*	*Ana*	*Ech*	*Pan*	*Poly*	2001	2002	Mean
Prometryn	1.0	Pre.	4.2 (18.6)	2.8 (13.3)	1.0 (0.0)	5.4 (29.3)	4.9 (25.3)	5.4 (29.3)	67.14	132.5	99.8
Prometryn	1.5	Pre.	5.0 (26.6)	1.0 (0.0)	1.6 (2.6)	5.3 (29.3)	3.3 (13.3)	2.7 (8.0)	58.99	98.7	78.8
Pendimethalin	1.5	Pre.	3.0 (11.0)	2.7 (7.3)	1.0 (0.0)	2.7 (8.0)	1.0 (0.0)	3.0 (14.6)	43.88	91.5	67.7
Metribuzin	0.3	Post	3.0 (10.6)	2.3 (8.0)	1.0 (0.0)	7.0 (48.0)	5.7 (33.3)	1.0 (0.0)	25.77	17.3	21.5
Metribuzin	0.5	Post	1.0 (0.0)	2.3 (8.0)	1.0 (0.0)	5.5 (30.6)	4.1 (16.0)	1.0 (0.0)	25.77	48.5	37.1
Paraquat	0.6	Post to weeds but pre to crop	7.5 (56.0)	2.0 (5.3)	1.8 (4.0)	3.7 (14.6)	3.9 (16.0)	3.4 (16.0)	61.73	40.5	51.1
Atrazine	1.0	Pre.	1.0 (0.0)	2.8 (13.3)	2.1 (6.6)	5.0 (26.6)	6.0 (36.0)	1.0 (0.0)	37.80	96.0	66.9
Isoproturon	1.5	Post (30 DAP)	2.5 (6.6)	2.4 (9.3)	3.3 (10.6)	5.8 (33.3)	6.3 (40.0)	3.1 (9.3)	53.29	117.6	85.4
Napropamide	1.0	Pre	4.1 (17.3)	1.0 (0.0)	5.3 (28.0)	3.6 (13.3)	2.9 (8.0)	4.1 (17.3)	34.99	143.2	89.1
Oxyfluorfen	0.15	Pre.	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	5.2 (28.0)	3.8 (17.3)	1.0 (0.0)	21.13	4.3	12.7
Farmer's Practices	-	2 HW & earthing up	3.0 (18.6)	1.0 (0.0)	2.3 (8.0)	5.0 (26.6)	3.7 (13.3)	1.4 (1.3)	39.13	20.5	29.8
Unweeded	-	-	7.6 (57.3)	4.4 (20.6)	3.4 (16.0)	8.1 (6.3)	4.0 (16.0)	4.5 (22.6)	142.02	317.3	229.7
LSD (P=0.05)			2.2	1.8	2.3	2.4	2.1	2.0	16.9	40.9	28.9

DAP – Days after planting; HW – Hand weeding; * During 2002; Ph=*Phalaris*, *Lo= Lolium*, *Ana=Anagalis*, *Ech=Echinochloa*, *Pan=Panicum*, *Poly=Polygonum*; The data transformed to square root transformation, The data in parentheses are the mean of original values

All the weed control treatments except atrazine and prometryn each at 1.0 kg/ha significantly reduced *L. temulentum* over weedy check. The treatments other than atrazine and prometryn each at 1.0 kg/ha were statistically equal in influencing *L. temulentum*. The count of *A. arvensis* was significantly lower in oxyflourfen 0.15 kg/ha, metrobuzin 0.3 and 0.50 kg/ha, pendimethalin 1.50 kg/ha and prometryn 1.0 kg/ha treated plots. Pendimethalin 1.50 kg/ha resulted in to significantly lower count of *E. colona* and *P. dichotomiflorum*. However, paraquat 0.6 kg/ha, atrazine 1.0 kg/ha, napropamide 1.0 kg/ha and farmers practice were statistically at par with pendimethalin 1.50 kg/ha in influencing the count of *E. colona*.

Metribuzin 0.3 and 0.50 kg/ha, atrazine 1.0 and oxyflourfen 0.15 kg/ha were effective against *P. alatum*. The other herbicidal treatments were not effective in controlling *P. alatum* as the population of this weed in these treatments was not significantly different from weedy check.

All the weed control treatments brought about significant reduction in the dry matter of weeds over weedy check (Table 1). Weed dry matter accumulation was significantly lower in metribuzin 0.3 and 0.5 kg/ha, oxyflourfen 0.15 kg/ha and farmers' practice treatments. Paraquat 0.6 kg/ha, pendimethalin 1.50 kg/ha and prometryn 1.50 kg/ha were next to above treatments in influencing the dry matter accumulation by weeds.

Pendimethalin 1.50 kg/ha resulted in significantly higher potato tuber yield (Table 2). Prometryn 1.50 kg/ha in 2001 and farmers practice, metribuzin 0.50 kg/ha, oxyflourfen 0.15 kg/ha and atrazine 1.0 kg/ha during 2002 were statistically as good as pendimethalin 1.50 kg/ha in increasing potato tuber yield. Weeds in weedy plots reduced potato tuber yield by 54.0 per cent over pendimethalin at 1.50 kg/ha. WMI, AMI and IWMI were highest with pendimethalin 1.50 kg/ha followed by prometryn applied at 1.50 kg/ha.

Table 2. Effect of treatments on tuber yield, WMI, AMI, IWMI and economics in potato

Treatments	Dose (kg/ha)	Time of application	Potato tuber yield (t ha^{-1})			WMI	AMI	IWMI	Net return over weedy
			2001	2002	Mean				
Prometryn	1.0	Pre.	10.9	6.8	8.8	1.10	0.10	0.60	16175
Prometryn	1.5	Pre.	13.0	8.2	10.6	1.45	0.45	0.95	24845
Pendimethalin	1.5	Pre.	13.7	10.0	11.8	1.66	0.66	1.16	29420
Metribuzin	0.3	Post	9.6	5.4	7.5	0.42	-0.58	-0.08	9478
Metribuzin	0.5	Post	9.6	9.8	9.7	0.93	-0.07	0.43	20010
Paraquat	0.6	Post to weeds but pre to crop	11.1	8.0	9.6	0.97	-0.03	0.47	19543
Atrazine	1.0	Pre.	6.8	8.9	7.8	0.61	-0.39	0.11	11063
Isoproturon	1.5	Post (30 DAP)	10.1	7.8	9.0	1.03	0.03	0.53	16708
Napropamide	1.0	Pre	10.3	8.0	9.1	1.11	0.11	0.61	17675
Oxyfluorfen	0.15	Pre.	9.1	9.3	9.2	0.72	-0.28	0.22	17480
Farmer's Practices	-	2 HW & earthing up	9.6	9.8	9.7	0.89	-0.11	0.39	12821
Unweeded	-	-	7.2	3.7	5.5	-	-	-	-
LSD (P=0.05)			1.6	1.5	1.6	-	-	-	-

DAP – Days after planting; HW – Hand weeding

Due to higher yield, the net profit over weedy check was highest with pendimethalin at 1.50 kg/ha followed by prometryn 1.50 kg/ha and metribuzin 0.50 kg/ha. The magnitude of increase in net return due to pendimethalin 1.5 kg/ha, prometryn 1.5 kg/ha and metribuzin 0.5 kg/ha was 129.5, 93.8 and 56.0 per cent, respectively over the farmers practice of hand weeding twice and earthing up.

References

Tripathi B, Singh CM and Bhargava M 1989. Comparative efficacy of herbicides in potato under the conditions of north-western Himalaya. Pesticides **23**: 37-38.

Walia US 2003. *Weed Management*. Kalyani Publishers, B-I/292, Rajinder Nagar, Ludhiana.