

## Influence of Weed Control and Fertility Levels on the Productivity of Seed Potato Under Lahaul Valley Conditions of Himachal Pradesh

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### ABSTRACT

A field experiment comprising 12 treatment combinations of four weed control methods (atrazine at 1.0 kg ha<sup>-1</sup>, isoproturon at 1.25 kg ha<sup>-1</sup>, pendimethalin at 1.2 kg ha<sup>-1</sup> and farmer's practice) and three fertility levels (N<sub>50</sub>P<sub>50</sub>K<sub>25</sub>, N<sub>75</sub>P<sub>75</sub>K<sub>37.5</sub> and N<sub>100</sub>P<sub>100</sub>K<sub>50</sub>) was conducted at Kukumseri during four consecutive summers of 2000, 2001, 2002 and 2003. Pendimethalin at 1.2 kg ha<sup>-1</sup> was very effective against *Digitaria sanguinalis*. While atrazine at 1.0 kg ha<sup>-1</sup> gave lowest count of *Amaranth* sp. Atrazine recorded lowest total weed dry matter and significantly higher tubers plant<sup>-1</sup>, tuber yield (32.5 t ha<sup>-1</sup>), net return (Rs. 93232 ha<sup>-1</sup>) and B : C ratio (2.53). Pendimethalin and isoproturon were equally good in influencing seed potato yield. Increase in fertility level increased number of tubers, tuber weight plant<sup>-1</sup> and tuber yield significantly. 100 kg N, 100 kg P<sub>2</sub>O<sub>5</sub> and 50 kg K<sub>2</sub>O resulted in 18.6% higher yield and thereby tended to fetch Rs. 18564 more net returns ha<sup>-1</sup> as compared to 50 kg N, 50 kg P<sub>2</sub>O<sub>5</sub> and 25 kg K<sub>2</sub>O ha<sup>-1</sup>.

### INTRODUCTION

Himachal Pradesh in general and dry temperate high hills in particular are ideally suited to produce quality seed potato. Of the total area under potatoes, 88% lies in the higher hills which are covered with snow during December to March. Potato is cultivated as a main crop during summer, under long day conditions. Weed infestation in potato causes considerable yield reduction (Tripathi *et al.*, 1988; Singh, 1992; Lal, 1992). Manual and mechanical weeding is the common practice for controlling weeds. However, non-availability of labour and high labour charges are making this method uneconomical. Use of herbicides is thus essential for weed control in potato. Atrazine, isoproturon and pendimethalin have been found effective against weeds in potato (Singh *et al.*, 1984; Ahuja *et al.*, 1999). Nutrient management is an important factor for increased yields and quality of tubers. However, potential of the fertilizer can be harnessed successfully only if weeds are controlled effectively. The present investigation was, therefore, undertaken to evaluate different fertility levels in relation to weed control practices in potato.

### MATERIALS AND METHODS

A field experiment comprising treatment combinations of four weed management methods viz., pre-emergence application of atrazine at 1.0 kg ha<sup>-1</sup>, isoproturon 1.25 kg ha<sup>-1</sup>, pendimethalin at 1.2 kg ha<sup>-1</sup> and farmer's practice (earthing up at 80% tuber emergence followed by one hand weeding at 50-60 DAS) and three fertility levels (N<sub>50</sub>P<sub>50</sub>K<sub>25</sub>, N<sub>75</sub>P<sub>75</sub>K<sub>37.5</sub> and N<sub>100</sub>P<sub>100</sub>K<sub>50</sub>, figures as subscript represent dose of the respective nutrient in kg ha<sup>-1</sup>) was conducted at Highland Agricultural Research and Extension Centre, Kukumseri (2700 m altitude) in factorial randomized block design with three replications. The soil of the experimental field was sandy loam in texture having pH 6.2, 0.71% organic carbon, 251 kg available N, 35 kg available P and 212 kg available K ha<sup>-1</sup>. The potato variety 'Kufri Chandramukhi' was planted on May 2, May 19, May 10 and May 13 during 2000, 2001, 2002 and 2003, respectively. The crop was raised on the ridges 40 cm apart at 15 cm spacing and 5 cm depth. All the herbicide treatments were applied as pre-emergence with manually operated knapsack sprayer fitted with flat fan nozzle using 800 l water ha<sup>-1</sup>. Rest of the

Table 1. Effect of treatments on weeds (Mean of four seasons)

Treatment	Weed count (No. 0.25 m <sup>2</sup> )			Weed dry weight (g m <sup>2</sup> )				
	<i>Digitaria</i>	<i>Amaranthus</i>	Other weeds	2000	2001	2002	2003	Pooled
<b>Weed management</b>								
Farmer's practice	2.04 (3.7)	1.26 (1.1)	1.45 (1.7)	69.8	75.4	81.8	79.6	76.6
Pendimethalin	1.38 (1.4)	1.25 (1.1)	1.67 (2.3)	62.4	69.4	76.2	74.5	70.6
Isoproturon	2.03 (3.7)	1.52 (1.9)	1.13 (0.9)	66.3	65.8	73.3	71.3	69.2
Atrazine	2.71 (6.9)	0.99 (0.6)	1.52 (1.9)	58.7	62.1	69.3	67.4	64.4
LSD (P=0.05)	0.14	0.23	0.29	3.9	3.9	7.8	7.5	2.9
<b>Fertility levels</b>								
N <sub>50</sub> P <sub>50</sub> K <sub>25</sub>	1.90 (3.4)	1.16 (0.9)	1.30 (1.3)	57.5	61.5	68.1	66.4	63.4
N <sub>75</sub> P <sub>75</sub> K <sub>37.5</sub>	2.00 (3.8)	1.25 (1.2)	1.50 (1.8)	65.2	69.5	76.3	74.4	71.4
N <sub>100</sub> P <sub>100</sub> K <sub>50</sub>	2.20 (4.6)	1.34 (1.4)	1.53 (2.0)	70.1	73.5	80.9	78.8	75.9
LSD (P=0.05)	0.12	NS	NS	3.4	3.4	6.7	6.5	2.5

Pendimethalin at 1.2 kg ha<sup>-1</sup>, isoproturon 1.25 kg ha<sup>-1</sup> and atrazine at 1.0 kg ha<sup>-1</sup>.  
Figures in parentheses are the means of original values.

operations were in accordance with the recommended package of practices of the university. The potato crop was lifted by September end in respective years.

## RESULTS AND DISCUSSION

The weed flora consisted of *Digitaria sanguinalis* L. Scoop (58.2%), *Amaranthus* spp. (*A. viridis* and *A. spinosus*, 16.4%), *Chenopodium album* (8.1%), *Altha ludwigiis* (8%) and *Euphorbia* spp. (4.8%).

### Weed Control Methods

Pendimethalin at 1.2 kg ha<sup>-1</sup> resulted in significantly lowest *D. sanguinalis* count (Table 1), while atrazine at 1.0 kg ha<sup>-1</sup> reduced the count of *Amaranthus* spp. and isoproturon at 1.25 kg ha<sup>-1</sup> reduced the count of other weeds significantly. Atrazine at 1.0 kg ha<sup>-1</sup> recorded significantly lowest total weed dry matter. This was followed by isoproturon at 1.25 kg ha<sup>-1</sup> and pendimethalin at 1.2

kg ha<sup>-1</sup>. However, isoproturon and pendimethalin were statistically at par with each other.

Atrazine at 1.0 kg ha<sup>-1</sup> was at par with isoproturon at 1.25 kg ha<sup>-1</sup> and pendimethalin at 1.2 kg ha<sup>-1</sup> in influencing yield attributes (Table 2). But plants in atrazine treated plots produced more number of tubers plant<sup>-1</sup>. Highest tuber yield was obtained with atrazine which was 5.9% higher over farmer's practice. The higher yield due to atrazine at 1.0 kg ha<sup>-1</sup> tended to fetch Rs. 9951 ha<sup>-1</sup> more net returns over farmer's practice and highest benefit : cost ratio (2.53). Isoproturon and pendimethalin were equally good in influencing seed potato yield and thereby net returns and benefit : cost ratio.

### Fertility Levels

Increase in fertility levels increased the count of *D. sanguinalis* and total dry matter of weeds significantly (Table 1). Increase in fertility levels also increased number of tubers, tuber weight plant<sup>-1</sup> and tuber yield significantly. However, weight tuber<sup>-1</sup> due to N<sub>100</sub>P<sub>100</sub>K<sub>50</sub> fertility level was at par with

Table 2. Effect of treatments on yield attributes, yield and economics of potato (Mean of four seasons)

Treatment	Tubers plant <sup>-1</sup>	Weight tuber <sup>-1</sup> (g)	Tuber yield (t ha <sup>-1</sup> )					Net return (Rs. ha <sup>-1</sup> )	B : C ratio (Rs. ha <sup>-1</sup> )
			2000	2001	2002	2003	Pooled		
<b>Weed management</b>									
Farmer's practice	7.2	40.3	30.3	32.0	29.8	30.9	30.8	83281	2.1
Pendimethalin	7.8	41.0	31.4	32.9	30.7	30.7	31.4	88325	2.4
Isoproturon	7.9	40.9	30.9	33.1	30.3	31.5	31.4	88690	2.4
Atrazine	8.2	41.9	32.2	33.9	31.5	32.7	32.6	93232	2.5
LSD (P=0.05)	0.3	NS	1.1	0.9	1.0	0.9	0.7	-	-
<b>Fertility levels</b>									
N <sub>50</sub> P <sub>50</sub> K <sub>25</sub>	7.3	39.9	28.1	30.6	27.3	28.4	28.6	77980	2.1
N <sub>75</sub> P <sub>75</sub> K <sub>37.5</sub>	7.8	41.5	31.9	33.4	31.4	31.7	31.1	90641	2.4
N <sub>100</sub> P <sub>100</sub> K <sub>50</sub>	8.2	41.8	33.6	34.8	33.1	34.2	33.9	96544	2.5
LSD (P=0.05)	0.2	1.0	0.9	0.8	0.9	0.8	0.6	-	-

N<sub>75</sub>P<sub>75</sub>K<sub>37.5</sub> fertility level. Highest yield was recorded with 100 kg N, 100 kg P<sub>2</sub>O<sub>5</sub> and 50 kg K<sub>2</sub>O ha<sup>-1</sup> which fetched Rs. 18564 more net returns ha<sup>-1</sup> as compared to N<sub>50</sub>P<sub>50</sub>K<sub>25</sub> fertility level.

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