Himachal Journal of Agricultural Research Vol. 32(2) : 25-28, 2006

Response of seed potato to neem, sea weed extract and fertility levels under dry temperate high hills of Himachal Pradesh

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Abstract

A field experiment was conducted for two consecutive summer seasons of 2001 and 2002 at Mountain Agricultural Research and Extension Centre, Kukumseri to study the response of potato to neem and seaweed extract in relation to fertilizer application for sustainable productivity. Soil application of neem at 250 kg/ha increased plant height, haulms/plant, tubers/plant, and weight/tuber. The increase in A (>75 g) and B (50-75 g) grade potatoes due to 250 kg/ha neem over 150 kg/ha was 11.6 and 11.2%, respectively. Foliar application of seaweed extract at 22.5 g a.i./ ha increased plant height, haulms/plant, tubers/plant, weight/tuber, haulm and tuber yields significantly. Seaweed extract increased the yield of A and B grade potatoes by 7.04 and 5.89%, respectively over control. Plant height, haulms/plant, tubers/plant, weight/tuber, and yield of A and B grade potatoes increased with the increase in fertility level from 50 to 100% of the recommended dose.

Key words: Potato, fertilizers, neem, seaweed extract.

Introduction

Lahaul valley of Himachal Pradesh situated in North-West Himalayas (dry temperate high hills) has peculiar agro-climatic conditions favouring production of disease free seed potato which is in huge demand in the plains. This valley ranks first in per hectare consumption of fertilizer in the state but the use of fertilizer is imbalanced. Due to increasing cost of fertilizers, there is a need to substitute a part of inorganic fertilizers with bio-fertilizers and organic sources (Singh *et al.*, 1993) to make potato production an economically viable proposition. In this endeavour, crop neem besides being a source of nutrients in agriculture (Singh *et al.*, 1993; Upadhayay and Sharma, 2002) has been claimed to have insecticidal (Akhtar and Mahmood, 1996; Hanapur and Nandihalli, 2004) and herbicidal activity as well. The role of seaweed as a source of nutrients and growth hormone has also been established (Lopez and Pazos, 1997; Saravanan *et al.*, 2003; Shankar *et al.*, 2001). The information on these aspects especially under Lahaul valley conditions of Himachal Pradesh is lacking. Therefore, the present investigation was undertaken.

Material and Methods

A field experiment was conducted during summer seasons (May to September) of 2000 and 2001 on potato at the experimental farm of Highland Agricultural Research and Extension Centre, Kukumseri (32°44′15″ N latitude and 76°41′23″E longitude and 2772 m altitude) falling in dry temperate zone of Himachal Pradesh. The soil of experimental field was sandy loam in texture, rich in organic matter (0.7% organic C) with pH 6.8. The soil had available N 210 kg/ha, available P 33 kg/ha and K 175 kg/ha.

Twelve treatment combinations of two doses of neem (125 and 250 kg/ha), two seaweed extract treatments (sprays at complete emergence + tuber initiation + tuber development and check) and three fertility levels (50%, 75% and 100% of the recommended fertilizer) were evaluated in randomized block design with three replications. The recommended fertility rate was 100 kg/ha each of N and P_2O_5 and 50 kg/ha K_2O. Seaweed extract was applied at 22.5 g a.i./ha through 'Powerplus' (liquefied seaweed extract, 4.5% processed in Lacto Bacilli medium, a natural organic product and crop yield enhancer), a Gold Agro Product. Neem was applied through 'Crop Neem', a J.K. Chemicals and Fertilizer's Product having N 2.4%, P 3.0%, K 1.6%, Ca 2.5%, Mg 2.6%, S 1.3%, Fe 0.04 ppm, Cu 0.02 ppm, Zn 0.07 ppm and Mn 0.03 ppm.

The potato variety Kufri Chandermukhi was planted in the month of May on ridges at 45 cm x 20 cm. The N, P and K were applied through calcium

ammonium nitrate, single super phosphate and muriate of potash, respectively. The full amount of farmyard manure (20 t/ha), P and K and half dose of N were applied as basal and the remaining half of N was given one month after crop emergence. The crop was irrigated through sprinkler irrigation as and when required. Dehaulming was done 15 days before harvesting and the crop was harvested in the second fortnight of September. The data were recorded on growth, yield contributing traits and tuber yield in 4 different grades *viz.* A (>75 g), B (50-75g), C (25-50g) and D (< 25g).

Results and Discussion

Effect of fertility levels

Increase in fertility levels had a positive effect on growth and yield parameters of potato. With the increase in fertility level, the plant height, haulms/plant, tubers/plant, weight/tuber, and tuber and haulm yields increased significantly (Table 1 & 2). Application of 100% recommended fertility level resulted in 5.7 and 15.2 per cent increase in tuber yield. This led to give Rs. 10504 and 19124 additional net returns over the 75 and 50 per cent of the recommended fertility levels. Datt *et al.* (2002) reported 156% increase in tuber yield with the application of N, P and K (150+150+100 kg/ha) + 15 t FYM/ha over the control. Grewal *et al.* (1994) documented 150 kg N + 44 kg P + 84 kg K/ha, the optimum fertilizer rates in potato under Shimla hills. Increased level of fertility resulted in increased supply of nutrients which led to better tuber size as evident that with the increase in fertility level, the yield of A and B grade potatoes increased significantly. The increase in yield of A and B grade potatoes due to 100% of the recommended fertility level was 80.8 and 71.8% over 50% of the recommended fertility level and 17.7 and 21.8%, respectively over the 75% of the recommended fertility level.

Table 1. Effect of crop neem and power plus spray with graded levels of fertility on growth characters and yield attributes of potato (mean of 2 years)

Treatment	Plant height (cm))	Haulms/plant	Tubers/plant	Tuber Weight (g)
Fertility levels				
50% RD	77.6	2.92	6.8	37.7
75% RD	80.3	3.46	7.8	39.0
100% RD	82.5	4.02	8.2	40.1
CD (P = 0.05)	1.8	0.2	0.3	1.0
Neem levels (kg/ha)				
125	78.7	3.24	7.1	38.1
250	81.5	3.70	8.0	39.9
CD (P = 0.05)	1.5	0.2	0.2	0.8
Seaweed extract (500 ml/ha)				
Spray	81.6	3.68	7.7	40.1
Control	78.7	3.25	7.4	37.7
CD (P = 0.05)	1.5	0.2	0.2	0.8

VIR SOFTECH

Table 2. Effect of crop neem and power plus spray with graded levels of fertility on yield and economics of potato (mean of 2 years)

Treatment	Yield (q/ha)						Net return (Rs/ha)
	<25g tubers	25-50 g tubers	50-75g tubers	>75g tubers	Total tuber yield	Dry haulm yield	
Fertility levels							
50% of Rec.	67.6	98.2	69.8	42.7	278.2	24.3	69065
75% of Rec.	53.5	85.7	98.4	65.6	303.2	29.2	77685
100 % of Rec.	45.2	78.2	119.9	77.2	320.4	31.3	88189
CD (P = 0.05)	1.3	1.9	2.0	1.4	4.2	0.6	-
Neem levels (kg/ha)							
125	58.8	90.9	90.9	58.4	299.0	27.7	75956
250	52.1	83.8	101.1	65.2	302.4	28.8	77336
CD (P = 0.05)	1.1	1.6	1.6	1.1	3.3	0.5	-
Seaweed extract (500 ml/ha)							
Spray	54.0	85.6	98.8	63.9	302.3	28.7	77410
Control	56.8	89.1	93.3	59.7	298.9	27.8	75882
CD (P = 0.05)	1.1	1.6	1.6	1.1	3.3	0.6	-

VIR SOFTECH

Effect of crop neem

Growth and yield attributes of potato were significantly affected with the application of neem (Table 1). Soil application of crop neem at 250 kg/ha resulted in significantly taller plants, increased number of haulms/plant, tubers/plant and weight/tuber. The increase in growth and yield contributing traits owing to 250 kg/ha neem tended to increase tuber and haulm yields significantly over 125 kg/ha crop neem (Table 2). The increase in potato yield owing to application of neem has been documented (Singh *et al.*, 1993; Upadhayay and Sharma, 2002). It is interesting to note that while neem at 250 kg/ha resulted in significantly higher yield of A (>75 g) and B (50-75 g) grade potatoes, gave lower yield of C (25-50 g) and D (<25 g) grade potatoes over its rate at 125 kg/ha. This indicated that at higher rate neem played a pivotal role in increasing the size of the potato tubers. However, the average increase in tuber yield owing to 250 kg/ha was only 2.4 per cent.

Effect of seaweed extract

Foliar application of seaweed extract increased plant height, haulms/plant, number of tubers/plant, weight/tuber, haulm and tuber yields significantly over control. The average increase in tuber yield over the control treatment owing to seaweed extract spray irrespective of the size of the tubers was only 2.5 per cent. The additional net returns were also small (Rs. 1528/ha). However, the hormonal effect of the seaweed extract brought about significant increase in the yield of A and B grade tubers (Table2) over control. The significantly response of seaweed extract in enhancing crop yield has also been well documented (Lopez and Pazos, 1997; Saravanan *et al.*, 2003; Shankar *et al.*, 2001).

The findings of this investigation suggested an application of 250 kg/ha neem, spray of seaweed extract at 22.5 g a.i./ha along with recommended fertilizer dose for higher sustained productivity of potatoes under Lahaul valley conditions of Himachal Pradesh.

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