Indian Journal of Agricultural Sciences **81** (4): 386–8, April 2011

Bio-efficacy of herbicides against complex weed flora in potato (*Solanum tuberosum*) crop grown through mini plants*

RASHMI YADAV[1] and VANDANA A KUMAR[2]

G B Pant University of Agriculture and Technology, Hill Campus, Ranichauri, Uttarakhand 249 199

Received: 3 August 2009; Revised accepted: 21 January 2011

Key words: Herbicides, Potato mini plants, Weed control efficiency, Tuber yield

The availability of quality seed potato (*Solanum tuberosum* L.) is a major constraint, particularly when the cost of seed alone accounts for 40–50% of total cost of production. The micro- propagation technique has reduced the number of field multiplications needed to produce the desired quantity of disease-free seed and also increased the rate of multiplication by many folds. This technology has ensured greater availability of disease-free seed for cultivation which will ultimately help in boosting the overall potato production in the country (Kumar and Pandey 2008). So, the production of potato crop through micro-tubers is an efficient alternative to conventional method because the *in vitro* methods are mainly used to generate healthy starting material, build-up nuclear stock and increase the number of individuals of the first year clones. However, one of the major bottlenecks in the cultivation of potato is heavy infestation of weeds comprised broad-leaved and narrow-leaved weeds. Weeds compete with the crop for moisture, nutrients light and space during crop growth and also serve as alternate host to several insect-pest and diseases. Manual weeding is traditional practice and quite effective but it is expensive, tedious, time consuming and also causes root injury (Khurana *et al*. 1993). In such conditions chemical control is the only method for checking the early weed growth, reduces mechanical damage to the plants and to check the spread of mechanically transmitted viruses. However, information on the weed management in potato crop production through plantation of seedlings developed by micro-tubers is still limited. Keeping this in view, an experiment was carried-out to evaluate the bio-efficacy of different herbicides to control the complex weed flora in potato seedling plantation developed through micro-tubers.

A field experiment was conducted during rainy (*kharif*) season of 2007 and 2008 at the university campus, Ranichauri, Tehri Gahwal, Uttarakhand, which is situated between 30°18'N latitude and 78°24' E longitude at an altitude of 1 827 m above mean sea level. Region falls under humid temperate type of climate. During both the crop season a mean rainfall of 893.52 mm was received distributed over 52 days. The maximum temperature varied between 22.3 and 24.1°C during crop seasons. Similarly, minimum temperature varied between 11.9 and 16.1°C. The soil of Hill Campus is silty-clay loam in texture, low in available nitrogen, phosphorous and rich in available potassium. The depth of soil extended up to 1 m. The experiment was laid out in randomized block design with three replications per treatment and the treatments consisted of five herbicides and manual weeding, viz Simazine 500 g ai/ha, Paraquat dichloride 24% SL 500 g ai/ha, Metribuzin 70% WP 525 g ai/ha, two hand-weeding at 15 and 30 days after planting and the weedy check. The herbicides were applied by using knapsack sprayer fitted with flat fan nozzle and a directing hood using 500 litres of water/ha as post-emergence inter-row directed application on weeds of 2–3 leaf stage, ie 24 days after planting against complex weed-flora of potato. In case of Metribuzin the spray was done without hood. Micro-tubers of 'Kufri Himalini' potato variety were developed using *in vitro* methods (Kumar and Kumar 2004). After suitable time of storage to overcome the dormancy of micro-tubers were germinated in poly-house, developed as seedlings of 10–12 cm length and transplanted in field at 60 cm ×15 cm spacing. Density and dry weight of weeds/m^2 were taken using quadrants in each plot and then removing the weeds from base and drying them in oven at 60°C at 15, 30 and 45 days after sowing in case of all the treatments including two hand-weeding and weedy check. The data were subjected to square root transformation prior to statistical analysis.

The major weeds associated with potato crop were, *Echinochloa crusgalli* (L.) P Beauv, *Eleusine indica* Gaerts., *Digitaria sanguinalis* (L) Scop., *Dactyloctenium aegyptium* L., *Echinocloa colona* L. Link, *Setaria* sp. etc. *Oxalis latifolia*

*Short note

Present address:[1]Junior Scientist (Agronomy) (email: rashmiyadav74@rediffmail.com), [2]Professor (Biochemistry) (email: vandanaakumar@gmail.com)

Table 1 Bio-efficacy evaluation of herbicides against complex weeds flora population (no./m^2) and dry weight (g/m^2) in potato crop (mean of two years)

Treatment	Weed density/m^2 (no./m^2)											Weeds dry wt (g/m^2)	
	Grassy weeds					Sedges and broad-leaved weeds							
	Ec	Ei	Ds	Da	Others	Ol	Cr	Tm	Cs	Aa	Others	Grassy weeds	Sedges, broad-leaved weeds
T_1- Simazine @ 500 g ai/ha	7.6 (2.93)	8.4 (3.07)	4.5 (2.35)	3.4 (2.10)	2.2 (1.79)	30.4 (5.60)	24.4 (5.04)	5.4 (2.53)	18.2 (4.38)	10.4 (3.38)	10.5 (3.39)	7.92	17.00
T_2-Paraquat dichloride 24% SL 500 g ai/ha	10.2 (3.35)	11.2 (3.49)	4.4 (2.32)	5.4 (2.53)	3.5 (2.12)	32.3 (5.77)	25.4 (5.14)	6.5 (2.74)	19.2 (4.49)	10.5 (3.39)	10.5 (3.39)	8.74	18.66
T_3-Metribuzin 70% WP 525 g ai/ha	9.5 (3.24)	9.4 (3.22)	3.4 (2.10)	3.2 (2.05)	3.2 (2.05)	31.5 (5.70)	24.4 (5.04)	5.5 (2.55)	18.4 (4.40)	10.4 (3.38)	10.4 (3.38)	7.93	17.14
T_4- Two hand weeding (15, 30 DAS)	4.5 (2.35)	6.2 (2.68)	2.2 (1.79)	2.2 (1.79)	1.4 (1.55)	7.4 (2.90)	6.5 (2.74)	4.2 (2.28)	2.2 (1.79)	4.4 (2.32)	2.2 (1.79)	4.22	5.30
T_5- Weedy check	83.5 (9.19)	51.4 (7.24)	60.2 (7.82)	34.5 (5.96)	27.4 (5.33)	121.2 (11.05)	114.4 (10.74)	50.5 (7.18)	79.3 (8.96)	64.4 (8.09)	80.5 (9.03)	42.00	137.58
CD (*P*=0.05)	(0.09)	(0.05)	(0.78)	(0.06)	(0.26)	(0.09)	(0.13)	(0.04)	(0.12)	(0.18)	(0.16)	0.35	0.31

Ec, *Echinochloa crusgalli;* Ei, *Eleusine indica;* Ds, *Digitaria sanguinalis;* Da, *Dactyloctenium aegyptium;* Other grassy, *Echinocloa colona*, *Setaria* sp. etc; Ol, *Oxalis latifolia;* Cr, *Cyperus rotundus;* Tm, *Trianthema monogyna;* Cs, *Chenopodium* sp.; Aa, *Anagallis arvensis;* other sedges and broad-leaved weeds, *Cyperus iria*, *Trianthema portulacastrum*, *Melilotus* spp, *Portulaca* sp. and *Physalis* sp. etc.

Figures in parentheses are square root (√X+1) transformed values

Bk, *Cyperus rotundus* L., *Trianthema monogyna*, *Chenopodium* sp., *Anagallis arvensis*, Other sedges and broad-leaved weeds were *Cyperus iria*, *Trianthema portulacastrum* L., *Melilotus* spp, *Portulaca* sp. and *Physalis* sp. etc. *Echinochloa crusgalli* and *Oxalis latifolia* were the most dominant ones. Maximum density of grassy and broad-leaved weeds was recorded in weedy check. All the weed control treatments significantly reduced the density of grassy weeds. The lowest weed density of grassy and broad-leaved weeds was recorded with two hand-weeding at 15 and 30 days after planting compared to rest of the treatments at 45 days after transplanting.

Data presented in Table 1 show that the highest dry matter of weeds was recorded under weedy check treatment, which was significantly higher than all other treatments. The data recorded on number of weeds/m^2 and weeds dry weight (g/m^2) at 15, 30 and 45 days after spraying revealed that two manual weeding at 15 days and 30 days after planting resulted the maximum control of weeds in potato, followed by Metribuzin 70% WP 525 g ai/ha, Simazine 500 g ai/ha and Paraquat dichloride 24% SL 500 g ai/ha. The highest weed control efficiency was recorded for 2 manual weeding, followed by Metribuzin 70% WP 525 g ai/ha. The lowest weed control efficiency was observed under Paraquat dichloride 24% SL 500 g ai/ha. Among the herbicides, Metribuzin 70% WP 525 g ai/ha resulted in the maximum reduction in weed intensity and weed biomass, followed by Simazine 500 g ai/ha. Similar findings have been reported earlier also by Yadav *et al*. (1999).

Table 2 Effect of various herbicides on weed control efficiency, weed index and tuber yield of potato crop (mean of two years)

Treatment	Tuber yield of potato (tonnes/ha)	Weed control efficiency (%)
T_1- Simazine @ 500 g ai/ha	25.97	86.12
T_2- Paraquat dichloride 24% SL 500 g ai/ha	24.22	84.74
T_3- Metribuzin 70% WP 525 g a.i/ha	24.36	86.03
T_4- Two hand weeding (15, 30 DAS)	27.51	94.69
T_5- Weedy check	14.86	0.0
CD (*P*= 0.05)	2.89	

The potato tuber yield was less when the weeds were allowed to compete with the crop throughout the crop period in the weedy check plots but the yield increased identically when the weeds were controlled either by herbicides or hand weeded twice due to elimination of all types of weeds during the critical period of crop-weed competition. The maximum potato tuber yield (27.51 tonnes/ha) was obtained with two hand weeding (15 and 30 days after planting) and it was at par with Simazine 500 g ai/ha (25.97 tonnes/ha), followed by Metribuzin 70% WP 525 g ai/ha and Paraquat dichloride 24% SL 500 g ai/ha (Table 2). The lowest potato tuber yield

(14.86 tonnes/ha) was found with weedy check. It was concluded that application of Simazine 500 g ai/ha can used as alternative to hand weeding for management of complex weed flora in potato.

SUMMARY

An experiment was conducted during rainy (*kharif*) season of 2007 and 2008 to evaluate the bio-efficacy of different herbicides to control the complex weed flora in potato seedling plantation developed through micro-tubers. It was found that the highest weed control efficiency was recorded under that two manual weeding, followed by Metribuzin 70% WP 525 g ai/ha. The maximum potato tuber-yield (27.51 tonnes/ha) was obtained with two hand weeding (15 and 30 days after planting) and it was at par with Simazine 500 g ai/ha (25.97 tonnes/ha), followed by Metribuzin 70% WP 525 g ai/ha.

REFERENCES

Khurana SC, Thakral KK and Bhatia KK. 1993. Effect of pendimethalin and isoproturon on weeds and tubers yield of potato. *Indian Potato Association* **20** (3–4): 255–7

Kumar A and Kumar VA. 2004. Potato biotechnology in India-present status and future prospects. 5th World Potato Congress held during 25–27 March, 2004 at Kunming, China.

Kumar A and Pandey S K. 2008. *Impact of Potato Research in India*. Global Potato Conference held during 9–12 December 2008 2008 at New Delhi.

Yadav A, Malik RK, Banga RS and Kumar S. 1999. Chemical weed control in potato (*Solanum tuberosum*). *Indian Journal of Agronomy* **44** (3): 830–4.