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Efficacy of selective and non-selective herbicide for broad-spectrum weed management in potato (*Solanum tuberosum* L.)

Md. Hedayetullah, Javed Akhtar, Champak Kumar Kundu, Bhaskar Rajbanshi and Kanu Murmu

Abstract

India is the second largest producer of potato in the world. The productivity of the major potato growing region (Indo-Gangetic Plains) is often hampered due to weed infestation during early crop growth stage. Thus, chemical weed control often becomes necessary to tackle this problem. A field experiment was conducted in AB Block Farm, BCKV, Kalyani to evaluate the effectiveness of some selective and non-selective herbicide in aspect of broad-spectrum weed management. Different weed parameters were recorded for different grassy, broadleaf and sedge weed species. Dominant weed species found in the field were *Cyperus rotundus*, *Cynodon dactylon*, *Parthenium hysterophorus*, *Chenopodium album*, *Physalis minima* and *Cucumis melo*. The outcomes of the result indicated that Paraquat dichloride 24% SL @ 2 L ha⁻¹ had a lower weed density (no. m⁻²) and weed dry weight (g m⁻²). This treatment also recorded a higher weed control efficiency (%) than the other treatments. Paraquat dichloride 24% SL @ 2 L ha⁻¹ also recorded a higher tuber yield over the other treatments.

Keywords: Herbicides, weed species, WCE, weed management, tuber crop, potato yield

1. Introduction

Potato (*Solanum tuberosum* L.) is one of the most important tuber food crops in the world, and India ranks second in potato cultivation with an annual production of 51.3 million tonnes (Anonymous, 2018) [1]. Potato growing zone of Indian states comprising Uttar Pradesh, West Bengal, Bihar, Punjab, and Haryana produce 80% of the total potato cultivation (Chetan *et al.*, 2019) [2]. The crop weed competition at the early stage of potato crops is very crucial for controlling weed. Manual weed control along with this chemical weed control gives higher production of potato. The good agronomic practices including wider row spacing, frequent irrigations, and use of manures and fertilizers favour the environment for the early appearance of the weeds even before the germination of the tubers. Weeds can cause a loss in tuber yield by 20-80% in some cases. Thus, effective weed control is need to reduce the tuber yield loss. The manual as well as mechanical weed management involves human drudgery and becomes costlier and timely unavailable compared to chemical weed management (Kumar *et al.* 2019) [4]. The weed management practices are currently being followed in potato cultivation; however, the chemical management of the weeds has become popular because of its ease, economical and effective control of the weeds (Kaur *et al.* 2016) [3]. The effective control of weeds in potato cultivation by post-emergence (POE) herbicides minimises the broad spectrum of weed i.e. grasses, sedges and broadleaf. Thus, manual labour required to apply POE herbicides and the cost of potato cultivation get reduced compared to the manual weeding. Therefore, the possibilities of applying different POE herbicide for potato crop for effective control of broad spectrum weed species.

Hence, chemical weed control through different types of post emergence herbicides in weed management practices appears to hold a great promise in dealing with effective, timely and economic weed control. However, farmers in this region usually grow potato with having proper knowledge on use of herbicide as well as others weed management practices. Therefore, keeping all these points present study was conducted to find out suitable and economically viable weed management practice during *rabi* season for potato cultivation in New Alluvial zone of West Bengal.

2. Materials and Methods

The experiment was conducted during the *rabi* season of 2021-22 at the AB block farm of BCKV, Kalyani (22°59'15.5"N 88°25'30.1"E). The study site comes under the New alluvial zone of West Bengal with average rainfall of 1650 mm and evaporation of 1502 mm. Soil properties of the study site had low organic carbon with clay loam texture having pH of 6.6 and bulk density of 1.28 g cm⁻³. The experiment was conducted in RBD design with 8 treatments and replicated thrice. The potato (*v. Kufri Jyoti*) crop was cultivated with eight different weed management practices treatments. The treatment was conducted in a plot having the dimensions of 8 m × 5 m area and the total area of potato crop cultivation was obtained by multiplying the number of treatments with treatment plot area. The crop was sown on 08.12.2017 with a spacing of 60 cm × 20 cm and harvested on 13.03.2018. The weed management practices involved the application of T₁: Paraquat dichloride 24% SL @ 1.5 L ha⁻¹, T₂: Paraquat dichloride 24% SL 2 L ha⁻¹, T₃: Diquat 24% SL 1.5 L ha⁻¹, T₄: Diquat 24% SL 2 L ha⁻¹, T₅: 2,4-D Dimethyl Amine Salt 58% SL @ 3.5 L ha⁻¹, T₆: Weed free check, T₇: Untreated control (weedy check), T₈: Paraquat dichloride 24% SL @ 4 L ha⁻¹.

Periodic observations for weed density species wise were made at 30, 45 and 60 days after crop sowing (DAS) from randomly selected five places per plot using one sq. m quadrant. The weeds per plot were uprooted and after counting species wise, weeds were dried in sun followed by in oven at 70° C for three days. Observations on yield attributes and tuber yield per plot were recorded at crop harvest and yield expressed as q ha⁻¹. Based on weed dry weight per cent weed control efficiency was calculated for each observation period.

3. Result and discussion

3.1 Weed density

The observations were made for weed density in the experimental plots and data have been presented in tables 1 to 3. Main weed species observed were *Cyperus rotundus*, *Cynodon dactylon*, *Parthenium hysterophorus*, *Chenopodium album*, *Physalis minima* and *Cucumis melo*. Weed population was found significantly low in all the treatments as compared to untreated control (weedy check) at each observation time. Amongst treatments Paraquat dichloride 24% SL @ 2.0 L ha⁻¹ was significantly equally effective to its lower (1.5 L ha⁻¹) and higher (4.0 L ha⁻¹) dose. Other treatments of Diquat 24% SL @ 1.5 L ha⁻¹ and 2.0 L ha⁻¹ and 2, 4-D Dimethyl Amine Salt 58% SL @ 3.5 L ha⁻¹ were also effective to control weeds. Weed free check plots where two hand weeding was done at 20 and 40 days after crop sowing were done registered nil weed population at 30 DAS however, in some plots weeds were recorded 45 DAS onwards. Highest weed density was recorded in untreated control (weedy check) plots due to higher weed growth.

3.2 Dry weight of weeds

The species wise weight of dried weeds recorded has been presented in Tables 4 to 6. Weed dry weight was found significantly low in all the treatments as compared to untreated control (weedy check) at each observation. Amongst treatments Paraquat dichloride 24% SL @ 2.0 L ha⁻¹ was significantly equally effective to its lower (1.5 L ha⁻¹) and higher (4.0 L ha⁻¹) dose to record low weight of weeds. Other

treatments of Diquat 24% SL @ 1.5 L ha⁻¹ and 2.0 L ha⁻¹ and 2, 4-D Dimethyl Amine Salt 58% SL @ 3.5 L ha⁻¹ also recorded low weight of weeds. Hence these treatments were also effective to control growth of weeds. Weed free check plots where two hand weeding was done at 20 and 40 days after crop sowing were done registered nil weed weight at 30 DAS as population was also nil at 30 DAS. Low weed weight was recorded in the plots at 45 and 60 DAS as compared to other treatments. Highest weed dry weight was recorded in untreated control (weedy check) due to higher weed density and weed growth.

3.3 Weed Control Efficiency

Weed control efficiency (WCE) over untreated control (weedy check) was calculated based on weed dry weight recorded at 30, 45 and 60 DAS and presented in tables 7 to 9. The weed control efficiency was found to be higher in all the treatments including weed free check plots. Amongst treatments Paraquat dichloride 24% SL @ 1.5 L ha⁻¹, 2.0 L ha⁻¹ and 4.0 L ha⁻¹ recorded high weed control efficiency, which was comparable to weed control efficiency recorded in other treatments viz., Diquat 24% SL @ 1.5 L ha⁻¹ and 2.0 L ha⁻¹ and 2, 4-D Dimethyl Amine Salt 58% SL @ 3.5 L ha⁻¹ and weed free check plots. Mamnoie *et al.* (2016) [5] also reported similar results.

3.4 Growth, yield attributes and yield of potato

The results of the experiment showed that herbicidal treatments significantly influenced the growth and yield attributes (plant height, number of haulms plant⁻¹, number of tubers plant⁻¹, tuber length and tuber width) and yield of potato tuber, which were comparable to hand weeding at 20 and 40 days after crop sowing (Table 10). Highest plant height of 39.53 cm was recorded with treatment T₁ (Paraquat dichloride 24% SL @ 1.5 L ha⁻¹). The maximum number of haulms plant⁻¹ (4.00 plant⁻¹) and tubers plant⁻¹ (8.73 plant⁻¹) was recorded with application of Paraquat dichloride 24% SL @ 1.5 L ha⁻¹ among the different chemical weed control methods. Maximum tuber length (64.63 cm) and width (40.10 cm) was recorded with treatment T₈ (Paraquat dichloride 24% SL @ 4 L ha⁻¹). Highest tuber yield (163.03 q ha⁻¹) was recorded with treatment of Paraquat dichloride 24% SL applied @ 2.0 L ha⁻¹ (T₂) followed by its higher dose @ 4.0 L ha⁻¹ (153.20 q ha⁻¹), diquat dichloride 24% SL @ 2.0 lit ha⁻¹ (147.22 q ha⁻¹) and Paraquat dichloride 24% SL @ 1.5 L ha⁻¹ (144.78 q ha⁻¹). The findings were similar to the findings of Chetan *et al.* (2019) [2] and Tomar *et al.* (2008) [6].

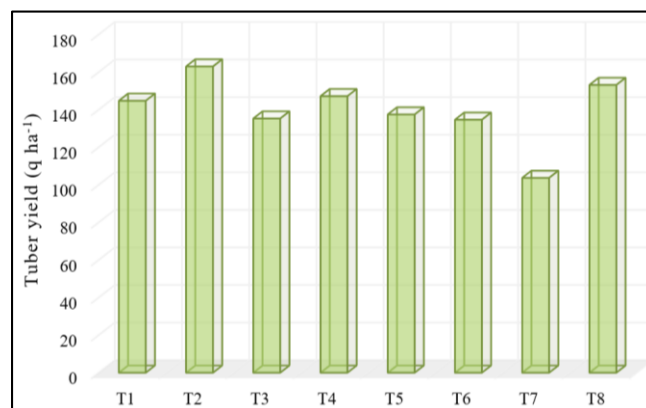


Fig 1: Tuber yield as varied with different weed management practices

Table 1: Effect of Paraquat dichloride 24% SL on number of weeds at various crop stage of potato

Treatment		Doses (L ha ⁻¹)	Weed density (no. m ⁻²)					
			<i>Cynodon dactylon</i>			<i>Cyperus rotundus</i>		
			30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS
T ₁	Paraquat dichloride 24% SL	1.5	2.48 (5.67)	1.83 (2.87)	1.98 (3.47)	2.64 (6.47)	3.60 (12.47)	4.80 (22.60)
T ₂	Paraquat dichloride 24% SL	2.0	2.30 (4.80)	1.60 (2.07)	1.74 (2.53)	2.21 (4.40)	2.82 (7.47)	3.65 (12.93)
T ₃	Diquat 24% SL	1.5	2.63 (6.47)	1.94 (3.27)	2.02 (3.60)	2.73 (6.93)	3.45 (11.40)	5.09 (25.40)
T ₄	Diquat 24% SL	2.0	2.31 (4.87)	1.75 (2.60)	1.87 (3.00)	2.39 (5.20)	2.86 (7.73)	3.86 (14.47)
T ₅	2,4-D Dimethyl Amine Salt 58% SL	3.5	2.37 (5.13)	1.80 (2.73)	2.39 (5.20)	2.24 (4.53)	3.52 (11.93)	3.56 (12.27)
T ₆	Weed free check	--	0.71 (0.00)	0.71 (0.00)	1.13 (0.87)	0.71 (0.00)	0.71 (0.00)	2.51 (5.87)
T ₇	Untreated control (weedy check)	--	3.46 (11.47)	3.74 (13.47)	4.54 (20.13)	5.09 (25.47)	6.63 (43.47)	7.88 (61.67)
T ₈	Paraquat dichloride 24% SL	4.0	1.85 (2.93)	1.51 (1.80)	1.55 (1.93)	2.00 (3.53)	2.53 (5.93)	3.16 (9.53)
CD 5%			0.31	0.24	0.38	0.25	0.40	0.47
Result			Sig	Sig	Sig	Sig	Sig	Sig

Figure in parentheses are original value which are subjected to square root transformation $\sqrt{(x+0.5)}$

Table 2: Effect of Paraquat dichloride 24% SL on number of weeds at various crop stage of potato

Treatment		Doses (L ha ⁻¹)	Weed density (no. m ⁻²)					
			<i>Parthenium hysterophorus</i>			<i>Physalis minima</i>		
			30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS
T ₁	Paraquat dichloride 24% SL	1.5	1.60 (2.07)	2.06 (3.73)	2.74 (7.00)	0.71 (0.00)	1.87 (3.00)	1.68 (2.33)
T ₂	Paraquat dichloride 24% SL	2.0	1.47 (1.67)	1.47 (1.67)	2.17 (4.20)	0.71 (0.00)	1.68 (2.33)	1.21 (1.00)
T ₃	Diquat 24% SL	1.5	2.20 (4.33)	1.87 (3.00)	3.08 (9.00)	0.71 (0.00)	2.27 (4.67)	2.29 (4.73)
T ₄	Diquat 24% SL	2.0	1.58 (2.00)	2.12 (4.00)	2.56 (6.07)	0.71 (0.00)	1.70 (2.40)	1.57 (2.00)
T ₅	2,4-D Dimethyl Amine Salt 58% SL	3.5	1.78 (2.67)	1.59 (2.07)	1.25 (1.07)	0.71 (0.00)	2.80 (7.33)	2.96 (8.27)
T ₆	Weed free check	--	0.71 (0.00)	0.71 (0.00)	1.62 (2.13)	0.71 (0.00)	1.15 (0.93)	1.38 (1.40)
T ₇	Untreated control (weedy check)	--	2.86 (7.67)	3.53 (12.00)	4.28 (17.87)	1.92 (3.20)	3.92 (14.87)	4.60 (20.73)
T ₈	Paraquat dichloride 24% SL	4.0	1.35 (1.33)	1.45 (1.60)	1.71 (2.47)	0.71 (0.00)	1.65 (2.27)	2.04 (3.67)
CD 5%			0.17	0.24	0.22	0.10	0.34	0.26
Result			Sig	Sig	Sig	Sig	Sig	Sig

Figure in parentheses are original value which are subjected to square root transformation $\sqrt{(x+0.5)}$

Table 3: Effect of Paraquat dichloride 24% SL on number of weeds of potato at various stage of crop

Treatment		Doses (L ha ⁻¹)	Weed density (no. m ⁻²)					
			<i>Chenopodium album</i>			<i>Cucumis melo</i>		
			30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS
T ₁	Paraquat dichloride 24% SL	1.5	0.71 (0.00)	1.77 (2.67)	1.47 (1.67)	2.80 (7.33)	3.08 (9.00)	3.76 (13.67)
T ₂	Paraquat dichloride 24% SL	2.0	0.71 (0.00)	1.35 (1.33)	1.32 (1.27)	3.29 (10.33)	2.34 (5.00)	2.68 (6.67)
T ₃	Diquat 24% SL	1.5	0.71 (0.00)	1.58 (2.00)	1.35 (1.33)	3.53 (12.00)	3.28 (10.27)	3.44 (11.33)
T ₄	Diquat 24% SL	2.0	0.71 (0.00)	2.14 (4.07)	1.47 (1.67)	3.67 (13.00)	3.10 (9.13)	3.89 (14.67)
T ₅	2,4-D Dimethyl Amine Salt 58% SL	3.5	0.87 (0.27)	1.68 (2.33)	1.40 (1.53)	2.61 (6.33)	2.04 (3.67)	2.72 (6.93)
T ₆	Weed free check	--	0.71 (0.00)	0.95 (0.53)	1.22 (1.00)	0.71 (0.00)	1.50 (2.07)	2.74 (7.07)
T ₇	Untreated control (weedy check)	--	1.19 (0.93)	2.93 (8.07)	2.45 (5.53)	4.81 (22.73)	5.59 (30.73)	5.05 (25.00)
T ₈	Paraquat dichloride 24% SL	4.0	0.71 (0.00)	1.35 (1.33)	1.27 (1.13)	2.03 (3.67)	2.01 (3.53)	2.56 (6.07)
CD 5%			0.11	0.33	0.30	0.34	0.48	0.26
Result			Sig	Sig	Sig	Sig	Sig	Sig

Figure in parentheses are original value which are subjected to square root transformation $\sqrt{(x+0.5)}$

Table 4: Effect of Paraquat dichloride 24% SL on dry weight of weeds at various crop stage of potato

Treatment		Doses (L ha ⁻¹)	Weed dry weight (g m ⁻²)					
			<i>Cynodon dactylon</i>			<i>Cyperus rotundus</i>		
			30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS
T ₁	Paraquat dichloride 24% SL	1.5	1.60 (2.07)	1.69 (2.36)	2.23 (4.48)	1.42 (1.51)	1.91 (3.16)	3.35 (10.77)
T ₂	Paraquat dichloride 24% SL	2.0	1.25 (1.07)	1.83 (2.85)	1.64 (2.23)	1.34 (1.30)	1.65 (2.23)	2.80 (7.33)
T ₃	Diquat 24% SL	1.5	1.54 (1.87)	2.21 (4.41)	2.27 (4.67)	1.70 (2.38)	1.86 (2.96)	3.65 (12.84)
T ₄	Diquat 24% SL	2.0	1.31 (1.22)	1.82 (2.82)	2.01 (3.55)	1.50 (1.75)	1.68 (2.34)	2.95 (8.25)
T ₅	2,4-D Dimethyl Amine Salt 58% SL	3.5	2.15 (4.13)	2.00 (3.51)	2.37 (5.13)	1.77 (2.62)	1.79 (2.72)	3.16 (9.48)
T ₆	Weed free check	--	0.71 (0.00)	0.71 (0.00)	1.37 (1.60)	0.71 (0.00)	0.71 (0.00)	2.03 (3.66)
T ₇	Untreated control (weedy check)	--	3.17 (9.54)	3.98 (15.41)	5.14 (25.91)	4.26 (17.64)	4.21 (17.25)	6.51 (41.93)
T ₈	Paraquat dichloride 24% SL	4.0	1.36 (1.34)	1.51 (1.81)	1.50 (1.75)	1.33 (1.27)	1.42 (1.53)	2.70 (6.79)
CD 5%			0.18	0.24	0.46	0.09	0.23	0.36
Result			Sig	Sig	Sig	Sig	Sig	Sig

Figure in parentheses are original value which are subjected to square root transformation $\sqrt{(x+0.5)}$

Table 5: Effect of Paraquat dichloride 24% SL on dry weight of weeds at various crop stage of potato

Treatment		Doses (L ha ⁻¹)	Weed dry weight (g m ⁻²)					
			<i>Parthenium hysterophorus</i>			<i>Physalis minima</i>		
			30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS
T ₁	Paraquat dichloride 24% SL	1.5	1.02 (0.54)	1.42 (1.54)	2.00 (3.49)	0.71 (0.00)	1.42 (1.51)	2.90 (7.92)
T ₂	Paraquat dichloride 24% SL	2.0	0.99 (0.48)	1.35 (1.31)	1.61 (2.08)	0.71 (0.00)	1.31 (1.22)	2.37 (5.10)
T ₃	Diquat 24% SL	1.5	1.20 (0.93)	1.61 (2.09)	2.31 (4.84)	0.71 (0.00)	1.75 (2.56)	3.37 (10.84)
T ₄	Diquat 24% SL	2.0	1.05 (0.60)	1.31 (1.23)	2.11 (3.96)	0.71 (0.00)	1.55 (1.92)	2.77 (7.17)
T ₅	2,4-D Dimethyl Amine Salt 58% SL	3.5	1.18 (0.89)	1.43 (1.54)	1.61 (2.13)	0.71 (0.00)	1.69 (2.36)	3.32 (10.53)
T ₆	Weed free check	--	0.71 (0.00)	0.71 (0.00)	1.49 (1.72)	0.71 (0.00)	1.13 (0.86)	2.16 (4.16)
T ₇	Untreated control (weedy check)	--	2.00 (3.52)	2.65 (6.53)	4.63 (20.91)	1.32 (1.24)	4.08 (16.13)	5.90 (34.37)
T ₈	Paraquat dichloride 24% SL	4.0	1.11 (0.74)	1.30 (1.19)	1.52 (1.83)	0.71 (0.00)	1.29 (1.17)	2.31 (4.86)
CD 5%			0.05	0.15	0.19	0.02	0.27	0.25
Result			Sig	Sig	Sig	Sig	Sig	Sig

Figure in parentheses are original value which are subjected to square root transformation $\sqrt{(x+0.5)}$

Table 6: Effect of Paraquat dichloride 24% SL on dry weight of weeds at various crop stage of potato

Treatment		Doses (L ha ⁻¹)	Weed dry weight (g m ⁻²)					
			<i>Chenopodium album</i>			<i>Cucumis melo</i>		
			30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS
T ₁	Paraquat dichloride 24% SL	1.5	0.71 (0.00)	1.39 (1.42)	1.69 (2.37)	1.17 (0.88)	1.75 (2.56)	2.18 (4.25)
T ₂	Paraquat dichloride 24% SL	2.0	0.71 (0.00)	1.32 (1.24)	1.60 (2.05)	1.12 (0.76)	1.68 (2.33)	1.80 (2.73)
T ₃	Diquat 24% SL	1.5	0.71 (0.00)	1.50 (1.75)	1.84 (2.87)	1.43 (1.54)	2.08 (3.82)	2.29 (4.76)
T ₄	Diquat 24% SL	2.0	0.71 (0.00)	1.30 (1.19)	1.54 (1.90)	1.20 (0.94)	1.89 (3.07)	1.83 (2.87)
T ₅	2,4-D Dimethyl Amine Salt 58% SL	3.5	0.95 (0.43)	1.35 (1.32)	1.80 (2.78)	1.39 (1.43)	2.05 (3.70)	2.01 (3.52)
T ₆	Weed free check	--	0.71 (0.00)	0.95 (0.52)	1.33 (1.28)	0.71 (0.00)	1.21 (1.10)	1.95 (3.32)
T ₇	Untreated control (weedy check)	--	1.81 (2.77)	2.76 (7.11)	3.64 (12.75)	2.49 (5.69)	3.93 (14.98)	5.08 (25.34)
T ₈	Paraquat dichloride 24% SL	4.0	0.71 (0.00)	1.26 (1.09)	1.52 (1.82)	1.11 (0.73)	2.01 (3.53)	1.65 (2.27)
CD 5%			0.15	0.26	0.24	0.12	0.29	0.26
Result			Sig	Sig	Sig	Sig	Sig	Sig

Figure in parentheses are original value which are subjected to square root transformation $\sqrt{(x+0.5)}$

Table 7: Effect of Paraquat dichloride 24% SL on per cent weed control efficiency at various crop stage of potato

Treatment	Doses (L ha ⁻¹)	Weed control efficiency (%)						
		<i>Cynodon dactylon</i>			<i>Cyperus rotundus</i>			
		30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS	
T ₁	Paraquat dichloride 24% SL	1.5	78.29	84.71	82.70	91.44	81.70	74.30
T ₂	Paraquat dichloride 24% SL	2.0	88.75	81.51	91.41	92.65	87.07	82.53
T ₃	Diquat 24% SL	1.5	80.36	71.40	81.98	86.51	82.86	69.38
T ₄	Diquat 24% SL	2.0	87.21	81.70	86.30	90.08	86.45	80.33
T ₅	2,4-D Dimethyl Amine Salt 58% SL	3.5	56.66	77.24	80.20	85.13	84.21	77.38
T ₆	Weed free check	--	100.00	100.00	93.82	100.00	100.00	91.27
T ₇	Untreated control (weedy check)	--	-	-	-	-	-	-
T ₈	Paraquat dichloride 24% SL	4.0	85.95	88.23	93.23	92.80	91.13	83.80

Table 8: Effect of Paraquat dichloride 24% SL on per cent weed control efficiency at various crop stage of potato

Treatment	Doses (L ha ⁻¹)	Weed control efficiency (%)						
		<i>Parthenium hysterophorus</i>			<i>Physalis minima</i>			
		30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS	
T ₁	Paraquat dichloride 24% SL	1.5	84.56	76.37	83.31	100.00	90.62	76.96
T ₂	Paraquat dichloride 24% SL	2.0	86.46	79.94	90.05	100.00	92.42	85.16
T ₃	Diquat 24% SL	1.5	73.58	67.99	76.87	100.00	84.11	68.45
T ₄	Diquat 24% SL	2.0	82.86	81.21	81.04	100.00	88.08	79.15
T ₅	2,4-D Dimethyl Amine Salt 58% SL	3.5	74.72	76.47	89.80	100.00	85.39	69.37
T ₆	Weed free check	--	100.00	100.00	91.77	100.00	94.67	87.89
T ₇	Untreated control (weedy check)	--	-	-	-	-	-	-
T ₈	Paraquat dichloride 24% SL	4.0	78.88	81.83	91.26	100.00	92.77	85.86

Table 9: Effect of Paraquat dichloride 24% SL on per cent weed control efficiency at various crop stage of potato

Treatment	Doses (L ha ⁻¹)	Weed control efficiency (%)						
		<i>Chenopodium album</i>			<i>Cucumis melo</i>			
		30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS	
T ₁	Paraquat dichloride 24% SL	1.5	100.00	79.99	81.41	84.60	82.88	83.24
T ₂	Paraquat dichloride 24% SL	2.0	100.00	82.52	83.95	86.65	84.42	89.24
T ₃	Diquat 24% SL	1.5	100.00	75.40	77.46	72.89	74.47	81.22
T ₄	Diquat 24% SL	2.0	100.00	83.22	85.10	83.55	79.48	88.69
T ₅	2,4-D Dimethyl Amine Salt 58% SL	3.5	84.38	81.44	78.20	74.94	75.27	86.10
T ₆	Weed free check	--	100.00	92.69	89.96	100.00	92.63	86.91
T ₇	Untreated control (weedy check)	--	-	-	-	-	-	-
T ₈	Paraquat dichloride 24% SL	4.0	100.00	84.68	85.75	87.12	76.41	91.06

Table 10: Effect of Paraquat dichloride 24% SL on growth and yield parameters of potato

Treatment	Doses (L ha ⁻¹)	Plant height (cm)	No. of haulms plant ⁻¹	No. of tubers plant ⁻¹	Tuber length (mm)	Tuber width (mm)	Tuber yield (kg plot ⁻¹)	Tuber yield (q ha ⁻¹)	
T ₁	Paraquat dichloride 24% SL	1.5	39.53	4.00	8.73	62.70	33.83	57.91	144.78
T ₂	Paraquat dichloride 24% SL	2.0	36.60	3.67	8.67	59.13	37.03	65.21	163.03
T ₃	Diquat 24% SL	1.5	36.47	2.67	7.67	56.50	32.30	54.13	135.32
T ₄	Diquat 24% SL	2.0	36.53	2.40	8.20	62.13	34.93	58.89	147.22
T ₅	2,4-D Dimethyl Amine Salt 58% SL	3.5	38.33	3.13	8.07	58.67	36.13	54.99	137.48
T ₆	Weed free check	--	37.40	4.07	8.53	60.43	38.70	53.87	134.68
T ₇	Untreated control (weedy check)	--	35.47	2.47	6.00	48.07	34.33	41.49	103.73
T ₈	Paraquat dichloride 24% SL	4.0	37.13	3.73	9.67	64.63	40.10	61.28	153.20
	CD 5%		0.16	0.17	0.13	0.14	0.10	0.64	5.21
	Result		Sig	Sig	Sig	Sig	Sig	Sig	Sig

Conclusion

It is concluded that Paraquat dichloride 24% SL @ 1.5 L ha⁻¹ and 2.0 L ha⁻¹ controlled weeds in potato crop effectively with higher potato yield. The product was also found non phytotoxic to potato crop when applied up to the level of 4.0 lit ha⁻¹. Based on the studies the use of Paraquat dichloride 24% SL @ 1.5 L ha⁻¹ and 2.0 L ha⁻¹ can be suggested for the control of different weed flora in potato crop.

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