Original Research Article

Effect of chemical and mechanical weed management practices on potato (*Solanumtuberosum* L.) plant height, number of tubers and relative composition of weed under Varanasi region, Uttar Pradesh

ABSTRACT

A two-year field experiment was conducted on potato crop to evaluate the bio-efficacy of herbicides, suitable doses and their feasibility with mechanical weed control method in terms of plant height, number of tubers and relative composition of weeds.The experiment was arranged in randomized complete block design (RCBD) with three replications at the vegetable research farm Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India, during winter season of2017-18 and 2018-19. Randomly selected five plants were used as a sample for recording plant height and average number of tubers per plant in each plot. Plant height was measured at 30, 45, 60 DAS and at harvest then averaged and expressed in centimetre. However, the average number of tubers per plant obtained by counting the tubers from selected plant at harvest. For calculation of relative composition of weeds, by counting the number of weedsspecies at 1.0 m^2 randomly at one place in each plot at 15, 30, 45 and 60 DASthenexpressed in percent.Amongst the herbicidal weed management treatments,Paraquat dichloride 24% SL @ 2.0 L/ha had significantly taller plant at 45 and 60DASand alsoproduces the highest average number of tubers per plant. With respect to the relative composition of weeds, sedges (*Cyperusrotundus* L.) contributed the most to total weeds, followed by grasses (*Cynodondactylon* L.) and broad-leaves weeds (*Chenopodium album* L., *Partheniumhysterophorus* L., *Sonchusoleraceus* L., *Anagalisarvensis* L., *Oxalis* spp., *Spergulaarvensis* L.) at 15, 30, 45 and 60 DAS during both years. It is concluded that application of Paraquat dichloride 24% SL @ 2.0 L/hacontrol weeds more efficiently thereby it helps in vigorous plant growththusultimately increasesthe number of tubers per plant.

Keywords: Herbicide, bio-efficacy, weed, sedges, grasses, broad-leaves.

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1. INTRODUCTION

According to an estimate, about 9.7 billion people worldwide will need 70 % more food by 2050 than is currently consumed and the global food system will need to be significantly improved in order to feed this growing population in a wholesome and sustainable manner. Potato is one of the important tuber crop and the fourth most significant food crop in the world after rice, wheat and maize [1, 2]. In terms of high return per unit area, energy and protein it can be used as raw material for starch, alcohol production [3] and human feeding. In India, potato is grown throughout the country and the major *rabi* season potato growing sites includes the Indo-Gangetic Plains of Uttar Pradesh, West Bengal, Bihar, Gujarat, Madhya Pradesh, Punjab, Assam, Chhattisgarh, Jharkhand and Haryana, which contributes nearly 80% of the total potato production in the country. In contrast, the major *kharif* season potato growing sites are Maharashtra, Uttarakhand, Karnataka, Himachal Pradesh and Tamil Nadu. Potato plays a major role in solving these because of their medium to short growing period, high yield potential, nutritional significance and economic viabilities act as patronage to food, nutrition and employment.

The total potato production in India is 56.173 million tonneswhich rank first amongst vegetables with an area of 2.203 million hectares and with an average productivity of 25.49 t/ha. Uttar Pradesh ranks first in total vegetable production,i.e. 29.160 million tonnesunder an area of 1.307 million hectares. However, total potato production in Uttar Pradesh is15.811 million tonnes under an area of 0.620 million hectares with an average productivity of 25.48 t/ha[4]

Because of its diverse distribution patterncultivation of potato predominantly relies upon weed management practices. The wider row spacing, use of manures and fertilizers, and regular irrigations make the favorable conditions for weed establishment as a result of interference in potato weeds compete with potato crop for water, light, and nutrients during the early crop growth stage. Before germination of the tubers, it may cause significant reduction in the number of tuber and ultimately reduces tuber yield up to 40-65% or more sometimes [5]. This weed flora includes broad leaves, grasses and sedges.

Therefore, effective weed control is required to reduce the competitive effect between crop and weeds and tuber yield loss caused by weed populations. Weed management by traditional practices, i.e. manual and mechanical weed management is very effective, but due to the high cost of operation, labor intensive, tedious and time consuming process makes it costlier and un-feasible to farmers as compared to chemical weed management[6, 7, 8]. Since different weed management practices have followed in potato growing fields infested with weeds but chemical weed control becomes more popular among farmers because of its ease, superior efficiency, economic and effective control of the weeds [9, 10] but the major drawback is selection of herbicides, rate of application and application timings should be suited to the degree of weed infestation, the optimal date for using of herbicides and prevailing agro-ecological condition of particular region required to eliminate a wide spectrum of weeds [11, 12].

At present application of herbicides and the planting of potatoes are done separately as two different operations; therefore, the effective control of weeds in potato cultivation by pre and post-emergence herbicides give a possibility to overcome these weeds and their intensity during the peak period of crop growth. Nowadays, chemicals like Paraquat and Oxyfluorfen as early emergence is highly preferred for weed control in potato because less laborious and quick response helps in timely weed control and covers large area in a short time.

Paraquat dichloride (1, 1-di-methy l, 4, 4-bi-pyridylium di-chloride) comes under group bipyridilium, a non-selective contact herbicide and absorbed by the foliage and destroys plant tissue by disrupting photosynthesis activities and rupturing the cell membranes. It is profoundly stable in soil and impervious to microbial degradation under aerobic and anaerobic conditions, it doesn't go through hydrolysis and photodegradation in aqueous solutions and the environmental dissipation occurs mainly by sorption of biological materials and soil clay particles which results in environmentally inactive. Oxyfluorfen (2-Chloro 1, 3-ethoxy, 4-nitrophenoxy, 4 tri-fluoromethyl benzene) belongs to diphenyl-ether group herbicide [13] which is also a contact herbicide used for the control of annual broadleaf and grassy weeds in potato [14]. Oxyfluorfen mainly used as a pre and post-emergence[15] for herbicidal activities in plants and mainly degraded by photolysis.

To find out suitable doses of herbicide and compare herbicide feasibility with mechanical weed control methodsa two years field experiment was carried out at Vegetable Research Farm, Department of Horticulture, Institute of Agricultural Sciences, BHU, Varanasi, during the *rabi* seasons of 2017-18 and 2018-19 with the specific objectives to find out the Effect of chemical and mechanical weed management practices onpotato plant height, number of tubers and relative composition of weed under Varanasi region, Uttar Pradesh.

2. MATERIALS AND METHODS

The present investigation was carried out during the winters of 2017-18 and 2018-19 at Vegetable Research Farm, Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India. The experiment field was located at 25º18' N latitudes and 83º03' E longitudes with an elevation of 75.7 meters above the mean sea level (MSL) for both years of investigation. The experimental site lies approximately in the centre of north Gangetic alluvial plain.

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Varanasi region possesses sub-tropical climate having semi-arid to sub-humid climate with extremes heat in summer and cold in winter. The climate of the region has been divided into three seasons*viz*. rainy season (June to September), winter season (October to March) and summer season (April to mid-June). The average temperature ranges from 18°C to 32°C. May and June are the hottest months with mean maximum temperature ranging from 40°C to 45°C while the minimum, may drop down to as low as 4°C during December to January. The normal period for the onset of the monsoon is third week of June, which last up to the end of September or sometimes to the first week of October. During the crop season first year have seen no precipitation, however the second year have just seen a cumulative rainfall of 29.4 mm. Even in the second year, the highest amount of rain, 13.0 mm, fell during the week of January 22-28. The average weekly maximum temperature (^{o}C) during crop growing period (40th to 10th meteorological week) ranged from 16.1 to 34.1 ^{o}C, with an average of 26.6 ^{o}C during winter 2017-18 and 19.8 to 34.2 ^{o}C having an average of 26.0 ^{o}C during winter 2018-19, respectively. The average weekly minimum temperature (^{o}C) during crop growing period (40th to 10th meteorological week) ranged from 5.9 to 25.2 ^{o}C with an average of 12.7 ^{o}C in winter 2017-18 and 3.9 to 20.8 ^{o}C having an average of 10.5 ^{o}C in winter 2018-19, respectively. The mean weekly minimum relative humidity (%) during crop growing period (40th to 10th meteorological week) ranged from 36 to 71 % with an average of 51.5 % in winter 2017-18 and 38 to 69 % having an average of 49.0 % in winter 2018-19, respectively.

The soil was alluvial with good drainage and moderate water holding capacity with low available nitrogen and medium in accessible phosphorus and potassium. In order to evaluate the physicochemical properties, soil samples were collected before planting the potato tuber from 5 randomly selected spots at a depth varying from 0-30 cm from the experimental plot. The experiment was laid out in a randomized block design consistingof12treatmentsand replicated threetimes. The treatments along withtheirsymbols aregiven inTable 1.The gross and net plot size of the treatments were 3.0 m x 4.0 m (12 m^{2}) and 2.4 m x 3 m (7.2 m^{2}), respectively. Two main irrigation channels of 1.0 m in width were prepared in the experimental field to meet the irrigation requirement,the one-meter area is left around the field for the border line of the same crop.

Table 1 Details of treatments.

Treatment	Herbicide	Dose
T_1	Oxyfluorfen 23.5 % EC	0.45L/ha
T_2	Oxyfluorfen 23.5 % EC	0.55L/ha
T_3	Oxyfluorfen 23.5 % EC	0.65L/ha
T_4	Oxyfluorfen 23.5 % EC	0.75L/ha
T_5	Oxyfluorfen 23.5 % EC	0.85L/ha
T_6	Paraquat dichloride 24 % SL	1.75 L/ha
T_7	Paraquat dichloride 24 % SL	2.0 L/ha
T_8	Paraquat dichloride 24 % SL	2.25 L/ha
T_9	Paraquat dichloride 24 % SL	2.5 L/ha
T_{10}	2,4-d Dimethyl Amine Salt 58 % SL	3.5 L/ha
T_{11}	Untreated control (weed free check) (hand weeding at 20 & 40 DAS)	--
T_{12}	Untreated control (weedy check)	--

A spacing of 60 cm between rows and 15 cm within the plantswas adopted for all treatments. Oxyfluorfen and 2,4-d dimethyl amine salt was applied as pre-emergence of crop at 3-4 days after tuber planting and Paraquat dichloride was applied as post- emergence after 5-10 % crop emergence.Seed tubers of KufriJyoti were soaked in solution of Dithane M-45 @ 2g l^{-1}and soaked them for 10 minutes before planting and then allowed to dry in shade for 30 minutes prior to planting into the field. Dig a trench to a depth of about 10 cm and place the seed potato into the trench with the rose end facing upwards with a spacing of 60 cm between rows and 15 cm within the plant.

A common dose of farmyard manure i.e. 30 tonnes per hectare was applied to the experimental land area uniformly in the last ploughing and incorporated into the soil. The recommended dose of nitrogen (150 kg ha^{-1}) was applied in two splits doses viz., half dose as a basal dressing at the time of planting and the remaining half dose at the time of earthing-up in each plot. The whole quantity of

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phosphate (80 kg ha^{-1}) and potash (120 kg ha^{-1}) were applied along with the basal dose of nitrogen in each plot. The sources of Nitrogen, Phosphorus and Potash were applied through Urea, Single Super Phosphate and Muriate of Potash respectively. The top dressing of nitrogen was doneat 40 days after planting during the early vegetative growth period.For the preparation of herbicidal spray solution, the required quantity of herbicide measure weighed/volume and all above the herbicides were dissolved in water separately. Subsequently, solution of different concentrations was prepared by the addition of the required quantity of distilled water before spraying.The fresh herbicidal solution was sprayed on weed flora in aqueous form by using a Knapsack sprayer fitted with flat fan nozzle and the weed flora were wetted thoroughly with a fine mist and all necessary precautions were taken into account during the spraying of chemicals.

Five plants per experimental plot as a sample size via a random sampling technique were used to record the test crops' growth and development. Plant height from the base of the plant to tip of the main stem was measured with the help of a scale. Plant length was measured at 30, 45, 60 DAS and harvest and expressed in centimetres. The number of tubers per plant was obtained by counting the number of tubers from the randomly selected five plants in each plot. Weed samples were randomly collected by placing a quadrate (1.0 x 1.0 m) at one place in each plot. The observations were taken at different stages viz., at 15, 30, 45 and 60 DAS and at harvest. The data related to relative composition of different weed species was calculatedby using the following formula and averaging respective weed populations in weedy check treatments.

$$\text{Relative composition of weeds (\%)} = \frac{\text{Number of individual species}}{\text{Total number of weeds}} \times 100$$

The data obtained by various observations during the course of investigation were subjected to statistical analysis for determining the significance of difference between the treatments and to draw valid conclusion by adopting an appropriate method of 'Analysis of Variance' for randomized complete block design (RCBD) as described by Cochran and Cox (1963)[16].

3. RESULTS AND DISCUSSION

Effect of chemical and mechanical weed management practices on potato (*Solanumtuberosum* L.) plant height, number of tubers and relative composition of weed under Varanasi region, Uttar Pradesh

3.1 Plant height (cm)

At 30 DAS an examination of data reveals that amongst the herbicidal weed management treatments did not differed significantly. However, Paraquat dichloride 24% SL @ 2.0 L/ha had taller plant which were statistically at par with all the treatments during both the years of experiment. It is evident from the result at 45 DAS that amongst the herbicidal weed managementParaquat dichloride 24% SL @ 2.0 L/ha had taller plant which were statistically at par with Oxyfluorfen 23.5% EC @ 0.75 and 0.85L/ha, Paraquat dichloride 24% SL @ 1.75 and 2.25 L/ha and 2,4-d Dimethyl Amine Salt 58% SL @ 3.5 L/ha during both the years of experimentation.At 60 DAS and at harvest it is evident from the data that amongst the herbicidal weed management treatments Paraquat dichloride 24% SL @ 2.0 L/ha had taller plant which were statistically at par with Oxyfluorfen 23.5% EC @ 0.75 and 0.85L/ha, Paraquat dichloride 24% SL @ 1.75 and 2.25 L/ha and 2,4-d dimethyl amine salt 58% SL @ 3.5 L/ha during both the years of experimentation.The tallest plant height was observed in hand weeding at 20 and 40 DAS however the shortest was recorded with weedy at all the growth stages except 30 DAS during both the years of experiment (Table 2).Amongst the herbicidal weed management treatments, Paraquat dichloride 24% SL @ 2.0 L/ha was recorded to higher plant height compared to other doses of Paraquat dichloride 24% SL, Oxyfluorfen 23.5% EC and 2,4-d Dimethyl Amine Salt 58% SL during both the years of investigation. This could be attributed to lower dry matter accumulation under these treatments as a result of which crop confronted minimum competition from weeds for growth factors like moisture, nutrient, light and space. The weeds were controlled at initial stage due to herbicides. Similar findings were recorded byHoogar*et al.* [17], Arora *et.al.* [18], Soren *et. al.*[19].

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Table 2Effect of chemical and mechanical weed management practices on potato plant height

Treatment		Dose L/ha	Plant height (cm)							
			30 DAS		45 DAS		60 DAS		At harvest	
			2017-18	2018-19	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19
T_1	Oxyfluorfen 23.5% EC	0.45	16.53	16.70	28.24	28.67	45.00	45.36	61.33	61.69
T_2	Oxyfluorfen 23.5% EC	0.55	16.43	16.54	28.69	28.70	46.12	46.40	62.73	63.09
T_3	Oxyfluorfen 23.5% EC	0.65	16.81	16.99	29.33	29.70	46.56	47.00	63.53	63.93
T_4	Oxyfluorfen 23.5% EC	0.75	16.88	17.29	30.23	30.63	48.63	48.97	65.53	65.75
T_5	Oxyfluorfen 23.5% EC	0.85	17.32	17.45	32.11	32.31	49.36	50.41	73.20	73.53
T_6	Paraquat dichloride 24% SL	1.75	17.03	17.26	31.26	31.57	48.34	48.90	68.47	68.78
T_7	Paraquat dichloride 24% SL	2.0	17.50	17.63	33.42	33.75	52.36	53.03	75.16	75.36
T_8	Paraquat dichloride 24% SL	2.25	17.16	17.31	31.39	31.60	48.78	49.07	72.54	70.74
T_9	Paraquat dichloride 24% SL	2.5	16.81	16.94	29.35	29.58	46.53	46.67	63.67	64.00
T_{10}	2,4-d Dimethyl Amine Salt 58% SL	3.5	17.06	17.06	30.87	31.10	48.56	48.83	70.93	71.16
T_{11}	Untreated control (weed free check) (hand weeding 20 & 40 DAS)	--	17.60	18.27	34.33	35.57	53.83	54.78	78.24	78.86
T_{12}	Untreated control (weedy check)	--	16.67	17.00	26.70	26.85	43.10	43.37	58.63	59.11
	SEm±		0.40	0.33	1.32	1.32	1.97	1.99	3.87	3.59
	CD (P = 0.05)		NS	NS	3.87	3.87	5.77	5.84	11.35	10.54

3.2 Average number of tubers per plant

It is apparent from the data that amongst the herbicidal weed management treatments the maximum number of tubers per plant was observed with Paraquat dichloride 24% SL @ 2.0 L/hawhich was statistically at par with Oxyfluorfen 23.5% EC @ 0.55, 0.65, 0.75 and 0.85L/ha, Paraquat dichloride 24% SL @ 1.75, 2.25 L/ha and 2,4-d dimethyl amine salt 58% SL @ 3.5 L/ha during 2017-18 however in 2018-19 at par with Oxyfluorfen 23.5% EC @ 0.65, 0.75, 0.85L/ha, Paraquat dichloride 24% SL @ 1.75, 2.25 and 2.50 L/ha and 2,4-d Dimethyl Amine Salt 58% SL @ 3.5 L/ha. The highest number of tubers per plant was observed in hand weeding at 20 and 40 DAS however the lowest was recorded with weedy at all the growth stages during both the years of experimentations (Table 3).During both years of the experiment, all herbicidal weed management methods statistically altered the yield attributes compared to weedy. In terms of yield-attributing characteristics, Paraquat dichloride 24 percent SL @ 2.0 L/ha treated plot produces the most number of tubers per pants. This might be because this treatment has the most effective weed control. The vigorous growth and better canopy coverage of cover crop, biologically suppressed the growth of sedges, grasses and broad-leaved weeds. Due to effective suppression of weeds, restricting the nutrient drain by weeds and higher nutrient availability in potato helped in improving tuber number. The Paraquat dichloride 24% SL @ 2.0 L/haacts as a potential herbicide in the reduction of weed dry matter accumulation

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consequently increasing growth attributes of crop plantwhich in turn increases tuber number. Jalali et al. [20] also found this type of resultin potato- quinoa intercropping and Faruqet al. [21] on potato.

Table 3Effect of chemical and mechanical weed management practices on average tuber per plant

Treatment		Dose (L/ha)	Average number of tubers per plant	
			2017-18	2018-19
T_1	Oxyfluorfen 23.5% EC	0.45	9.20	9.37
T_2	Oxyfluorfen 23.5% EC	0.55	9.33	9.40
T_3	Oxyfluorfen 23.5% EC	0.65	9.57	9.67
T_4	Oxyfluorfen 23.5% EC	0.75	9.37	9.53
T_5	Oxyfluorfen 23.5% EC	0.85	10.33	10.43
T_6	Paraquat dichloride 24% SL	1.75	9.41	9.63
T_7	Paraquat dichloride 24% SL	2.0	10.40	10.73
T_8	Paraquat dichloride 24% SL	2.25	10.19	10.27
T_9	Paraquat dichloride 24% SL	2.5	9.20	9.57
T_{10}	2,4-d Dimethyl Amine Salt 58% SL	3.5	10.07	10.17
T_{11}	Untreated control (weed free check) (hand weeding 20 & 40 DAS)	--	10.63	10.90
T_{12}	Untreated control (weedy check)	--	8.00	8.55
	SEm±		0.38	0.40
	CD (P = 0.05)		1.10	1.18

3.3Relativecompositionofweeds in the experimental plot(%).

A close inspection of the data revealed that sedges (*Cyperusrotundus* L.) contributed the most to total weeds, followed by grasses (*Cynodondactylon* L.) and broad-leaves weeds (*Chenopodium album* L., *Partheniumhysterophorus* L., *Sonchusoleraceus* L., *Anagalisarvensis* L., *Oxalis*spp., *Spergulaarvensis* L.) during both years.

Relative composition of *Cyperusrotundus* L. (54.46 % and 53.88 % at 15 DAS, 44.69 % and 45.55 % at 30 DAS, 45.81 % and 48.44 % at 45 DAS and 38.10 % and 39.32 % at 60 DAS), *Cynodondactylon* L. (31.42 % and 31.57 % at 15 DAS, 28.25 % and 28.88 % at 30 DAS, 28.27 % and 26.72% at 45 DAS and 22.47 % and 22.10 % at 60 DAS), *Chenopodium album* L. (4.76 % and 5.08 % at 15 DAS, 3.54 % and 3.47 % at 30 DAS, 3.76 % and 3.90 % at 45 DAS and 8.18 % and 8.20 at 60 DAS), *Partheniumhysterophorus* L. (1.32 % and 1.17 % at 15 DAS, 6.07 % and 6.04 % at 30 DAS, 4.30 % and 4.01 % at 45 DAS and 7.22 % and 7.02 % at 60 DAS), *Sonchusoleraceus* L. (1.32 % and 1.17 % at 15 DAS, 3.21 % and 3.01 % at 30 DAS, 5.35 % and 5.22 % at 45 DAS and 4.88 % and 4.61 % at 60 DAS), *Anagalisarvensis* L. (4.85 % and 5.37 % at 15 DAS, 8.13 % and 6.55 % at 30 DAS, 6.31 % and 5.77 % at 45 DAS and 8.69 % and 8.73 % at 60 DAS), Oxalis spp. (0.88 % and 0.88 % at 15 DAS, 5.50 % and 5.87 % at 30 DAS, 4.05 % and 3.90 % at 45 DAS and 6.15 % and 1.82 % at 60 DAS), *Spergulaarvensis* L. (0.97 % and 0.88 % at 15 DAS, 0.62 % and 0.62 % at 30 DAS, 2.16 % and 2.06 % at 45 DAS and 4.31 % and 4.20 % at 60 DAS) was observed in the year of 2017-18 and 2018-19, respectively. During the two years of field research, eight weed species from six families were identified in the experimental field (Table 4). One species, *Cyperusrotundus*L. was a sedge; and one species *Cynodondactylon* L. was a grass and the remaining six species, *Chenopodium album*L.,*Partheniumhysterophorus*L.,*Sonchusoleraceus*L.,*Anagalisarvensis*L.,*Oxalis* spp., and *Spergulaarvensis*L., were broad-leaved weeds. During both years, the weed flora was dominated by the sedge, which was followed by grass and broad-leaved weeds. Crop faced significant competition due to the increased number of sedges and grass weeds with similar growth habits.

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Table 4Effect of chemical and mechanical weed management practices on relative composition of weed (%)

Name of weed species	Relative composition of weed (%)							
	15 DAS		30 DAS		45 DAS		60 DAS	
	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19
Cyperusrotundus L.	54.46	53.88	44.69	45.55	45.81	48.44	38.10	39.32
Cynodondactylon L.	31.42	31.57	28.25	28.88	28.27	26.72	22.47	22.10
Chenopodium album L.	4.76	5.08	3.54	3.47	3.76	3.90	8.18	8.20
Oxalis spp. L.	0.88	0.88	5.50	5.87	4.05	3.90	6.15	5.82
Partheniumhysterophorus L.	1.32	1.17	6.07	6.04	4.30	4.01	7.22	7.02
Sonchusoleraceus L.	1.32	1.17	3.21	3.01	5.35	5.22	4.88	4.61
Anagalisarvensis L.	4.85	5.37	8.13	6.55	6.31	5.77	8.69	8.73
Spergulaarvensis L.	0.97	0.88	0.62	0.62	2.16	2.06	4.31	4.20
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

4. CONCLUSION

Based on two-year research finding it is concluded that application of Paraquat dichloride 24% SL @ 2.0 L/ha was found superior as compared to other herbicidal treatment since it controls weed more efficiently, and promote plant height, this leads to accumulation of more photosynthates which ultimately increased the number of tuber per plant. With respect to relative composition of weeds, sedges (*Cyperusrotundus* L.) contributed the most to total weeds, followed by grasses (*Cynodondactylon* L.) and broad-leaves weeds (*Chenopodium album* L., *Partheniumhysterophorus* L., *Sonchusoleraceus* L., *Anagalisarvensis* L., *Oxalis*spp., *Spergulaarvensis* L.) during both years. It is recommended based on research findings that for obtaining maximum benefits from potato one should apply Paraquat dichloride 24% SL @ 2.0 L/ha.

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