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Effect of Different Pre and Post Emergent Herbicides on Growth and Yield of Potato (*Solanum tuberosum* L.)

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ABSTRACT

A field experiment was conducted during kharif 2016 at College of Agriculture, Hassan, University of Agricultural Sciences, Bengaluru to evaluate different pre and post emergent herbicides on growth and yield of potato (Solanum tuberosum L.) the soil of experimental site is red sandy loam in texture, neutral in reaction and medium in available nitrogen, phosphorus and potassium. The experiment was laid out in a RCBD with seven treatments replicated thrice. Application of Fenoxaprop–p-ethyl 54 gm a.i. ha^{-1} as early post emergent at 20 DAP recorded significantly higher growth parameters viz; plant height (64.4 cm), number of shoots plant^{-1} (8.03), number of leaves plant^{-1} (21.0), leaf area (724 cm^2), leaf area index (0.60), total dry matter plant^{-1} (7.30 g) over weedy check (48.67 cm, 4.33, 10.33, 400 cm^2, 0.33 and 4.84 g, respectively). Application of Fenoxaprop–p-ethyl 54 gm a.i. ha^{-1} as early post emergent at 20 DAP recorded significantly higher number of tubers plant^{-1} (4.30), tuber weight plant^{-1} (250.50 g) and tuber yield (19.77 t ha^{-1}) which was on par with Quizalofop–p-ethyl (4.07, 247.37 g and 18.93 t ha^{-1}, respectively) except weed free check.

Key words: *Potato, Weed, Fenoxaprop–p-ethyl, Quizalofop–p-ethyl, growth, yield, grading.*

INTRODUCTION

Potato (*Solanum tuberosum* L.) is one of the most important vegetable cum food crops of the world. Potato is cultivated in 2.13 m ha^{-1} in India, with a production of 43.7 m t and productivity of 20.5 MT ha^{-13}. At present, potato is grown in about 15 countries of the world on a wide range of soils and agro climatic conditions[6]. Hassan and Chikkamagaluru are the major potato producing districts under southern transitional zone of Karnataka contributing nearly 60 per cent of the total production in the state[2].There are several constraints in potato production, of which weeds often pose a serious problem. It is a very poor competitor with weeds because of its extremely slow growth in the initial emergence phase. The yield reduction due to weeds in potato is estimated to be as high as 10 to 80 per cent[7]. So, control of weeds in the initial stages appears imperative as it plays an important role in maximizing the tuber production.

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Timely weed control may not be possible manually due to non availability of labours and high rate of wages during peak period of farm operations. Hence, chemical weed control appears to hold a great promise in dealing with effective, timely and economic weed suppression.

MATERIALS AND METHODS

A field experiment was conducted during *kharif* 2016 at College of Agriculture, Hassan, University of Agricultural Sciences, Bengaluru. The experimental site is geographically situated in the Southern Transitional Zone (Zone-7) of Karnataka and located between 12º 13' and 13º 33' N Latitude and 75º 33' and 76º 38' E Longitude at an altitude of 827 m above Mean Sea Level (MSL). The soil of the experimental site was red sandy loam. The experiment was laid out in randomized block design with seven treatments and replicated thrice. The treatments comprised of four herbicide levels, conventional weed control practices followed by the farmers and check treatments *Viz*., weedy check and weed free check. Kufri jyoti variety was selected for study. The required quantities of herbicides were applied as pre emergence (2 days after planting) and early post emergence (20 days after planting) as per the treatments. The conventional weed control practices followed by the farmers and check treatments *Viz*., weedy check and weed free check.Sowing was done by dibbling on 15th June, 2016 and pre-emergent application of Metribuzin 500 g a.i. ha^{-1} was imposed on 17th, June, 2016. Early post emergent application of Fenoxaprop–p-ethyl 54 g a.i. ha^{-1}, Quizalofop–p-ethyl 30 g a.i. ha^{-1}, Paraquat dichloride 480 g a.i. ha^{-1}was imposed on 05th July, 2016.The data was analyzed statistically for test of significance following the procedure described by Gomez and Gomez[5]. The results have been discussed at the probability level of five per cent. The level of significance used in "F" and "t" test was *p*=0.05. Critical difference values were calculated whenever the "F" test was significant.

RESULT AND DISCUSSION

Effect of different pre and post emergent herbicides on growth parameters at harvest

Plant growth is dependent on the rate of accumulation of dry matter. The dry matter accumulation may reflect on the economic yield. The fact is that vegetative part of the plants serve as source, whereas, grains are the sink.Application of Fenoxaprop–p-ethyl 54 g a.i. ha^{-1} as early post emergent recorded significantly higher plant height (64.40 cm at harvest) as compared to Weedy check (**Table 1**). This increased plant height due to effective control and suppression of weeds as compared to farmers practice and weedy check. These results are in accordance with Abdullahi *et al*.[1], Sitangshu and Majumdar[8] in potato. Application of Fenoxaprop–p-ethyl 54 g a.i. ha^{-1} as early post emergent recorded significantly higher number of shoots (8.03 at harvest). This increase in crop growth parameters in these treatments was due to better control of weeds resulting in minimum competition of weeds with potato during crop growth period which helped in better utilization of nutrients, moisture, space and light by the crop. However, weedy check recorded significantly lower number of shoots (4.33). This might be due to severe crop weed competition for the same growth resources. These results are in line with the findings of Abdullahi *et al*.[1], Sitangshu and Majumdar[8] in potato.

Effect of different pre and post emergent herbicides on dry matter of potato at harvest

Application of Fenoxaprop–p-ethyl 54 g a.i. ha^{-1} as early post emergent recorded significantly higher dry matter of leaves plant^{-1} in potato (4.33 g plant^{-1}), dry matter of haulms plant^{-1} in potato (2.97 g plant^{-1}), dry matter of tubers plant^{-1} in potato (63.00 g plant^{-1}) and total dry matter (7.30 g plant^{-1} at harvest) which was on par with Quizalofop–p-ethyl 30 g a.i. ha^{-1} (4.23, 2.80, 61.67 and 7.05 g respectively.) as early post emergent as compared to weedy check (3.07, 1.77, 51.0 and 4.84 g respectively). The increased dry matter production was supported by higher dry

matter accumulation in leaf, stem and tuber which was due to better control of weeds. The reduced competition and increased availability of resources like nutrients, soil moisture, light paved way for higher leaf area per plant (leaf area index) and consequently increased the biomass of the crop and less phytotoxocity to crop, which resulted in increase in leaf area per plant and better photosynthesis. However, significantly lower total dry mater production was noticed in weedy check in the experiment due to high crop weed competition (**Table 2**). These results are in conformity with findings of Sitangshu and Majumdar[8].

Effect of different pre and post emergent herbicides on yield and yield attributes and tuber grading of potato at harvest

Application of Fenoxaprop–p-ethyl 54 g a.i. ha^{-1} as early post emergent recorded significantly higher tuber weight (250.50 g), number of tubers (4.30) and tuber yield (19.77 t ha^{-1}). Higher tuber yield was attributed to better control of weeds, lower weed index (5.9 %) and higher weed control efficiency (73.3 %) throughout the crop growth period, which resulted in better availability of growth factors like light, space, nutrients and moisture to the potato crop resulting in better crop growth and yield. These findings are in confirmatory with the work of Chitsaz and Nelson[4].The higher yield of 'B' grade (25-100g) and 'C' grade (>100g) tubers were recorded with early post emergent application of Fenoxaprop–p-ethyl 54 g a.i. ha^{-1} which was found on par with the application of Quizalofop–p-ethyl 30 g a.i. ha^{-1} as early post emergent, except weed free check. Higher yield of 'B' grade and 'C' grade tuber was due to efficient control of annual weeds during early stage of the growth by applied herbicides. The lower 'A' grade tubers (<25 g) were recorded with early post emergent application of Fenoxaprop–p-ethyl 54 g a.i. ha^{-1} due to effective control of weeds at initial stage of the crop period as well as reduced weed dry weight and also due to higher weed control efficiency.

Table 1: Effect of different pre and post emergent herbicides on growth parameters of potato at harvest

Treatments		Plant height (cm)	Number of shoots $plant^{-1}$	Number of leaves $plant^{-1}$	Leaf area (cm^2)	Leaf area index
T_1	Farmers practice	56.00	4.97	12.33	463	0.38
T_2	Metribuzin 500 g a.i. ha^{-1} as PE	58.90	6.90	17.50	641	0.53
T_3	Fenoxaprop –p-ethyl 54 g a.i. ha^{-1} as EPE	64.40	8.03	21.00	724	0.60
T_4	Quizalofop –p-ethyl 30 g a.i. ha^{-1} as EPE	62.80	7.83	20.00	711	0.56
T_5	Paraquat dichloride 480 g a.i. ha^{-1} as EPE	57.33	6.00	15.67	580	0.47
T_6	Weedy check	48.67	4.33	10.33	400	0.33
T_7	Weed free check	65.33	8.33	21.67	744	0.62
S.Em±		2.00	0.24	0.10	1.35	11.10
LSD(*p*=0.05)		6.17	0.73	0.31	4.16	34.19

Note: **PE:** pre-emergent application **EPE:** early post emergent application **BLW:** Broad leaf weeds **DAP**-days after planting

Table 2: Effect of different pre and post emergent herbicides on dry matter of potato at harvest

Treatments		Dry matter of leaves (g plant^{-1})	Dry matter of haulms (g plant^{-1})	Dry matter of tubers (g plant^{-1})	Total dry matter (g plant^{-1})
T_1	Farmers practice	3.33	2.07	55.74	5.40
T_2	Metribuzin 500 g a.i. ha^{-1} as PE	3.83	2.48	58.67	6.00
T_3	Fenoxaprop –p-ethyl 54 g a.i. ha^{-1} as EPE	4.33	2.97	63.00	7.30
T_4	Quizalofop –p-ethyl 30 g a.i. ha^{-1} as EPE	4.23	2.80	61.67	7.05
T_5	Paraquat dichloride 480 g a.i. ha^{-1} as EPE	3.53	2.30	57.10	5.83
T_6	Weedy check	3.07	1.77	51.00	4.84
T_7	Weed free check	4.47	3.03	63.67	7.50
S.Em±		2.00	0.10	0.08	0.01
LSD(*p*=0.05)		6.17	0.31	0.24	0.03

Note: **PE:** pre-emergent application **EPE:** early post emergent application **BLW:** Broad leaf weeds **DAP-**days after planting

Table 3: Effect of different pre and post emergent herbicides on yield and yield attributes and tuber grading of potato at harvest

Treatments		Tuber weight plant^{-1} (g)	Number of tubers plant^{-1}	Tuber grading (t ha^{-1})			Tuber yield (t ha^{-1})
				A < 25g	B 25 - 100g	C > 100g	
T_1	Farmers practice	235.67	2.50	4.20	9.13	5.03	16.17
T_2	Metribuzin 500 g a.i. ha^{-1} as PE	242.67	3.43	3.30	9.50	5.47	18.10
T_3	Fenoxaprop –p-ethyl 54 g a.i. ha^{-1} as EPE	250.50	4.30	3.00	10.33	5.77	19.77
T_4	Quizalofop –p-ethyl 30 g a.i. ha^{-1} as EPE	247.67	4.07	3.15	9.83	5.50	18.93
T_5	Paraquat dichloride 480 g a.i. ha^{-1} as EPE	238.67	3.00	3.90	9.20	5.27	17.43
T_6	Weedy check	221.67	2.10	4.40	9.10	4.77	14.00
T_7	Weed free check	253.33	4.50	2.67	10.50	6.00	21.00
S.Em±		3.57	0.14	0.16	0.24	0.18	0.79
LSD(*p*=0.05)		10.99	0.44	0.51	0.73	0.54	2.2

Note: **PE:** pre-emergent application **EPE:** early post emergent application **BLW:** Broad leaf weeds **DAP-**days after planting

CONCLUSION

The study concluded that higher number of tubers (4.30) and tuber yield (19.77 t ha^{-1}) were recorded by application of Fenoxaprop–p-ethyl 54 g a.i. ha^{-1} as early post emergent as compared to the other treatments, except weed free check.

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