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Influence of weed management practices on growth and yield of Rabi potato under northern hill zone of Chhattisgarh

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Abstract
The field experiment was carried out at Potato Research Station, Mainpat, IGKV (C.G.) during rabi 2019-20 and 2020-21.An experiment entitled "Influence of weed management practices on growth and yield of rabi potato under Northern Hill Zone of Chhattisgarh" was laid out in Randomized Block Design having eight weed management practices *viz*. W_1-Metribuzin 70% WP @ 0.75 kg ha^{-1}, PE, W_2-Pendimethalin 38.7% CS 1.0 kg ha^{-1}, PE,W_2-Oxyflourfen 23.5% EC @ 0.1 kg ha^{-1}, PE, W_4-Atrazine 50% WP @ 1.0 kg ha^{-1}, PE, W_5-Paraquat 24% SL @ 0.5 kg ha^{-1} early POE after 10% germination of potato, W_6-Mechanical weeding 40 DAP, W_7-Hand weeding 20 and 40 DAP and W_8-Unweeded check. The result of the experiment revealed that, all the growth parameters *i.e.* emergence, plant height, number of shoots $plant^{-1}$, shoot fresh and shoot dry weight $plant^{-1}$, quality parameter and yield attributes and yield were maximum under hand weeding (20 and 40 DAP). Total tuber yield was increased 71% over the unweeded check.

Keywords: Influence, management, Rabi, potato, plant

Introduction
Potato known as "The king of vegetable" has emerged, as fourth most important food crop in India after rice, wheat and maize. Potato is major world food crop and plays an important role in food security for ever increasing world population (Scott and Sourez, 2012) [22].

Potato (*Solanum tuberosum*) is the most important food and vegetable cum starch supplying crop of the world believed to be originated in South America. The potato is a crop which has always been the 'poor man's friend'. Potato is being cultivated in the country for the last more than 300 years. Potato contains carbohydrates (20.6%), protein (2.1%), fat (0.3%), crude fibre (1.1%) and ash (0.9%). It also contains essential amino acids like leucine, tryptophane and isolucine (Khurana and Naik, 2003) [14]

In present world scenario, potato is grown in around 19.33 million hectares with the production of 388 million tones. India is the second largest potato producer after China. In India, potato is cultivated in an area of about 2.18 million hectares with a production of 48.61 million tonnes and productivity is 22.3 tones per hectare (FAOSTAT, 2019) [8]. In Chhattisgarh potato grown around 42750 ha area, 614056 million tones production with 14.36 tones ha^{-1} productivity (Anonymous, 2022). Uttar Pradesh, West Bengal and Bihar account of nearly $3/4^{th}$ of the area and contribute 71 per cent of total potato production in the country (Anonymous, 2019). Planting density strongly affects yield and more tubers and yield per square meter are expected at higher planting densities. Bussan *et al.* (2007) [4] argued that optimizing plant density was one of the most important practices in potato production management, as it affects seed cost, plant development, yield and quality of the crop. Rex *et al.* (1987) [21] also argued that yield increases are attributable to more tubers being produced at the greater plant population per hectare although tuber size is decreased because of increased inter-plant competition with closer spacing. The optimum spacing for different size of seed tubers effects on yield contributing characters and yield.

Yield losses in potato due to weeds occur in several ways. Among these, competition between potato plants and weeds for nutrients, water, light and space are the major contributing factor. The nutrient losses caused by weeds in the potato crop 43, 8 and 49 kg N, P and K per hectare, respectively Nankar and Singh (1982) [19]. It was observed that the most critical period of crop-weed competition is first 4-6 weeks after planting when the crop must be kept free from weeds.

The yield reduction due to weeds in potato is estimated to be as high as 10 to 80 per cent (Lal and Gupta, 1984) [16]. So, control of weeds in the initial stages appears imperative as it plays an important role in maximizing the tuber production. Timely weed control may not be possible manually due to non-availability of labours. Hence, chemical weed control appears to hold a great promise in dealing with effective, timely and economic weed control Singh and Bhan, (1999).
Especially hilly area in Northern hills zone of Chhattisgarh, farmers are presently adopting *kharif* potato followed by rabi potato in large areas due to its better productivity under existing climatic conditions. However, till now no concerted afford have been made on agro management practices for rabi potato to harness higher productivity of this potato.

Material and Methods

The experiment was conducted at the Potato Research Station, Mainpat, Surguja, (C.G.) during rabi season of 2019-20 and 2020-21.The soil was sandy loam in texture with acidic in pH, having low nitrogen and organic carbon, medium in available phosphorus and potassium. The potato variety KufriChipsona-1 was grown as test crop. Experiment was laid out in Randomized Block Design having eight weed management practices *viz.*W_1-Metribuzin 70% WP @ 0.75 kg ha^{-1}, PE, W_2-Pendimethalin 38.7% CS 1.0 kg ha^{-1}, PE,W_2-Oxyflourfen 23.5% EC @ 0.1 kg ha^{-1}, PE, W_4-Atrazine 50% WP @ 1.0 kg ha^{-1}, PE, W_5-Paraquat 24% SL @ 0.5 kg ha^{-1} early POE after 10% germination of potato, W_6-Mechanical weeding 40 DAP, W_7-Hand weeding 20 and 40 DAP and W_8-Unweeded check.

Results and Discussion

1. Plant height (cm)

The data on plant height of potato was recorded at 80 DAP showed significantly influence of weed management practices at different time intervals are presented in Table 1.
The plant height increased with the advancement in crop age irrespective of the treatment and reached the maximum at 80 DAP. The height of potato plants was almost increased and slightly declined at harvest because of senescence. Height is an index of plant growth and is known to be influenced by environmental and crop management practices. The plant height, in general, enhanced considerably in all the treatments with the advancement of plant growth from initial up to 80 DAPS. The plant height varied significantly among the various methods of weed control at all growth stages due to positive effect. At all the growth stages, under the treatment of hand weeding at 20 and 40 DAP (W_7) during both the years data exhibited the maximum plant height and which was at par with metribuzin 70% WP @ 0.75 kg $ha^{-1,}$ PE(W_1),pendimethalin 38.7% CS @ 1 kg $ha^{-1,}$ PE (W_2), oxyflourfen 23.5% EC @ 0.1 kg ha^{-1}, PE(W_3) and atrazine 1.0 kg ha^{-1},PE(W_4). Similar findings are also reported by Kumar *et al*. (2017), Arora *et al*. (2009) [2] and Hooda and Pandita (1978) [10].

2. Number of shoots plant^{-1}

The data on number of shoot $plant^{-1}$ of potato was recorded at 80 DAP as significantly influenced by weed management practices at different time intervals are presented in Table 1.
At 80 DAP, the highest number of shoot $plant^{-1}$ was also recorded under the treatment of hand weeding at 20 and 40 DAP (W_7) during both the years. However, it was at par with metribuzin 70% WP @ 0.75 kg $ha^{-1,}$ PE (W_1) and pendimethalin 38.7% CS @ 1 kg $ha^{-1,}$ PE(W_2). They were followed by oxyflourfen 23.5% EC @ 0.1 kg $ha^{-1,}$ PE(W_3), atrazine 1.0 kg ha^{-1}, PE(W_4), paraquat 0.5 kg ha^{-1} at10% germination of potato(W_5) and mechanical weeding at 40 DAP(W_6).The lowest number of shoot $plant^{-1}$ was found under the treatment unweeded check(W_8) during both the years at all the time intervals.
Similar finding is in close vicinity with Lavlesh *et al.* (2018) [17]. He reported that the number of shoots per hill as affected by different weed management treatments. The number of shoots per hill at both stages of crop growth was not significantly affected by various weed control treatments. The maximum number of shoots per hill was recorded under hand weeding at 30 DAP and weed free at 45 DAP stage of crop growth whereas, the minimum was recorded with treatment hand weeding at 50 DAP at 30 days stage and hand weeding at 30 DAP at 45 stage of crop growth. The results indicated that the various weed management treatments didn't have any impact on number of shoots per hill of potato tubers. The number of shoots per hill depends on the cultivar, seed size and its physiological stage of the seed tuber. These findings were in close conformity with Chandrakar *et al,* (2013) [5], Dua (2000) [7] and Mohaniya *et al*. (2020) [18].

3. Shoot fresh weight g plant^{-1}

The fresh shoot weight of potato was recorded at harvest. It was significantly affected by weed management practices and data are presented in Table 2.
Fresh weight of plant increased considerably in all the treatments with the progress of crop age from initial up to 80 DAP. Weed control treatment W_7-Hand weeding at 20 and 40 DAP gave significantly higher fresh weight as compared to other treatments. All tested herbicides and hoeing twice significantly enhanced all tested growth parameters. Hand weeding exhibited taller plants, higher shoot fresh weight and dry weight, and also showed a higher number of stems compared with other treatments and the control. The current results indicated that the treatment with herbicides had a positive effect on reducing weed density and improved plant growth. This improvement could be due to the lower competition with associated weeds for light, water, and nutrient absorption reported by Ibrahim *et al.*, 2021 [12]. Similar finding are in close vicinity of Arora *et al.* (2009) [2], Gill *et al*. (1983) [9] and Shekhawat and Maliwal (1989) [23].

4. Shoot dry weight g plant^{-1}

The shoot dry weight of potato was recorded at harvest. It was significantly affected by weed management practices are presented in table 2.
Dry weight of plant, in general, increased considerably in all the treatments with the progress of crop growth from initial up to 80 DAP. Weed control treatment hand weeding at 20 and 40 DAP (W_7) gave significantly higher dry weight as compared to other treatments. These results are in close proximity of the finding made by Ibrahim *et al* (2021) [12], Mohaniya *et al* (2020) [18], Arora *et al*. (2009) [2] and Gill *et al*. (1983) [9] and reported that all the treatments of herbicides, two hand weeding at 20 and 40 DAP and hoeing twice significantly enhanced all tested growth parameters. Hand weeding recorded taller plants, higher shoot dry weight and also showed a higher number of stems compared with other treatments and the control. The current results indicated that the treatment with herbicides had a positive effect on reducing

weed density and improved plant growth. This improvement could be due to the little competition with associated weeds for light, water, and nutrient absorption.

5. Fresh weight and Dry weight of tuber (g plant^{-1})

Fresh weight of tuber plant^{-1}(g) and dry weight of tuber plant^{-1}(g) are very important parameters because it decided the final tuber yield of potato. The data presented fresh weight and dry weight of tuber plant^{-1} (g) have been recorded in table 2.

With respect to weed management practices. The maximum fresh weight and dry weight of tuber plant^{-1} (g) were also noticed in hand weeding at 20 and 40 DAP (W_7) over the rest of the weed management practices. But fresh weight of tuber plant^{-1} (g) and dry weight of tuber plant^{-1} (g) were at par with metribuzin 70% WP @ 0.75 kg ha^{-1} PE (W_1), pendimethalin 38.7% CS @ 1.0 kg ha^{-1} PE (W_2) and oxyflourfen 23.5% EC @ 0.1 kg ha^{-1} PE (W_2) followed by atrazine 1.0 kg ha^{-1} PE (W_4), paraquat 24% SL @ 0.5 kg ha^{-1} at10% germination of potato (W_5) and mechanical weeding at 40 DAP (W_6) during both the years.

Among the weed control treatments significantly minimum fresh weight and dry weight of tuber plant^{-1} (g) were recorded under the treatment unweeded check (W_8) during both the years but statistically at par with mechanical weeding at 40 DAP (W_6).

The formation of tuber per plant increased gradually in all the treatments with the enhancement of plant growth up to harvest. Shekhawat and Maliwal (1989) [23] reported that number of tubers per plant at harvest increased with application of herbicides or hand weeding as compared to untreated control. This might be due to effective weed control during critical period of crop-weed competition, which might have helped in growth and development and there by resulted into fresh weight and dry weight of tuber plant^{-1}(g). The results are in line with those reported by Hooda and Pandit (1978) [10], Hodda *et al.* (1982) [11] and Ahuja *et al.* (1999) [1] and similar findings are also reported by Mohaniya *et al.* (2020) [18].

Higher tuber yield was attributed to better control of weeds, lower weed index and higher weed control efficiency 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 (1983) [6].

6. Tuber yield (t ha^{-1})

The data found to total tuber yield during 2019-20 and 2020-21 as affected by different weed management practices have been presented in Table 2.

Among different weed management practices significantly total tuber yield (24.95, 23.93 and 24.44 t ha^{-1}**)** was obtain with application of two hand weeding at 20 and 40 DAP as compared to other treatments during first and second year of data respectively and which was at par with treatments metribuzin 70% WP @ 0.75 kg ha$^{-1,}$ PE(W_1), pendimethalin 38.7% CS @ 1 kg ha$^{-1,}$ PE(W_2) and oxyflourfen 23.5% EC @ 0.1 kg ha$^{-1,}$ PE(W_3)then followed by atrazine 50% WP @ 1.0 kg ha^{-1}, PE(W_4),paraquat 24% SL @ 0.5 kg ha^{-1} at10% germination of potato(W_5) and mechanical weeding 40 DAP(W_6).

The minimum total tuber yield (15.07, 13.50 and 14.29 t ha^{-1}) were observed under the treatment unweeded check (W_8) during first and second year of experiment data respectively and which was at par with mechanical weeding at 40 DAP (W_6).

The increase in growth parameter like plant height, number of compound leaves and number of shoots per hill, increase in total photosynthetic area helped to increase tuber yield and yield attributes like number of tubers per plant also decided the tuber yield.

Similarly, Tripathi *et al.* (1989) reported a yield loss of 16 to 76% in potato. Among the weedy check resulted in the lower (42%) yield reduction than two hand weeding at 20 and 40 DAP plot and this was followed by metribuzin 70% WP @ 0.75 kg ha$^{-1,}$ PE(W_1) (7%) indicating the effectiveness of these treatments in controlling the weed and realizing the higher yield.

Reason for higher plant growth parameters and yield attributes may be that the intensity of weeds and weed biomass were low in two hand weeding at 20 and 40 DAP resulted in higher tuber yield. Similar results were obtained by Phogat *et al.* (1991) [20], Jan *et al.* (2004) [13], Arora *et al.* (2009) [2], Mohaniya *et al.* (2020) [18] and Bhattacharya *et al.* (2005) [3].

Table 1: Plant growth parameters of potato as influenced by weed management practices at different time intervals

Treatment	Plant height (cm)			Number of shoots plant^{-1}			Shoot fresh weight (g plant^{-1})			Shoot dry weight (g plant^{-1})		
	80 DAP			80 DAP			At harvest			At harvest		
	2019-20	2020-21	Mean	2019-20	2020-21	Mean	2019-20	2020-21	Mean	2019-20	2020-21	Mean
W_1-Metribuzin 70% WP @ 0.75 kg ha^{-1}, PE	51.31	46.40	48.86	7.23	6.83	7.03	169.86	165.73	167.19	15.11	14.08	14.60
W_2 – Pendimethalin 38.7% CS @ 1.0 kg ha^{-1}, PE	51.13	45.67	48.40	6.87	6.47	6.67	163.75	160.02	161.88	14.52	12.94	13.73
W_3-Oxyflourfen 23.5% EC @ 0.1 kg ha^{-1}, PE	51.09	45.40	48.25	6.54	6.30	6.42	159.63	157.05	158.50	14.41	12.81	13.61
W_4-Atrazine 50% WP @ 1.0 kg ha^{-1}, PE	48.55	45.00	46.78	6.49	6.26	6.39	157.08	154.38	155.75	13.38	12.20	12.79
W_5-Paraquat 24% SL @ 0.5 kg ha^{-1} at 10% germination of potato	47.93	43.63	45.78	6.36	6.02	6.19	140.14	136.14	138.14	12.56	11.74	12.15
W_6-Mechanical weeding 40 DAP	47.20	42.60	44.90	6.15	5.97	6.06	127.88	123.48	125.14	12.56	11.44	12.00
W_7-Hand weeding 20 and 40 DAP	52.53	47.29	49.91	7.42	7.17	7.29	170.54	168.44	169.78	16.23	14.98	15.60
W_8-Unweeded check	39.53	38.73	39.13	5.67	5.26	5.47	111.90	100.57	115.24	9.23	8.72	8.97
SEm±	1.34	1.17	1.05	0.21	0.24	0.22	4.48	5.00	4.90	1.20	1.00	1.06
CD (P=0.05)	4.05	3.63	3.15	0.63	0.70	0.65	14.33	15.10	14.70	3.65	3.01	3.20

Table 2: Yield attributing character of potato as influenced by weed management practices

Treatment	Yield attributing character								
	Total yield (t ha^{-1})			Fresh weight of tuber g plant^{-1}			Dry weight of tuber g plant^{-1}		
	2019-20	2020-21	Mean	2019-20	2020-21	Mean	2019-20	2020-21	Mean
W_1-Metribuzin 70% WP @ 0.75 kg ha^{-1}, PE	23.3	22.23	22.77	270.99	263.99	267.49	53.07	51.11	52.09
W_2 – Pendimethalin 38.7% CS @ 1.0 kg ha^{-1}, PE	23.09	21.91	22.50	265.28	255.28	260.28	51.35	49.83	50.59
W_3-Oxyflourfen 23.5% EC @ 0.1 kg ha^{-1}, PE	22.61	21.55	22.08	264.70	254.03	259.37	51.04	49.67	50.36
W_4-Atrazine 50% WP @ 1.0 kg ha^{-1}, PE	22.1	21.14	21.62	248.61	233.61	241.11	49.78	47.67	48.73
W_5-Paraquat 24% SL @ 0.5 kg ha^{-1} at 10% germination of potato	19.6	18.55	19.08	206.67	199.67	203.17	47.67	45.83	46.75
W_6-Mechanical weeding 40 DAP	17.01	16.43	16.72	195.87	194.50	195.19	43.10	41.43	42.27
W_7-Hand weeding 20 and 40 DAP	24.95	23.93	24.44	273.94	266.22	270.08	54.45	52.50	53.48
W_8-Unweeded check	15.07	13.5	14.29	189.44	186.83	188.14	41.67	40.37	41.02
S.Em ±	0.95	1.0	0.92	3.39	4.13	3.58	1.03	1.00	1.06
CD (P=0.05)	2.95	2.94	2.87	10.86	12.38	10.75	3.42	3.00	3.30

Conclusion

On the basis of two years of experimentation on spacing and nutrient management and weed management under Inceptisol of northern hills of Chhattisgarh, it can be concluded that the all the weed management practices gave more tuber yield comparable weedy check. On the basis of above findings, it may be concluded that the maximum total tuber yield was obtain with application of two hand weeding at 20 and 40 DAP as compared to other treatments during first and second year of the investigation and mean data respectively but which was at par with treatments metribuzin 70% WP @ 0.75 kg ha$^{-1,}$ PE, pendimethalin 38.7% CS @ 1 kg ha$^{-1,}$ PE and Oxyflourfen 23.5% EC @ 0.1 kg ha$^{-1,}$ PE then followed by atrazine 50% WP @ 1.0 kg ha^{-1}, PE, Paraquat 24% SL @ 0.5 kg ha^{-1} at10% germination of potato and mechanical weeding at 40 DAP during both the years.

References

1. Ahuja KM, Yaduraju NT, Singh R, Singh DK. Chemical weed control in potato. Indian Journal of Weed Science. 1999;31(1&2):8-12.
2. Arora A, Tomar SS, Gole MK. Yield and quality of potato as influenced by weed management practices and their residual study in soil. Agriculture Science Digest. 2009;29(2):1-3.
3. Bhattacharya SP, *et al*. National Biennial Conference, ISWS, PAU, Extended Summaries. 2005 Apr 6-9;146:250-252.
4. Bussan AJ, Mitchell PD, Copas ME, Drilias MJ. Evaluation of the effect of density on potato yield and tuber size distribution. Crop Science. 2007;47:2462-2472.
5. Chandrakar CK, Shrivastava GK, Saxena RR, Kumar CA, Dewangan C. Effect of water management, weed and integrated nutrient management on weed parameters and yield of potato (*Solanum tuberosum*). Journal of Progressive Agriculture. 2013;4(1):77-80.
6. Chitsaz M, Nelson DC. Comparison of various weed control programes for potatoes. American potato Journal. 1983;60:336-339.
7. Dua VK. Weed management in potato under different fertility levels in the North-Western Hills. Journal of the Indian Potato Association. 2000;27(1-2):61-64.
8. FAOSTAT. Agricultural Statistics World; c2019. http:/www.potatopro.com/world/potato-statics.
9. Gill HS, Brar LS, Mehra SP. Comparative performance of some herbicides for weed control in autumn planted potatoes. In Abstract of papers ISWS/Annual Weed Science Conference, BHU, Varanasi; c1983. p.66.
10. Hooda RS, Pandita ML. Weed control studies in potato (*Solanum tuberosum* L.) cv. Kufri Siduri. Haryana Journal of Horticulture Science. 1978;7(3-4):192-196.
11. Hooda RS, Pandita ML, Sindhu AS. Herbicidal control of weeds in potato (*Solarium tuberosum* L.) cv. 'YJCM\ Pesticides. 1982;16(10):13-14.
12. Ibrahim S, Abdallah Mohamed AM, Atia, Amira K Nasrallah, Hossam S El-Beltagi, Farida F Kabil, *et al*. Effect of new pre-emergence herbicides on quality and yield of potato and Its Associated weeds Sustainability. 2021;13(9796):1-17.
13. Jan Hamidullah, Muhammad, Ayaz, Ali, Asad. Studies on Weed Control in Potato in Pakhal Plains of Mansehra. Pakistan Journal of Weed Science Research. 2004;10(3-4):157-160.
14. Khurana SMP, Naik PS. The potato: An overview. In: The potato: production and utilization in sub-tropics, eds. New Delhi: Mehta Publishers; c2003. p.1-14.
15. Kumar D, Sharma RC. Fertilizer management for sustainable production of potato (*Solanum tuberosum* L.) onion (*Allium cepa*)- rice (*Oryza sativa*) cropping sequence in alluvial soils of Bihar. Indian Journal of Agricultural Sciences. 2002;72(9):503-507.
16. Lal SS, Gupta A. Efficacy of different herbicides for controlling weeds in potato. Annual Conf Indian Soc. Weed Science. BHU, Varanasi; c1984. p.36.
17. Lavlesh Raghav, Sati Manoj, Chandra Umesh, Sati Kailash. Weed management in potato (*Solanum tuberosum* L.) using manual and chemical methods, International Journal of Chemical Studies. 2018;6(5):585-588.
18. Mohaniya Singh L, Sasode Singh D, Gupta V. Integrated weed management studies in potato (*Solanum tuberosum* L.) Crop. International Journal of Current Microbiology and Applied Sciences. 2020;9(10):3475-3486.
19. Nankar JT, Singh M. Nutrient removal and uptake as influenced by weed management in potato in Shimla Hills. Proceedings of international seminar on approaches towards increasing the potato production in the developing countries. Central Potato Research Station, Jalandhar (Punjab), India; 1982. p. 144-148.
20. Phogat BS, *et al*. Effects of different herbicides on weeds and tuber yield in potato. Indian Journal Agronomy. 1991;36(1):131-132.
21. Rex BL, Russell WA, Wolfe HR. The effect of spacing of seed species on yields quality and economic value for processing of Shepody potato in Manitoba. American Potato Journal. 1987;64(4):177-189.
22. Scott GJ, Sourez V. The rise of Asia as the center of global potato production and some implications for industry. Potato Journal. 2012;39(3-4):1-22.
23. Shekhawat PS, Maliwal PL. Evaluation of herbicides for weed control in potato (*Solanum tuberosum* L). Indian Journal of Agriculture Science. 1989;59(11):739-741.