PERFORMANCE OF POTATO GENOTYPES AT FARMER' S FIELD IN JUMLA, NEPAL

ABSTRACT

On-farm varietal trial was carried out to evaluate promising genotypes of potato received from International Potato Centre (CIP), Lima, Peru through National Potato Research Program (NPRP), Khumaltar at Guthichaur Rural Municipality in the high hills of Jumla during two consecutive years 2017 and 2018. Five promising potato genotypes and two check cultivars i.e. Desiree and Jumli Local were tested in Randomized Complete Block Design (RCBD). The treatments were replicated three times. Compost was used at the rate of 20 t/ha. Well sprouted tubers of 25-50 g were planted at 60cm x 25cm spacing. Observations were recorded on vegetative parameters and yield attributes. Tested genotypes differed significantly for emergence percentage at 30 days after planting, uniformity, ground coverage, plant height, number of main stems, total number of tubers and tuber yield per hectare. The highest tuber yield (26.14 t/ha) was recorded in CIP393073.179 followed by CIP 395112.32 (24.56 t/ha) and CIP 390478.9 (23.12 t/ha). The average results of both years showed that potato genotypes CIP393073.179, CIP 395112.32 and CIP 390478.9 were promising for commercial cultivation in Jumla and in the similar agro-ecological domains of Karnali province.

Key words: *Promising Genotypes, On-farm Trial, Parameters, Yield*

1. INTRODUCTION

Potato (*Solanum tuberosum* L.) is one of the most important tuber as well as cash crops of Nepal. Potato is the most important crop for food security after rice, wheat and maize in the World [1]. It is utilized as a major vegetable in terai and mid hills and used as a vegetable and staple food in high hills. Potato serves as staple food supplying in lean period in remote high hills thus fills food gap. It occupies the 5th position in area (198788 ha), 2nd in total production (3325231 ton) and 1st in productivity (16.73 t/ha) among the food crops (rice, wheat, maize, millet and potato) grown in Nepal [2]. The area under potato in Jumla district is about 2240 ha, total production is 32450 ton with average productivity of 14.49 t/ha [3]. This indicates that the average productivity of potato in Jumla is less than the national average productivity (16.7 t/ha). Low productivity of potato in Nepal is due to lack of quality planting materials, prevalence of insect pest and diseases, inadequate research on varieties for different locations [4] and adoption of new varieties of potato is relatively less in many parts of Nepal [5]. Out of total area under potato, around 19% is in the high hills and mountains, 44% in the mid hills and 37% in terai [6]. In the recent years, food and nutritional insecurity has become one of the great threats to Nepalese agriculture.

Similar to other developing countries, food security situation has been affected in the country by the increasing population, changes in food habits and impacts of climate changes [7]. In this context, productivity of crops including potato should be increased.

In addition, low productivity of potatoes in the Karnali region has been identified as core problem resulting from several limiting factors such as inadequate quantity of disease free, drought tolerant basic seed of recommended varieties to flush out the degenerated seed potatoes, inadequate knowledge regarding the new varieties and inadequate availability of quality seed potatoes of recommended varieties. Though area, production and productivity are increasing over the periods, the national productivity is still low in comparison to its potential yield [8]. Demand of high yielding varieties with resistance to major disease and pest has remained always very high since long in Nepal [9]. Increased varietal diversity with high productivity in high

mountain environment can cope with the impacts of climate change, food insecurity and malnutrition. To address these issues the present study was designed including high yielding and promising genotypes of potato which were selected from series of previous experiments such as on station varietal Trial in Jumla district.

2. MATERIALS AND METHODS

On-farm trial was conducted by Horticulture Research Station (HRS), Rajikot, Jumla at Guthichaur Rural Municipality 3, Garjyangkot in Jumla district. Experiment area is situated at 29^0 15' 08'' N and 82^0 15'' 26' E with the altitude of 2506 meters above mean sea level. Its climate is temperate. March-April is the main planting season in Jumla. Soil is sandy loam in nature. Maximum & minimum average temperature of growing season in 2017 were 20^0C to 27^0C and 3^0C to 17^0C. Total rainfall during this year was 591mm [10]. Similarly, during 2018 maximum & minimum average temperature were 21^0C to 25^0C and 4^0C to 16^0C and total rainfall was 692mm [11]. Tested genotypes (CIP 395112.32, CIP 394611.112, CIP 393073.179, CIP 390478.9, CIP 397060.19 and CIP 392222.25) were selected from previous on station varietal trial conducted at HRS, Rajikot, Jumla.

These potato genotypes were initially introduced from International Potato Centre (CIP), Lima, Peru and evaluated by National Potato Research Program (NPRP) in the stations of NARC including HRS, Rajikot, Jumla. We selected and tested them in the farmers' field at Garjyangkot settlement of Guthichaur Rural Municipality of Jumla district of Nepal in 2017 and 2018. Desiree and Jumli local were used as check cultivars. The plot size was assigned 5.4 m^2 (3m x 1.8m). The plots were fertilized with 20 t/ha compost. There was no use of chemical fertilizer.

Well sprouted tubers of 25-50 g were planted in 60cm x 25cm spacing. The trial was designed at RCBD with three replications. Planting and harvesting were done on the 2^{nd} week of March and 3^{rd} week of September respectively. All the management practices were followed as per the NPRP recommendation. Observations were recorded on various growth parameters like emergence count, plant uniformity, plant height, ground coverage, number of main stem per plant and yield attributing parameters like number of tuber per plot, weight of tuber per plot and converted to number and yield per hectare. Plant uniformity was observed by using a scale from 1 to 5 (1 =very poor, 2= poor, 3=fair, 4=good and 5=excellent). Quality parameters like shape and color of tuber were also observed. The late blight disease was scored using 1-9 scale where 1 is resistant and 9 is highly susceptible**.** The necessary data for growth, yield and yield attributes were analyzed with the help of Genstat 18^{th} edition [12].

3. RESULTS AND DISCUSSION

In both years, the results revealed that the genotypes were found significantly different for most of the vegetative as well as yield and yield attributing parameters except emergence at 45 Days After Planting (DAP) and insect damage.

3.1 Emergence percentage

Highly significant difference was recorded for emergence at 30 DAP. Average emergence was maximum (78.24 %) in Desiree while it was minimum (26.39 %) in CIP 394611.112. In 45 DAP, average emergence ranged from 96.76 % in Desiree to 90.74% in CIP393073.179 indicating no differences in genotypes for emergence (Table 1). Genotypes differed significantly in plant emergence at 30 and 45 days after planting. The variation in plant emergence of the potato genotypes was reported by previous researchers too [13].

3.2 Plant height

Highly significant difference was observed for plant height. All tested genotypes had similar but significantly taller plants than the plants of Desiree. The plant height ranged from 46.7 cm in CIP 390178.9 to 25.03 cm in check variety Desiree (Table 2). The selected genotypes received from CIP were competitive to Jumli Local cultivar in terms of plant height. Some of the researchers [14] reported the reduced plant height in late cultivars. In contrast, the late cultivars identified in this study had the highest plant height. Besides, the differences in plant height among the genotypes may be caused by genetics of the plant as well as the quality of planting materials [15].

3.3 Number of main stem per hill

Statistically highly significant difference was observed in number of main stem per hill. The highest number of main stems (5.8) was counted in CIP 395112.32 which was at a par with CIP 390478.9 (4.77) and CIP393073.179 (4.63) respectively, whereas the lowest number (2.4) was recorded in Jumli Local followed by Desiree (3.53) (Table 2). Some of the researchers [16] reported that the variation in number of main stem per plant among the genotypes might be due to genetic traits. Number of main stem is also affected by the length of the pre-sprouting period [17], size of the seed tuber [15] and physiological age [18].

Table 1: Effect of different potato genotypes on emergence (%) at 30 and 45 days after planting in On-Farm Varietal Trial at Guthichaur Rural Municipality, Jumla during 2017 and 2018

SN	Genotypes	Emergence % at 30 DAP			Emergence % at 45 DAP		
		2017	2018	Average	2017	2018	Average
1	CIP 392222.25	37.04 bc	40.74 bc	38.89 bc	96.3	95.37	95.83
2	CIP 395112.32	36.11 bc	38.89 bcd	37.5 bc	91.67	90.74	91.2
3	CIP 394611.112	25 d	27.78 d	26.39 d	98.15	95.37	96.76
4	CIP393073.179	27.78 cd	28.7 d	28.24 cd	92.59	88.89	90.74
5	CIP 390478.9	29.63 cd	31.48 cd	30.56 cd	94.44	94.44	94.44
6	Desiree	74.07 a	82.41 a	78.24 a	97.22	96.3	96.76
7	Jumla Local	44.44 b	49.07 b	46.76 b	96.3	97.22	96.76
	Mean	39.2	42.7	40.9	95.24	94	94.64
	F test	**	**	**	NS	NS	NS
	CV (%)	13.6	14.6	13.8	3.4	4.9	4
	LSD (0.05)	9.45	11.11	10.8			

Note: NS=Non Significant *= Significant at *P*=.05 **=Significant at *P*=.01 LSD=Least Significant Difference CV= Coefficient of Variation

Table 2: Effect of different potato genotypes on Plant height (cm) and number of main stems/plant in On-Farm Varietal Trial at Guthichaur Rural Municipality, Jumla during 2017 and 2018

SN	Genotypes	Plant height (cm)			No. of main stem		
		2017	2018	Average	2017	2018	Average
1	CIP 392222.25	42.93 a	41.47 a	42.2 a	4.73 bc	4.33 ab	4.53 ab
2	CIP 395112.32	45.6 a	46.07 a	45.83 a	6 a	5.6 a	5.8 a
3	CIP 394611.112	42.8 a	43.13 a	42.97 a	4.73 bcd	3.93 bc	4.33 b
4	CIP393073.179	44.87 a	45.4 a	45.13 a	6.13 a	3.13 bc	4.63 ab
5	CIP 390478.9	46.8 a	46.6 a	46.7 a	5.13 ab	4.4 ab	4.77 ab
6	Desiree	25.2 b	24.87 b	25.03 b	3.53 c	3.53 bc	3.53 bc
7	Jumla Local	42.8 a	43.6 a	43.2 a	2.4 e	2.4 c	2.4 c
	Mean	41.57	41.6	41.58	4.67	3.9	4.29
	F test	**	**	**	**	*	**
	CV (%)	9.7	11.3	10.4	14	22.1	16.7
	LSD (0.05)	7.16	8.36	7.72	1.16	1.54	1.27

Note: NS=Non Significant *= Significant at *P*=.05 **=Significant at *P*=.01 LSD=Least Significant Difference CV= Coefficient of Variation

3.4 Ground coverage percentage

Statistically significant difference was observed among the tested potato genotypes for ground coverage at six weeks of DAP Maximum ground coverage (56.67%) was recorded in CIP 390478.9 which was at a par with CIP 394611.112 (52.5%) and CIP393073.179 (50%) whereas the lowest (39.17%) ground coverage was in Desiree which was at a par with CIP 392222.25 (44.17%), CIP 395112.32 (45%) (Table3). Different genotypes differ genetically in their growth habit [19, 20].

Ground cover is also determined by the growing condition and planting time. In this study, late cultivars had higher ground cover than early maturing cultivars.

3.5 Uniformity (1-5 scale)

Uniformity among the genotypes was found statistically highly significant. The highly uniform (scale 5) plants were recorded in CIP 390478.9 reflecting similar trend in CIP393073.179 (4.83), CIP 395112.32 (4.67) and CIP 394611.112 (4.67) whereas the less uniform (3) plants were observed in Jumli Local (Table 3). The variation in plant uniformity of different genotypes of potato was reported by previous researchers also [21, 22, 23].

Table 3: Effect of different potato genotypes on ground coverage (%) and Plant uniformity (1-5 scale) in On-Farm Varietal Trial at Guthichaur Rural Municipality, Jumla during 2017 and 2018

SN	Genotypes	Ground coverage (%)			Uniformity		
		2017	2018	Average	2017	2018	Average
1	CIP 392222.25	46.67 ab	41.67 bc	44.17 bc	4.67 a	4 b	4.33 bc
2	CIP 395112.32	46.67 ab	43.33 bc	45 bc	5 a	4.33 ab	4.67 abc
3	CIP 394611.112	55 a	50 ab	52.5 ab	4.67 a	4.67 ab	4.67 abc
4	CIP393073.179	51.67 a	48.33 abc	50 ab	5 a	4.67 ab	4.83 ab
5	CIP 390478.9	56.67 a	56.67 a	56.67 a	5 a	5 a	5 a
6	Desiree	40 b	38.33 c	39.17 c	4.33 a	4 b	4.17 c
7	Jumla Local	51.67 a	45 bc	48.33 abc	3 b	3 c	3 d
	Mean	49.8	46.2	48	4.52	4.24	4.38
	F test	*	*	*	**	**	**
	CV (%)	10.7	12	10.1	8.8	9.4	0.59
	LSD (0.05)	9.44	9.83	8.63	0.71	0.71	7.5

Note: NS=Non Significant *= Significant at *P*=.05 **=Significant at *P*=.01 LSD=Least Significant Difference CV= Coefficient of Variation

3.6 Insect damage (%)

Damage caused by insects (Blister beetle, Leaf minor) was minimum in all the genotypes. However, insect damage percentage was maximum (1.83%) in genotype Jumli local and minimum (1.17%) in genotype CIP 395112.32 (Table 4). Similar type of observation was observed by some researchers [19] in the potato varieties in Jumla.

3.7 Late blight scoring (1-9 scale)

Late blight disease was occurred in all genotypes but it remained under the less damage level. The score of late blight was maximum (4) in Jumli Local followed by Desiree (3) whereas minimum (1) in genotypes CIP 395112.32, CIP393073.179 followed by CIP 390478.9 (1.17), CIP 394611.112 (1.17) and CIP 392222.25 (1.33) (Table 4). Statistically highly significantly differences of potato genotypes against late blight disease was observed by some researchers [24, 25].

Table 4: Effect of different potato genotypes on insect damage (%) and late blight infection (scale 1-9) in On-Farm Varietal Trial at Guthichaur Rural Municipality, Jumla during 2017 and 2018

SN	Treatment	Insect damage (%)			Late blight reading (1-9 scale)		
		2017	2018	Average	2017	2018	Average
1	CIP 392222.25	1.33	1.33	1.33 de	1.33 c	1.33 c	1.33 c
2	CIP 395112.32	1.33	1	1.17 de	1 c	1 c	1 c
3	CIP 394611.112	1.33	1	1.17 de	1 c	1.33 c	1.17 c
4	CIP393073.179	1.67	1.33	1.5 cd	1 c	1 c	1 c
5	CIP 390478.9	2	1.33	1.67 bc	1 c	1.33 c	1.17c
6	Desiree	2	1.67	1.83 ab	3 b	3 b	3 b
7	Jumla Local	2	2	2 a	4 a	4 a	4 a
	Mean	1.67	1.38	1.52	1.76	1.86	1.81
	F test	NS	NS	**	**	**	**
	CV (%)	20.7	33.5	11.7	12.4	20.4	14.6
	LSD (0.05)			0.32	0.39	0.67	0.47

Note: NS=Non Significant *= Significant at *P*=.05 **=Significant at *P*=.01 LSD=Least Significant Difference CV= Coefficient of Variation

3.8 Total number of tubers per hectare

Highly significant difference was recorded in tuber number per hectare among the potato genotypes tested. Maximum number of tubers (534877) was in Jumli local which was at a par with CIP 395112.32 (379630) and CIP 392222.25 (379321) whereas minimum number of tubers (241975) was in Desiree (Table 5). The significant variation in tuber number might be due to genotypic factors. Tuber number was more affected in early maturing genotypes [26], which was similar to this study. Statistically highly significant variation in tuber number of different genotypes of potato was also observed from some of the researchers [27, 28].

3.9 Tuber yield and other characteristics

Tested genotypes were significantly different for tuber yield. CIP genotypes had significantly higher yield than the existing popular cultivar Jumli Local. The tuber yield of CIP genotypes crossed 21 t/ha while it remained below 9 t/ha in Jumli Local (Table 5). Most of the tested potato genotypes were late (>120 days after planting) in maturity whereas Desiree was early (<120 days after planting) in maturity. Tuber characteristics (tuber shape and tuber color) differed among potato genotypes. CIP393073.179 and CIP 392222.25 were round; CIP 395112.32 and CIP 390478.9 were Oblong; CIP 394611.112 was oval whereas Jumli Local and Desiree were round in shape. CIP393073.179, CIP 395112.32 and Desiree were red CIP 394611.112 was pink in color and CIP 392222.25, CIP 390478.9 & Jumli Local were white in tuber color. Difference in vegetative as well as yield and yield attributing parameters were possibly related to wider genetic diversity as well as genetic variability and potentiality in tested genotypes [29,30]. Similar types of results have been reported by researchers [31, 32]. Significant differences for almost all the vegetative as well as yield parameters show the wider genetic diversity as well as variability and potentiality among the tested potato genotypes [33, 34]. Tuber weight is an important yield component of potato that contributes to total tuber yield [35, 33].

Besides genotypes, management practices, seed quality and agro-ecological condition of the experimental site also affect the yield of tubers [15].As per the yield performance of these genotypes (23.12 t/ha to 26.24 t/ha) with-out use of chemical fertilizer, it indicates that these genotypes have genetic potentiality to perform better under Jumla condition of Nepal. In a recent study conducted by some researchers [36] tuber yields were significantly different between clones received from International Potato Center. Similar type of significant yield difference among potato genotypes were also reported by other researchers [33, 34, 37]. There are many factors for controlling variation in the performance of genotypes, among them genetic and environmental factors are mostly taken into consideration.

Table 5: Effect of different potato genotypes on number of tuber/ha and tuber yield (t/ha) in On-Farm Varietal Trial at Guthichaur Rural Municipality, Jumla during 2017 and 2018

SN	Treatment	Tuber number per ha			Tuber yield (t/ha)		
		2017	2018	Average	2017	2018	Average
1	CIP 392222.25	351852 bc	406790 b	379321 bc	20.37 a	22.59 a	21.84 a
2	CIP 395112.32	361111 b	398148 bc	379630 b	23.02 a	26.1 a	24.56 a
3	CIP 394611.112	296914 bc	327160 bc	312037 bcd	19.69 a	21.53 a	20.61 a
4	CIP393073.179	262346 bc	282716 bc	272531 bcd	25.37 a	26.91 a	26.14 a
5	CIP 390478.9	288889 bc	293827 bc	291358 bcd	22.35 a	23.89 a	23.12 a
6	Desiree	228395 c	255556 c	241975 bd	15.56 ab	18.7 ab	17.13 ab
7	Jumla Local	518519 a	551235 a	534877 a	8.24 b	8.33 b	8.28 b
	Mean	329718	359347	344533	19.2	21.2	20.2
	F test	**	**	**	*	*	*
	CV (%)	20	21.1	20.3	28.3	29.2	28.3
	LSD (0.05)	117143	134937	124718	9.67	10.99	10.18

Note: NS=Non Significant *= Significant at *P*=.05 **=Significant at *P*=.01 LSD=Least Significant Difference CV= Coefficient of Variation

4. CONCLUSION

Nepal is one of the countries where year-round production of potato is possible due its diversified agro-ecology. It is currently considered as a cash crop with its significant role in income generation. Yet, its yield in the country is very low compared to developed countries. In Nepal, Karnali province is very back in productivity of potato. There are various factors leading to the low productivity of potato but lack of high yielding varieties is the most important. Varieties performing well in a specific area may not do the same in another area. Therefore, development or selection varieties for the specific region should be given in high priority. The results of both years showed that significant differences for total number of tubers per hectare and total tuber yield. Among the tested genotypes better yield was harvested from CIP393073.179 (26.24 t/ha), CIP 395112.32 (24.56 t/ha) and CIP 390478.9 (23.12 t/ha). These yields were based on without application of chemical fertilizers in the field and with 20 tons of compost per hectare. Considering the yields, these genotypes will support in food security as well as income generation of farmers in the conditions of Jumla and similar environments of the country.

ACKNOWLEDGEMENTS

The authors are grateful to National Potato Research Program (NPRP), Khumaltar and Local Initiatives for Biodiversity, Research and Development (LIBIRD), Pokhara for providing the potato genotypes and . The authors also acknowledge the staff of Horticulture Research Station, Rajikot, Jumla and farmers of Garjyangkot settlement of Guthichaur Rural Municipality, Jumla for their active participation and co-operation during field experiment. This study was conducted under the financial support of Agriculture and Food Security Project (AFSP).

COMPETING INTERESTS

Authors declare that there is no conflict of interest related to the publication of this manuscript.

AUTHORS' CONTRIBUTIONS

The field trial was carried out in close collaboration with the authors. First draft was prepared by the corresponding author. All the authors read, incorporated their ideas, proof read the final paper and approved it for submission.

REFERENCES

1. Akkale C, Yildirim Z, Yildirim MB, Kaya C, Öztürk G, Tanyolac B. Assessing genetic diversity of some potato (*Solanum tuberosum* L.) genotypes grown in Turkey by using AFLP marker technique. Turk. J. Field Crops. 2010;15:73-78.
2. NPRP. 2022. Annual Report 2021/22. National Potato Research Program, Khumaltar, Lalitpur, Nepal.
3. ABPSD. 2022. Statistical information on Nepalese Agriculture. Agri-Business Promotion and Statistics Division, MOAD, Kathmandu, Nepal.
4. NDPP. 2010. Potato Crop Detail Booklet. National Potato Development Program, Khumaltar, Lalitpur, Nepal.
5. Kafle B, Shah P. Adoption of Improved Potato Varieties in Nepal: A case of Bara district. The Journal of Agricultural Sciencces.2012; 7:14-22.
6. NPRP. 2016. Annual Report 2015/16. National Potato Research Program, Khumaltar, Lalitpur, Nepal.
7. Bista DR, Amgain LP, Shrestha S. Food Security Scenario, Challenges and Agronomic Research Directions of Nepal. Agronomy Journal of Nepal.2013; 3:42-52
8. Sharma, GP. Potato Development in Nepal. Present Status and Future Strategies. Proceedings of National Potato Working group workshop, April 4-5, 2011.NARC, NPRP, Khumaltar, Lalitpur, Nepal.2011; 84-90.
9. Khatri BB, Sharma BP, Chaudhary D, Luitel BP, Ahamad S, Chapagain TR. On-farm Performance of Three Advanced Potato Clones in Different Agroecological Zones of Nepal. Proceedings of Ninth Outreach Research Group Workshop, Khumaltar, Kathmandu, Nepal. 2010; 30-34.
10. HRS. 2017. Annual Report 2016/17. Horticulture Research Station, Rajikot, Jumla, Nepal.
11. HRS. 2018. Annual Report 2017/18. Horticulture Research Station, Rajikot, Jumla, Nepal.
12. VSN International. Genstat for Windows 18th Edition. VSN International, Hemel Hempstead, UK; 2015. Web page: Genstat.co.uk.
13. Luitel BP, Lama Laxmi, Khatri BB, Choudhary D, Giri RK, Kadian MS, Arya S, Dhakal R, Bonierbale M. Evaluation of micro-nutrient rich potato genotypes in temperate conditions of Nepal. Potato J. 2016; 43: 138-145.
14. Deblonde PMK, Ledent JF. Effects of moderate drought conditions on green leaf number, stem height, leaf length, and tuber yield of potato cultivars. Eur. J. Agron. 2001; 14:1-41.

15. Eaton TE, Azad AK, Kabir H, Siddiq AB. Evaluation of six modern varieties of potatoes for yield, plant growth parameters and resistance to insects and diseases. Agri Sci. 2017; 8:1315-1326.
16. Nielson M, Iritani WM, Weiler LD. Potato seed productivity; factors influencing eye number per seed piece and subsequent performance. Am. J. Potato Res. 1989; 66:151-160.
17. Allen EJ. Plant density, In: Harris PM (Ed.), The potato crop. The scientific basis of improvement, Chapman and Hall, Ltd., London. 1978; 278-326.
18. Iritani WM. Factors affecting aging (degeneration) of potato tubers used as seed. *Am Potato J.* 1968; 45:111-116.
19. Giri RK, Upadhyay KP, Bhusal Y, Dhakal R, Subedi GD, Chalise B, Poudel B. Performance Evaluation of Nutrient Dense Potato Genotypes at High Hills of Karnali Province, Nepal. Asian Journal of Advances in Agricultural Research. 2023; 21(2), 40–50. https://doi.org/10.9734/ajaar/2023/v21i2415.
20. Tessema L, Wassu M, Abebe T. Evaluation of potato (Solanum tuberosum L.) varieties for yield and some agronomic traits. Open Agriculture. 2020; 5:63-74.
21. Pant S, Luitel BP, Upadhyay KP, Sapkota P, Pariyar K, Lohani S. On-Farm Evaluation of Potato Clones in Mid-Western region of Nepal. Proceedings of National Potato Working Group Workshop, November 9-10, 2017, NPRP, Khumaltar, Lalitpur, Nepal.2017; 26-30.
22. Rijal A, Khanal A, Poudel S, Khatri BB. Effects of Organic Manures of Growth and Yield of Potato. Proceeding of Ninth National Horticulture Workshop, May 31 to June 1, 2017. NARC, HRD, Khumaltar, Lalitpur, Nepal. 2017;182-188.
23. Giri RK, Chalise B, Paneru PB, Subedi GD, Khadka K, Dhakal R, Poudel S, Khatri BB, Luitel BP, Gautam S. Evaluation of Nutrient Dense Potato Genotypes at Jumla District of Nepal. Proceeding of Ninth National Horticulture Workshop, May 31 to June 1, 2017. NARC, HRD, Khumaltar, Lalitpur, Nepal. 2017;182-188.
24. Ahamad S, Shrivastav A, Sharma MD, Shah SC. Response of Potato Genotypes to Different Mositure Conditions in Mid-Western Terai of Nepal. Proceeding of Ninth National Horticulture Workshop, May 31 to June 1, 2017. NARC, HRD, Khumaltar, Lalitpur, Nepal. 2017; 189-194.
25. Upadhyay K P, Pandey S, Khatri BB, Luitel B, Tripathi N, Poudel K, Timilsina C, Piya S, Gautam S. Variation of Yield and Yield Attributing Parameters of Promising Clones of Potato. Proceeding of Ninth National Horticulture Workshop, May 31 to June 1, 2017. NARC, HRD, Khumaltar, Lalitpur, Nepal. 2017;195-202.
26. Lahlou O, Ouattar S, Ledent JF. The effect of drought and cultivar on growth parameters, yield and yield components of potato. Agronomie. 2003; 23: 257-268. DOI: 10.1051/agro:2002089.
27. Luitel BP, Khatri BB, Choudhary D, Paudel BP, Jung-Sook Sung, Hur On-Sook, Baek Hyung Jin, Cheol Ko Ho, Yul Ryu Kyoung. Growth and Yield Characters of Potato Genotypes Grown in Drought and Irrigated Conditions Of Nepal. Int J Appl Sci Biotechnol. 2015; 3(3): 513-519.
28. Seifu F, Betewulign E. Evaluation of potato (Solanum tuberosum L.) varieties for yield attributes. Journal of Biology, Agriculture and Healthcare. 2017; 7:15-22.
29. Chapagain TR, Tiwari DN, Adhikaari RC, Khatri BB, Luitel B. Performance of Potato Clones in Mid Hill of Western Nepal. Proceedings of National Potato Research Workshop, March 31 to April 2, 2014. NARC, NPRP, Khumaltar, Lalitpur, Nepal.2014;11-16.
30. Giri RK, Bhusal YR, Gautam S, Paneru PB, Subedi GD, Khadka K, Lama L, Khatri BB, Luitel BP, Regmi H, Khadka D, Khathyat DB, Budha C. Performance of Micronutrient Dense Potato Genotypes. The Journal of Agriculture and Environment. 2016; 17: 118-123.
31. Ghimire S, Rawal R, KC YP, and Upadhyay KP. Performance of Potato (*Solanum tuberosum*) Genotypes in on-station trial at Khajura, Nepal. Proceedings of National Potato Working Group Workshop, November 9-10, 2017, NPRP, Khumaltar, Lalitpur, Nepal. 2017; 67-71.
32. Piya S, Upadhyay KP, Poudel B, Upadhyay CP. Varietal performance of potato at outreach sites of Outreach Research Division. Proceedings of National Potato Working Group Workshop, November 9-10, 2017, NPRP, Khumaltar, Lalitpur, Nepal.2017; 100-104.

33. Luitel BP, Khatri BB, Lama L, Dhakal R, Khadka K, Choudhary D, Arya S, Bonierbale M, Kadian MS. Yield evaluation of nutrient-rich potato clones in high hills of Nepal. Journal of Nepal Agricultural Research Council. 2017; 3: 06-14.
34. Poudel K, Shah MK, Prasai HK, Upadhyay KP. Performance of Potato Genotypes at Farmers Field in Eastern High Hills. Proceedings of National Potato Working Group Workshop, November 9-10, 2017, NPRP, Khumaltar, Lalitpur, Nepal. 2017; 96-99.
35. Morena I, Guillen A, Moral LFG. Yield development in potatoes as influenced by cultivar and the timing and level of nitrogen fertilization. American Journal of Potato Research. 1994; 7:165-173.
36. Gotame TP, Paudel S, Thapa B, Neupane JD. Performance evaluation of potato clones for the central Terai Region of Nepal. Journal of Agriculture and Natural Resources. 2021; 4(2): 155-166.
37. Upadhyay KP, Bhattarai P, Pandey S, Neupane JD, Khatri BB. Performance of promising potato clones at different research sites in Super Zone of potato. Proceedings of the 12th National Outreach Research Workshop, Rampur, Chitwan, June 18-19 2017. 2017; 118-121.