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Research Article

Performance evaluation of potato clones for the central Terai Region of Nepal

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ABSTRACT

A series of experiments were carried out to evaluate the performance of exotic potato clones including PRP lines at research field of Regional Agricultural Research Station (RARS), Parwanipur, Bara, Nepal during the winter seasons of 2017 and 2018. Thirty-nine potato clones were evaluated in initial evaluation trial and eleven clones were evaluated in coordinated varietal trial with check varieties Khumal Ujjwal and Kufri Jyoti. From the initial varietal trial in 2017, the highest tuber yield (21.54 mt/ha) was found in CIP389660.9 followed by CIP391046.14 (21.38 mt/ha). In 2018, the highest tuber yield (29.72 mt/ha) was produced in CIP392759.1 followed by CIP393085.5 (26.92 mt/ha) and CIP391046.14 (26.64 mt/ha). In 2018, the tuber yield was the highest (26.12 mt/ha) in PRP 266265.15 followed by CIP 393371.159 (24.79 mt/ha). In coordinated varietal trial carried out in 2017/18, the highest tuber yield was noted in CIP394600.52 (42.65 mt/ha) followed by CIP395443.103 (30.83 mt/ha) and CIP395445.16 (24.43 mt/ha) respectively. Whereas in 2018/19, the highest yield was produced by PRP266265.15 (26.12 mt/ha) followed by CIP393371.159 (24.79 mt/ha) and CIP 396012.266 (22.66 mt/ha) respectively. In RARS, Parwanipur conditions, CIP 394600.52, CIP 395443.103, CIP 395445.16 and CIP 304394.56 along with PRP 266265.15 were found to be superior to standard check variety. These potential genotypes need to be further verified in farmers field in additional districts of central Terai region before notifying in the national seed system. Adoption of these clones as variety may increase the potato production and improve the food, and nutritional security in the central Terai region of Nepal.

Keywords: CIP lines, Potato, PRP lines, Tuber yield, Central Terai Region

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INTRODUCTION

Potato (*Solanum tuberosum* L.) is one of most important staple food crops in Nepal. It occupies the fifth position in area coverage, second in total production and first in productivity among the food crops grown in the country (MoALD, 2019). The area and production of potato in Nepal is 193,997 ha and 3,112,947 mt with productivity of 16.05 mt/ha (MoALD, 2019).Comparing to other countries, the yields of potato were 20.4 mt/ha,

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10.6 mt/ha, 18.8 mt/ha, 22.6 mt/ha, 36.6 mt/ha and 49.8 mt/ha in Bangladesh, Bhutan, China, India, The Netherlands and the USA, respectively in 2018 (FAOSTAT, 2019). In central Terai region (Province 2), area under potato is 24,400 ha and production is 377,128 mt with a productivity of 15.46 mt/ha. It serves as a staple food in the high hills and plays a vital role in the food security in the country. Out of the total area under potato, around 20% is in the high hills and mountains, 41.5% in the mid-hills and 38.5% in Terai (ABPSD, 2015). Low productivity of potato relies on various factors such as irrigation, fertilizer, varieties, diseases, insect pests and management practices (NPDP, 2018). The factors identified by National Potato Research Program (NPRP) were low yielding varieties, inadequate cultivation practices with the soil-cultivars-climate complex, inadequate control measures for major diseases and insect pests, insufficient soil fertility management practices (NPRP, 2015; Upadhyay *et al*., 2020). Another reason behind the low productivity in Terai region is due to lack of suitable location specific potato varieties. There is huge potential of potato crop that could contribute to the national economy.

National Potato Research Program (NPRP) is one of the public institutions for the development of new varieties. In Nepal, among 16 potato varieties developed and officially notified, 11 varieties are released and 5 varieties are registered for different agroecological conditions so far (NPRP, 2020). There were many recommended varieties of potato for the hills and mid hill conditions. Many CIP lines were also evaluated for mid hills. For example Luitel *et. al.* (2016) evaluated CIP lines and found that CIP 395112.32 produced the highest marketable tuber yield (18.5 mt/ha) followed by CIP 393073.179 (16.5 mt/ha) in hill conditions. Shrestha *et al.* (2012) reported that CIP 393280.64 was the best genotypes for central Terai conditions which increased fresh tuber yield by 11.4% and dry tuber yield by 28.2% as compared to Kufri Sindhuri.

NPRP has released and recommended Kufri Sindhuri, Desiree, Cardinal, Janak Dev, Khumal Rato and IPY8 for Terai and inner Terai region. However, the present varieties cannot meet the requirement of farmers in these locations. These varieties could not be adopted widely in this region due to low productivity, late blight susceptibility, and poor keeping quality. There is always a demand of high yielding varieties which are resistant of diseases and insect pests and even perform in the drought and dry condition (Khatri *et al*., 2010). Apart to the high yielding varieties, area specific varieties and quality planting material is the other most important part for the successful cultivation of the crop. Farmers desired characters are high yielding, late blight resistant, red skinned tubers and good keeping quality. Therefore, the present study was carried out to evaluate CIP bred potato clones including PRP lines at on-station and to select varieties for central Terai region of Nepal.

MATERIALS AND METHODS

Site characteristics

Experiments were conducted at Regional Agricultural Research Station (RARS), Parwanipur, Bara, Nepal in the winter season from September to March of 2017/18 and 2018/19.The RARS is situated between 84° 15' to 86° 15' east longitude and 26° 15' to 26° 45' north latitude with the elevation of 115 m-asl having subtropical climate (Gotame *et al*., 2020). The average maximum and minimum mean daily temperature was 29.8°C and 19.6°C, respectively. Similarly average relative humidity was 50.4% and mean rainfall was 35.5 mm during the growing period. The soil structure was angular blocky, dark grayish brown (10YR

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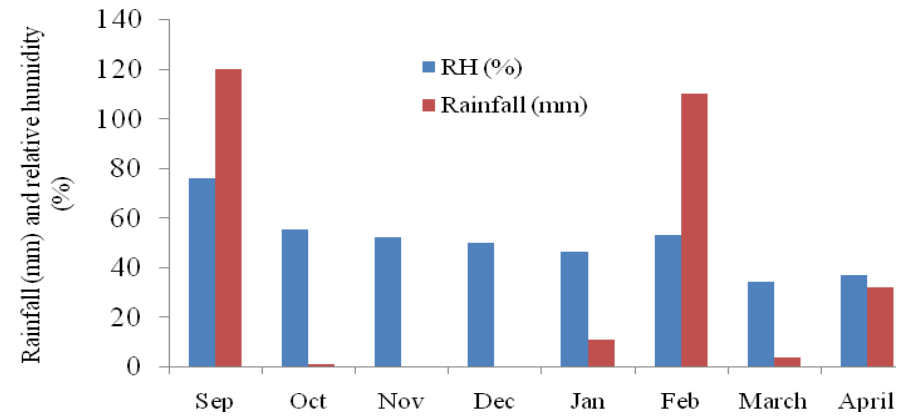
4/2) in color, silt loam in texture. The soil was moderately acidic in pH (5.67±0.09), low in organic matter (0.74±0.04%) (Khadka, *et al*., 2018).



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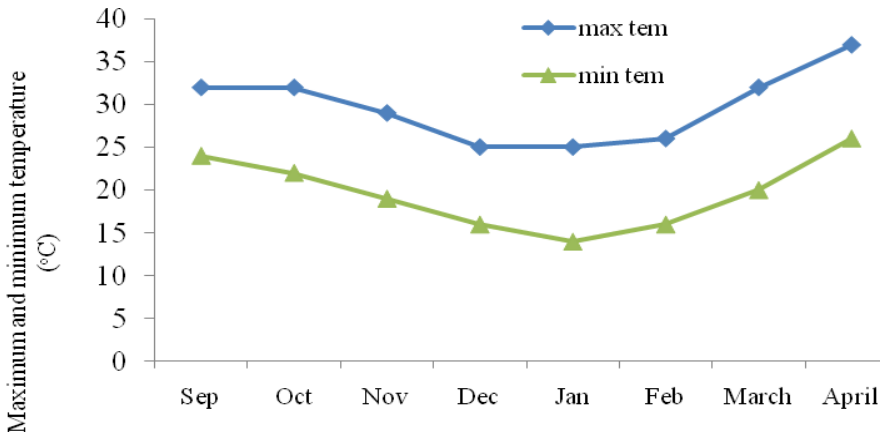

B

Figure 1. (A) Average monthly rainfall (mm), relative humidity (%), and (B) maximum temperatures, and minimum temperatures (°C) based on daily data from 2018 to 2019 for RARS, Parwanipur, Bara district (RARS, Parwanipur, Bara district

Experimental details

Initial evaluation trial (IET)

Thirty-three potato genotypes imported from International Potato Centre (CIP), Peru and six Potato Research Program (PRP) genotypes in 2017 and 31 exotic genotypes and 6 PRP lines along with the check varieties in 2018 were sown in a RCBD (Randomized Complete Block Design) with two replications in the winter at RARS, Parwanipur. Planting was done in November 1st week with a spacing of 60 cm x 25 cm. The plot size was 1.2 m x 3 m =3.6 m^2. There were 12 plants per row and 2 rows were maintained per plot. Therefore, the total plants were 24 per plot. The fertilizer rate was 100:100:60 kg/ha with FYM 20 mt/ha. The nitrogen

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was applied in two split doses. First half dose was applied as a basal dose and second half at stolon formation stage at 35 days after sowing.

Co-ordinated varietal trial

Nine exotic genotypes (CIP lines) and 7 PRP lines of potatoes along with a check variety were evaluated in the winter of 2017 and six CIP lines along with PRP and check varieties were evaluated in 2018 in co-ordinated varietal trial. The seed size was 20-50 g. The experiment was carried out in RCBD design with 4 replications. The plot size was 3.0 m x 2.4 m =7.2 m^2. There were 4 rows per plot and 12 plants per row. Therefore, the total plants were 48 per plot. The fertilizer rate was FYM/compost 20 mt /ha and NPK 100:100:60 kg/ha. The nitrogen was applied in two split doses. First half dose was applied as a basal dose and second half after at stolen formation stage (35 days after sowing).

The emergence percentage was recorded at 45 days after sowing (DAS). Tubers were harvested and total tuber produced per plot was recorded. The tuber size ranging from 25-50 g and > 50 g were categorized as marketable tuber and tubers size of <25 g, diseased, insect damaged/infested, heavily bruised, green, cracked, knobby shaped, secondary growth and early sprouted tubers were categorized into nonmarketable (Khatri & Luitel, 2014). Crop was monitored regularly during growing season. Irrigation and plant protection measures were carried out when required. The evaluation was done based on the following criteria set for the potato sizes.

Observation recorded

Emergence percentage

It was calculated by following formula;

$$\text{Emergence \%} = \frac{\text{Number of plants per plot} \times 100}{\text{Number of tubers sown per plot}}$$

Tuber grading

Tubers were categorized into 3 main groups as follows.

Under sized tuber	= Tuber weight <25 g
Medium or seed sized tuber	= Tuber weight 25-50 g
Over sized tuber	= Tuber weight >50 g

Tuber number and tuber yield (kg/plot)

It was determined by dividing the total fresh tuber yield to their respective total tubers number.

Adjusted tuber yield (mt/ha)

It was calculated as the sum of the weight of marketable and unmarketable tubers from the net plot area and transformed to ton per hectare. The adjusted yield was obtained by dividing the tuber yield per plot by the net number of hill harvested and multiplying with number of hills per plot.

Data analysis

Collected data was tabulated in Microsoft excel and recorded data was analyzed using R software. The analysis of variance (ANOVA) in Randomized Complete Block Design (RCBD) was used to determine the level of significance. The treatment means were

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compared by the Least Significant Difference (LSD) test at 1% and 5% level (Gomez & Gomez, 1984; Shrestha, 2019).

RESULTS AND DISCUSSIONS

From the initial varietal trial carried out in 2017/18, significant differences were found in the ground coverage (%), medium sized tuber yield per plot, over sized tuber number and over sized tuber yield per plot, total tuber per plot, and yield per hectare ($P<0.05$). It was found that CIP392657.15 had the highest ground coverage (100%) followed by CIP399004.19 (92%). The observed tuber yield was the highest in CIP389660.9 (43 tubers) while the lowest was found in CIP388576.10 and CIP392617.54 (3 tubers). Seed sized tuber yield was the highest (3.31 kg per plot) in CIP391046.14 followed by CIP393085.5 (2.38 kg per plot) and PRP136368.9 (2.26 kg per plot). The highest oversized tuber number (43 tubers) was produced by CIP389660.9 followed by CIP392792.22 (31 tubers). However, the highest oversized tuber yield (4.67 kg per plot) was produced by CIP389660.9 followed by CIP396033.107 (2.77 kg per plot). The highest tuber yield per plot was noted in CIP391046.14 (5.98 kg per plot) followed by 389660.9 (5.94 kg per plot). The results on adjusted yield showed that CIP391046.14 produced the highest yield (21.54 mt/ha) followed by CIP389660.9 (21.38 mt/ha) respectively (Table 1). However, emergence %, undersized tuber number and undersized tuber yield were not significantly different within the clones evaluated. In contrast with the results reported by Abbasi *et al.* (2004), there were no differences in germination among various genotypes of potatoes. The similarity in emergence could be due to the tubers dormancy controlling factors that might be similar in the clones evaluated so far.

From the initial varietal trial carried out in 2018/19, there was significant differences in undersized tuber yield, seed sized tuber yield, oversized tuber number and yield per plot, and total yield per hectare was noted in CIP392759.1 (29.72 mt/ha). CIP393085.5 (26.92 mt/ha). Check variety Khumal Ujjwal and Kufri Jyoti produced 16.1 mt/ha and 12.9 mt/ha respectively which was lower than the potential CIP and PRP lines.

From the initial varietal trial carried out in 2018/19, significant differences were found in under sized tuber number and yield per plot, seed sized tuber per plot, over sized tuber number and over sized tuber yield per plot, total tuber per plot, and yield per hectare. However, seed sized tuber yield were not significantly different within the clones evaluated so far. Among tested genotypes, CIP 392759.1 (29.72 mt/ha) performed better over other genotypes followed by CIP 393085.5 (26.92 mt/ha), CIP 391046.14 (26.64 mt/ha), CIP 303381.106 (26.35 mt/ha) and CIP 386612.5 (25.7 mt/ha) respectively (Table 2).

Results from coordinated varietal trial in 2017/18 showed that PRP25861.11 and PRP336769.1 had the highest emergence (74%) at 45 days after sowing followed by CIP393371.159 (66%). However, the highest ground coverage was noted in PRP336769.1 (71%) followed by CIP393371.159 (70%). Plants emergence is a significant factor of any crop that affects stand establishment, population dynamics of crop and helps towards the final yield (Khan *et al*, 2018). Similar finding was reported Abbasi *et al.* (2004), there were differences in germination among various genotypes of potatoes. The differences in emergence could be due to the tuber's dormancy controlling factors that might be different in the clones evaluated so far.

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Table 1. Performance of potato genotypes in the initial evaluation trial (IET) at Regional Agricultural Research Station (RARS), Parwanipur, 2017/18

SN	Genotypes	Emergence % (45 DAS)	Ground cover % (60 DAS)	Under sized tuber/plot (3.6 m^2)		Seed sized tuber/plot (3.6 m^2)		Over sized tuber/plot (3.6 m^2)		Total tuber yield (kg/plot) (3.6 m^2)	Adjusted tuber yield (mt/ha)
				Number	Yield (kg)	Number	Yield (kg)	Number	Yield (kg)		
1	CIP 391046.14	73	77.5	21	0.12	87	3.31	22	2.23	5.98	21.54
2	CIP 389660.9	77	77.5	15	0.09	37	1.18	43	4.67	5.94	21.38
3	CIP 396033.107	81	77.5	18	0.11	67	2.14	29	2.77	5.01	17.59
4	CIP 392759.1	60	65	12	0.05	26	1.88	19	1.97	3.90	17.2
5	CIP 392792.22	85	82.5	18	0.11	74	2.16	31	2.45	4.72	15.56
6	CIP 392250.56	77	77.5	13	0.04	46	1.74	22	2.23	4.01	14.77
7	CIP 386612.5	67	70	6	0.02	27	0.98	25	2.48	3.48	14.61
8	CIP 392206.35	67	55	24	0.28	59	1.94	12	1.25	3.47	14.46
9	CIP 303381.106	75	65	10	0.20	43	1.64	20	1.99	3.83	14.14
10	CIP 396011.47	69	70	13	0.16	43	1.48	17	1.67	3.30	13.47
11	CIP 388556.4	71	65	8	0.06	52	1.73	16	1.53	3.31	13.19
12	CIP 393085.5	92	74	38	0.28	81	2.38	20	1.54	4.19	12.84
13	CIP 397073.15	79	60	8	0.25	26	0.88	18	2.35	3.48	12.27
14	CIP 392797.22	79	67.5	8	0.36	41	1.31	24	1.82	3.49	12.1
15	PRP 136368.9	83	77.5	36	0.22	86	2.26	15	1.10	3.58	12.07
16	CIP 393633.54	65	67.5	24	0.15	48	1.42	15	1.23	2.80	12.04
17	CIP 391011.17	44	47.5	4	0.20	15	0.49	12	1.18	1.86	11.92
18	CIP 391518.75	81	67.5	11	0.05	56	1.60	20	1.80	3.46	11.84
19	CIP 395445.16	77	57.5	3	0.18	29	0.93	18	2.06	3.17	11.39
20	CIP 378711.7	81	67.5	18	0.11	42	1.25	19	1.91	3.27	10.77
21	CIP 387115.8	88	82.5	6	0.03	55	1.87	13	1.25	3.15	9.84
22	CIP 397012.22	79	72.5	15	0.09	60	2.02	6	0.45	2.56	9.25
23	CIP394038.105	77	62.5	3	0.01	34	0.79	19	1.83	2.63	9.09
24	CIP 392243.17	90	72.5	13	0.12	70	1.99	9	0.70	2.81	8.81
25	CIP 399092.16	92	57.5	20	0.10	64	1.85	10	0.92	2.87	8.47
26	PRP 226265.4	63	50	11	0.06	40	1.09	10	0.67	1.81	8.11
27	CIP 392227.15	81	60	12	0.06	56	1.71	8	0.60	2.37	8.09
28	PRP 056567.9	73	62.5	21	0.12	41	1.05	12	0.89	2.07	7.64
29	CIP 392657.15	100	77.5	9	0.19	65	1.96	6	0.46	2.61	7.26
30	PRP 336769.1	58	67.5	28	0.30	72	1.46	4	0.19	1.95	7.07
31	CIP 392256.48	92	65	17	0.12	49	1.53	9	0.65	2.29	6.89

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SN	Genotypes	Emergence % (45 DAS)	Ground cover % (60 DAS)	Under sized tuber/plot (3.6 m^2)		Seed sized tuber/plot (3.6 m^2)		Over sized tuber/plot (3.6 m^2)		Total tuber yield (kg/plot) (3.6 m^2)	Adjusted tuber yield (mt/ha)
				Number	Yield (kg)	Number	Yield (kg)	Number	Yield (kg)		
32	PRP 136368.1	67	57.5	14	0.40	32	0.94	6	0.39	1.74	6.65
33	PRP 016567.13	81	57.5	8	0.08	52	1.33	14	0.47	1.87	6.4k
34	CIP 393248.55	83	65	5	0.03	31	1.00	12	0.88	1.91	6.29
35	CIP 399004.19	96	75	26	0.13	72	1.64	5	0.30	2.07	5.99
36	CIP 399079.22	85	55	8	0.18	31	0.96	5	0.54	1.68	5.60
37	CIP 39339.242	77	32.5	8	0.02	35	0.81	5	0.28	1.11	4.35
38	CIP 392617.54	65	30	2	0.07	23	0.60	3	0.16	0.83	3.48
39	CIP 388576.10	88	55	9	0.06	31	0.78	3	0.21	1.05	3.39
	Mean	77	64.78	14	0.13	48	1.49	15	1.33	2.96	10.71
	CV%	16.4	18.7	67.8	107.6	46.7	41.3	51.9	52.3	-	28.2
	P-value	>0.05	0.024	>0.05	>0.05	>0.05	0.04	0.002	<.001	<.001	<.001
	LSD (0.05)	-	24.48	-	-	-	1.24	15.22	1.413	-	6.10

DAS, Days after sowing

Under sized tuber number was the highest (52) in Khumal Ujjwal followed by CIP395443.103 (47). Seed sized tuber yield was the highest in PRP336769.1 (195) followed by Khumal Ujjwal (111). However, the seed sized tuber yield was the highest in PRP336769.1 (6.39 kg/plot) followed by Khumal Ujjwal (3.55 kg/plot). Total tuber yield per plot was produced by CIP394600.52 (11.44 kg per plot) followed by CIP393371.159 (10.25 mt/ha). The highest yield was produced in CIP 394600.52 (42.65 mt/ha), CIP 395443.103 (30.83 mt/ha) and CIP 395445.16 (24.43 mt/ha) in 2017/18 (Table 3). Yield is a quantitative trait that is controlled by many factors including genotype and environment. In our findings, tuber yield per plot and yield per hectare were significantly different between clones could be due to the genotypic variations of the CIP clones of potato. Tuber yield is the product of intercepted photosynthetically active radiation (PAR) and efficiency to convert into dry matter. For potato, the ability of the leaf to convert the PAR into carbohydrates and the storage capacity of the tubers affect growth of tubers, tuber size and tuber yield (Oliveira et al., 2016). There are many factors controlling the yield and quality traits of potato, probably depending on the genetic background of the respective genotypes evaluated so far.

From the coordinated varietal trial of 2018/19, the yield per hectare was the highest in CIP395443.52 (42.65 mt/ha) followed by CIP395443.103 (30.83 mt/ha). From the pooled value of two consecutive years, it was found that CIP 394600.52 produced the highest yield (31.225 mt/ha) followed by CIP 395443.103 (25.61 mt/ha), CIP 395445.16 (24.43 mt/ha) and CIP 304394.56 (23.01 mt/ha) respectively.

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Table 2. Performance of potato genotypes in initial evaluation trial (IET) at RARS, Parwanipur conditions, 2018/19

SN	Genotypes	Under sized tuber/plot (3.6 m^2)		Seed size tuber/plot (3.6 m^2)		Over sized tuber/plot (3.6 m^2)		Yield (kg/plot) (3.6 m^2)	Adjusted tuber yield (mt/ha)
		Number	Yield (kg)	Number	Yield (kg)	Number	Yield (kg)		
1	CIP 392759.1	32	0.243	78	3.812	53	6.643	10.698	29.72
2	CIP 393085.5	113	1.335	122	4.587	39	3.769	9.691	26.92
3	CIP 391046.14	48	0.595	100	4.231	43	4.765	9.591	26.64
4	CIP 303381.106	71	1.026	108	4.517	39	3.944	9.487	26.35
5	CIP 386612.5	38	0.325	83	3.499	50	5.428	9.252	25.7
6	CIP 392792.22	36	0.325	83	3.557	43	4.756	8.638	23.99
7	CIP 389660.9	36	0.373	60	2.61	41	4.975	7.958	22.11
8	PRP 136368.9	56	0.5705	131	4.701	25	2.589	7.86	21.83
9	CIP 395445.16	17	0.374	73	3.233	37	3.804	7.411	20.59
10	CIP 3992227.15	13	0.41	51	2.257	34	4.382	7.049	19.58
11	CIP 391518.75	55	0.627	68	3.145	29	3.065	6.837	18.99
12	CIP 396011.47	80	0.771	69	2.767	35	3.256	6.794	18.87
13	CIP 392250.56	42	0.814	53	2.174	31	3.66	6.648	18.47
14	CIP 392243.17	53	0.44	104	3.65	27	2.43	6.52	18.11
15	CIP 392206.35	73	0.758	120	3.851	15	1.61	6.219	17.27
16	CIP 392797.22	27	0.242	67	2.645	31	3.279	6.166	17.13
17	CIP 388556.4	31	0.293	74	3.045	28	2.793	6.131	17.03
18	CIP 397012.22	42	0.6735	63	2.498	27	2.842	6.014	16.7
19	PRP 056567.9	92	0.833	113	3.983	11	1.12	5.936	16.49
20	PRP 016567.13	22	0.255	61	2.738	25	2.813	5.806	16.13
21	Khumal Ujjwal	54	0.442	63	2.82	30	2.533	5.795	16.1
22	PRP 226265.4	53	0.537	71	2.909	21	2.337	5.783	16.06
23	PRP 136368.1	22	0.259	55	2.341	26	3.136	5.736	15.93
24	CIP 393633.54	34	0.395	61	2.224	25	2.797	5.416	15.04
25	CIP 397073.15	12	0.14	37	1.78	26	3.484	5.404	15.01
26	CIP 396033.102	52	0.488	80	2.711	22	2.043	5.242	14.56
27	PRP 336769.1	45	0.49	54	1.852	33	2.806	5.148	14.3
28	Kufri Jyoti	30	0.284	59	2.348	22	2.012	4.643	12.9
29	CIP 388576.10	27	0.337	67	2.278	19	1.654	4.269	11.86
30	CIP 378711.7	35	0.263	50	2.06	16	1.918	4.241	11.78
31	CIP 394038.105	23	0.213	54	1.935	16	2.071	4.219	11.72
32	CIP 399092.16	46	0.475	76	2.733	15	1.375	4.126	11.46
33	CIP 39339.242	32	0.363	93	2.284	17	1.257	3.904	10.84
34	CIP 399079.22	26	0.223	62	2.404	17	1.379	3.547	9.85
35	CIP 393248.55	24	0.17	50	2.257	11	1.153	3.234	8.98
36	CIP 392256.48	50	0.435	56	1.568	9	0.683	2.686	7.46
37	CIP 387115.8	20	0.283	34	1.36	6	0.585	2.228	6.19
38	CIP 392657.15	14	0.164	45	1.623	2	0.029	2.032	5.64
39	CIP 399004.19	37	0.335	46	1.27	3	0.461	1.605	4.46
	Mean	41.1	0.451	71.4	2.78	26.62	2.86	5.9	16.38
	CV%	33.2	54.1	35.8	36.4	38.2	43.6	32.8	32.8
	P value	0.001	0.009	0.042	>0.05	0.004	0.006	0.002	0.002
	LSD (0.05)	27.63	0.493	51.74	-	-	-	3.915	10.87

Seed sized tuber yield determines the economic value of tuber production (Kim *et al.*, 2017). In the present experiment, seed sized tuber rate varied with respect to genotypes. Potato tuber yields are linked to the duration of the growth cycle, which depends on climate, cultivar, and crop management (Kooman *et al.*, 1996). In the optimum management conditions, potato tuber yield could be different among genotypes which could be due to differences in accumulated intercepted radiation, the utilization coefficient of foliage followed by dry matter partition within the plant (Oliveira *et al*, 2016).

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Table 3. Performance of potato genotypes in the coordinated varietal trail (CVT) at RARS, Parwanipur, 2017/18

SN	Genotypes	Emergence % (45 DAS)	Ground cover % (60 DAS)	Undersized tuber/plot(7.2 m^2)		Seed sized tuber/plot		Oversized tuber/plot		Tuber yield/plot (kg) (7.2 m^2)	Adjusted tuber yield (mt/ha)
				Number	Yield (kg)	Number	Yield (kg)	Number	Yield (kg)		
1	CIP 394600.52	40	59	24	0.12	78	3.16	62	8.16	11.44	42.65
2	CIP 395443.103	48	56	47	0.31	107	3.35	52	5.91	9.56	30.83
3	CIP 395445.16	31	35	6	0.05	35	1.29	26	3.04	4.38	24.43
4	CIP 304394.56	38	39	7	0.07	30	1.48	31	4.20	5.76	23.01
5	CIP 377957.5	37	41	22	0.16	51	2.04	26	3.40	5.60	22.73
6	CIP 393371.159	66	70	32	0.34	84	3.24	62	6.67	10.25	22.63
7	PRP 136368.9	45	56	24	0.12	73	2.71	34	4.15	6.98	21.45
8	CIP 396012.266	48	48	31	0.19	105	3.22	32	2.90	6.31	21.29
9	CIP 393371.164	61	69	7	0.04	79	3.18	51	6.09	9.31	21.22
10	PRP 266265.15	50	56	10	0.06	49	1.77	44	5.08	6.90	19.94
11	CIP 392797.22	41	44	12	0.09	55	1.98	32	3.42	5.49	18.88
12	PRP 225861.2	42	45	8	0.03	46	1.53	24	2.08	3.65	17.14
13	PRP 336769.1	74	71	46	0.29	195	6.39	22	1.73	8.41	15.93
14	Khumal Ujjwal	30	41	52	0.24	111	3.55	25	2.71	6.50	15.6
15	PRP 25861.10	22	22	9	0.07	27	0.95	11	0.98	2.00	12.23
16	PRP 25861.11	74	60	31	0.23	97	3.26	32	2.93	6.42	11.99
17	PRP 225861.5	34	43	14	0.08	47	1.55	10	0.80	2.43	10.08
	Mean	46	50	22	0.15	75	2.63	34	3.78	6.55	20.71
	CV%	35	25.8	50.3	70.3	41	33.6	42.1	40.9	-	29.5
	P-Value	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
	LSD (0.05)	10.97	18.43	10.04	0.14	43.46	1.25	20.7	2.19	-	8.70

DAS, Days after sowing

The significant variations among the genotypes for tuber size distribution in number and weight could be attributed to inherent potential of such genotypes which were highly influenced by genotype. Effect of heredity was significant with regard to tuber sizes (Muthuraj *et al.*, 2005). Patel *et al.*, (2008) found that rapid plant emergence and better plant growth results in higher number of seed (medium) size tubers. The highest yield of small size tubers may be due to varietal character. More number of under size tubers may be due to the higher vigor of plants coupled with delayed maturity (Sharma & Singh, 2009). Genotypic difference in tubers size among might be due to genetic and environmental factors. There was 80-90% difference among potato varieties in the case of tuber size. Masarirambi *et al.* (2012) has also found difference in tuber size per plant.

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Table 4. Performance evaluation of different potato genotypes in coordinated varietal trial (CVT) in 2018/19

SN	Genotypes	Emergence % (45 DAS)	Ground cover % (60 DAS)	Undersized tuber/plot(7.2 m^2)		Seed sized tuber/plot (7.2 m^2)		Oversized tuber/plot (7.2 m^2)		Tuber yield/ plot (kg) (7.2 m^2)	Adjusted tuber yield (mt/ha)		Adjusted Mean yield (mt/ha)
				Number	Yield (kg)	Number	Yield (kg)	Number	Yield (kg)		2017	2018	
1	CIP 394600.52	40	59	24	0.12	78	3.16	62	8.16	11.44	42.65	19.8	31.225
2	CIP 395443.103	48	56	47	0.31	107	3.35	52	5.91	9.56	30.83	20.39	25.61
3	CIP 395445.16	31	35	6	0.05	35	1.29	26	3.04	4.38	24.43	-	24.43
4	CIP 304394.56	38	39	7	0.07	30	1.48	31	4.2	5.76	23.01	-	23.01
5	CIP 377957.5	37	41	22	0.16	51	2.04	26	3.4	5.6	22.73	21.03	21.88
6	CIP 393371.159	66	70	32	0.34	84	3.24	62	6.67	10.25	22.63	24.79	23.71
7	PRP 136368.9	45	56	24	0.12	73	2.71	34	4.15	6.98	21.45	22.36	21.905
8	CIP 396012.266	48	48	31	0.19	105	3.22	32	2.9	6.31	21.29	22.66	21.975
9	CIP 393371.164	61	69	7	0.04	79	3.18	51	6.09	9.31	21.22	20.48	20.85
10	PRP 266265.15	50	56	10	0.06	49	1.77	44	5.08	6.9	19.94	26.12	23.03
11	CIP 392797.22	41	44	12	0.09	55	1.98	32	3.42	5.49	18.88	-	18.88
12	PRP 225861.2	42	45	8	0.03	46	1.53	24	2.08	3.65	17.14	-	17.14
13	PRP 336769.1	74	71	46	0.29	195	6.39	22	1.73	8.41	15.93	17.49	16.71
14	Khumal Ujjwal	30	41	52	0.24	111	3.55	25	2.71	6.5	15.6	19.79	17.695
15	PRP 25861.10	22	22	9	0.07	27	0.95	11	0.98	2	12.23		12.23
16	PRP 25861.11	74	60	31	0.23	97	3.26	32	2.93	6.42	11.99	19.7	15.845
17	PRP 225861.5	34	43	14	0.08	47	1.55	10	0.8	2.43	10.08	14.8	12.44
18	Kufri Jyoti	-	-	-	-	-	-	-	-	-	-	20.57	20.57
	Mean		93.3	0.995	167.4	7.11	63.21	6.85	20.7	6.55	20.71	20.77	-
	CV%		38.5	41.4	17.3	17.9	36.5	48.2	24.9	-	29.5	24.9	-
	P-values		0.001	0.002	0.001	0.001	0.001	>0.05	>0.05	<.001	<.001	>0.05	-
	LSD (0.05)		51.59	0.59	41.43	1.821	33.04	-	-	-	8.70	-	-

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CONCLUSION

In central Terai region, potato is harvested in March/April. In RARS, Parwanipur conditions, CIP 394600.52, CIP 395443.103, CIP 395445.16 and CIP 304394.56 along with PRP 266265.15 were found to be superior to standard check variety. On the basis of overall performances, CIP 394600.52 and PRP 266265.15 could be recommended for cultivation in central Terai condition.

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Authors' contributions

T.P. Gotame designed, executed the experiment and wrote the draft of the manuscript, S. Poodle involved in field layout, genotype evaluation, data collection. B. Thapa provided materials for research and analyzed the data, J.D. Neupane helped in plantation, harvesting and data collection.

Conflict of interest

The authors declare no conflicts of interest.

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