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Genetic Variability Studies for Yield and Yield Attributing Traits in Potato (*Solanum tuberosum* L.)

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Abstract

An experiment was comprised 20 genotypes of potato for the estimation of genetic variability and genetic parameters *viz*., GCV, PCV, heritability (*bs*) and genetic advance for yield and yield contributing traits during *Rabi*-2021-22. The analysis of variance revealed that the mean sum of square due to Nitrogen, variety and interaction of Nitrogen x Variety was exhibited highly significant superior for all the characters studied. This indicated that experimental material under study had sufficient genetic diversity for different traits among studied materials. The PCV (%) were higher than GCV (%) for all the traits whereas, high GCV (%) and PCV (%) were recorded for tuberization efficiency and number of shoots plant^{-1}. High heritability was recorded for all the traits except for number of eye tuber^{-1}. Moderate genetic advance was for in number of leaves plant^{-1}, plant height at maturity, tuber yield plant^{-1}, marketable tuber yield plant^{-1}, harvest index and plant emergence. High genetic advance as % of mean was found in all the traits except in harvest index (%) and plant emergence (%). High heritability coupled with high genetic advance as % of mean was recorded for Plant height (cm), No of leaves plant^{-1}, number of branches plant^{-1}, number of shoot plant^{-1}, dry matter content of shoot(%), numbers of tuber plant^{-1}, marketable tuber yield plant^{-1}, unmarketable tuber yield plant^{-1}, tuber yield plant^{-1}, number of eye tuber^{-1}, total tuber yield, tuberization efficiency (haulm: tuber ratio) and nitrate reductase activity. Thus it shows that heritability is due to additive gene effects and suggested selection will be effective for these traits for yield improvement.

Key words : *Variability, PCV, GCV, heritability (bs) and genetic advance.*

Introduction

Potato (*Solanum tuberosum* L.) belongs to solanaceae family having chromosome number 2n=4x=48, is one of the most important staple food crops among the vegetables; which is utilized throughout the year in India. Potato is a self-pollinated crop with a cross-pollination rate of up to 2.54% (1). Potato is known as “King of vegetable” has emerged, as fourth most important food crop in India after rice, wheat and maize. Potato is a crop which has always been a “poor man’s food”. The potato is a nutrient-rich food that includes minerals, proteins, vitamins C and B, high-quality dietary fibres, and phenolic compounds (2). A raw potato has a water content of roughly 79%, 17% carbohydrates (88% of which are starch), 2% protein, and little fat. 100 grammes of raw potatoes have 322 kilojoules (77 kilocalories) of energy. With no significant amounts of any other vitamins or minerals, this is a high source of vitamin B6 (23%) and vitamin C (24%) only. Major potato producing states are Uttar Pradesh, West Bengal, Madhya Pradesh, Punjab, Haryana, Bihar, Gujarat and Assam. The area and production and productivity of potato in India are around area 2202.15 million ha hectare, production 53387.35 million tones and productivity 24.24 kg ha^{-1}. In case of Chhattisgarh, potato is considered as an important commercial crop. This crop is mainly grown in different part of Chhattisgarh such as, Surguja, Balrampur, Jashpur, Raigarh, Bilaspur, and Raipur districts with a total area: 42.54 ha, Production: 651.48 million tones and Productivity: 15.32 kg ha^{-1} (3). At present the cultivated area of potato has increased in Chhattisgarh but the productivity is still lower than the global and national average, therefore it is an urgent need to develop the high yielding potato cultivars which suit the Chhattisgarh farmers. Understanding various estimates of genetic variability parameters such as genotypic coefficient of variation, heritability and genetic advance is absolutely necessary for plant breeder to start a judicious breeding programme. Furthermore, heritability measures the relative amount of the heritable portion of variation, while the genetic advance helps to measure the amount of progress that could be expected with selection in a character. High heritable estimates together with high genetic advance are more valid for selection than heritability estimates alone (4). Estimation of genetic variability along with heritability and genetic advance gives an idea of the possible improvement of the character through selection. Hence, present study was made to

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Table-1 : Analysis of variance (ANOVA) for yield and yield attributing traits in potato genotypes.

Sl. No.	Characters	Mean sum of square					
		Replicates	Nitro	Error A	Var	Nitro*Var	Error B
		2	2	4	19	38	114
1.	Plant Emergence (%)	19.15	479.10 **	5.91	259.04 **	8.43 **	4.61
2.	Plant Height (cm)	29.54	1417.51 **	2.58	253.48 **	11.93 **	3.38
3.	Number of Leaves Plant^{-1}	13.01	2380.57 **	5.04	173.29 **	29.67 **	3.68
4.	Number of Branches Plant^{-1}	5.29	94.20 **	0.41	13.20 **	1.51 **	0.76
5.	Number of Shoot Plant^{-1}	2.93	59.39 **	0.18	9.87 **	1.19 **	0.65
6.	Dry Mater content of shoot (%)	2.57	294.89 **	1.84	50.45 **	3.16 **	1.73
7.	Number of Tubers Plant^{-1}	3.03	230.88 **	1.29	10.65 **	1.56 **	0.75
8.	Marketable Tuber Yield Plant^{-1} (g)	251.74	70491.70 **	541.3	26045.47 **	462.02 **	170.96
9.	Unmarketable Tuber Yield Plant^{-1} (g)	8.02	424.43 **	1.82	126.71 **	10.82 **	2.46
10.	Tuber Yield Plant^{-1} (g)	373.21	80340.34 **	565.99	28562.32**	498.93 **	174.13
11.	Number of Eye Tuber^{-1}	4.90	67.21 **	0.52	4.15 **	1.31 **	0.68
12.	Total Tuber Yield (Kg/Plot)	2.07	289.19 **	2.03	102.83 **	1.80 **	0.63
13.	Tuberization Efficiency (Haulm : tuber ratio)	0.49	4.89 **	0.03	3.89 **	0.13 **	0.05
14.	Harvest Index (%)	12.82	321.96 **	6.79	284.97**	3.50 **	1.19
15.	Nitrogen Use Efficiency (%)	0.97	9530.12 **	2.64	59.46 **	37.04 **	4.98
16.	Nitrate Reductase Activity (µ mol/hour/g fresh weight)	38.40	3288.60 **	5.69	2501.79 **	32.83 **	7.68

*and ** significant at 5%, 1% level respectively.

estimate the genetic variability among 20 potatoes genotypes with the aid of genetic parameters.

Materials and Methods

The experimental material consisting 20 potatoes two checks namely Kufri Khyati and Kufri Chipsona-1 1including was evaluated in split plot design with three replications during *Rabi*-2021-22 at Research cum Instructional Farm Department of Genetics and Plant Breeding, IGKV, College of Agriculture, Raipur (C.G.). All recommended package of practices were adopted to raise the healthy crop. Observations were recorded on randomly tagged five plants *viz*., plant emergence(%), plant height at maturity(cm), number of leaves plant^{-1}, number of branches plant^{-1}, number of shoot plant^{-1}, dry matter content of shoot (%), number of tubers plant^{-1} (g), marketable tuber yield plant^{-1}(g), unmarketable tuber yield plant^{-1} (g), Tuber yield plant^{-1} (g), number of eye tuber^{-1}, Total tuber yield(kg plot^{-1}), tuberization efficiency (tuber: haulm ratio), harvest index Nitrogen use efficiency (%) and nitrate reductase activity (µ mol/min/g fresh weight) were recorded on plot basis.

Statistical methods : Analysis of variance was carried out as per the procedure given by Fisher's method and the GCV and PCV parameters were estimated by (Burton, 1952). Heritability and genetic advance as percentage of mean calculated as per procedure of Johnson *et al.,* 1955. The data analysis was carried out with INDOSTAT software.

Results and Discussion

Analysis of variance : The result of analysis of variance was found significant for all the characters were presented in table-1. The analysis of variance revealed that the mean sum of square due to Nitrogen, variety and interaction of Nitrogen x Variety was exhibited highly significant for all the characters studied. This indicated that experimental material under study had sufficient genetic amount of variability for different traits among studied materials. Similar result has been reported by (5, 6, 7).

Genotypic and phenotypic coefficient of variation : In present findings the phenotypic coefficient of variation was of higher magnitude than genotypic coefficient of variation for all characters indicating the influence of environment on the expression of these characters was presented in Table-3.

The high GCV (%) was reordered for nitrogen use efficiency, tuberization efficiency, nitrate reductase activity and number of shoot plant^{-1} low was noted in plant emergence (%) and harvest index (%) whereas moderate was observed in plant height at maturity(cm), number of leaves plant^{-1}, number of branches plant^{-1}, dry matter content of shoot (%), number of tubers plant^{-1} (g), marketable tuber yield plant^{-1}(g), unmarketable tuber yield plant^{-1} (g), Tuber yield plant^{-1} (g), number of eye tuber^{-1}, Total tuber yield (kg plot^{-1}).

Whereas, high PCV (%) was observed in traits *viz*., nitrogen use efficiency, tuberization efficiency, nitrate reductase activity and number of shoot plant^{-1} number of eye tuber^{-1} and number of tubers plant^{-1} and traits *viz*., plant emergence (%) and harvest index (%)were noted was showed low PCV however, moderate was observed in plant height at maturity (cm), number of leaves plant^{-1}, number of branches plant^{-1}, dry matter content of shoot (%), marketable tuber yield plant^{-1}(g), unmarketable tuber

Table-2 : Mean performance of yield and yield attributing traits in potato genotypes.

S.No.	GENOTYPES	PE	PH	NLPP	NBPP	NSPP	DM	NTPP	MTYPP	UMTYPP	TYPP	NEPT	TTY	TE	HI	NUE	NRA
1.	P-45	80.74	37.11	51.22	9.75	6.56	24.92	12.10	202.73	50.72	253.45	6.63	15.21	3.67	78.56	10.58	59.55
2.	P-46	83.85	40.56	51.67	10.14	5.67	24.37	8.37	62.38	50.46	112.84	6.94	6.77	1.58	90.67	5.12	72.97
3.	P-53	86.07	42.33	49.89	11.44	8.11	20.93	9.46	74.59	54.72	129.31	7.00	7.76	2.83	88.52	5.85	88.01
4.	P-73	88.07	48.78	56.78	12.06	5.94	21.78	10.70	243.09	62.83	305.92	7.38	18.36	3.35	79.00	13.33	91.52
5.	P-21	79.33	40.89	47.89	8.67	5.56	18.22	9.29	54.56	42.57	97.13	5.96	5.83	2.52	87.10	4.52	83.97
6.	K. SURYA	77.15	36.78	46.78	9.04	5.48	18.77	8.58	119.49	101.22	220.71	7.21	13.24	1.74	89.89	9.80	50.54
7.	K. JYOTI	82.11	48.11	43.56	9.64	4.79	18.00	8.46	123.36	36.42	159.77	4.96	9.59	2.37	91.49	6.96	63.83
8.	K. SINDURI	67.78	53.00	46.33	12.89	6.83	22.76	10.78	88.47	26.39	114.85	8.00	6.89	3.33	80.86	5.34	46.04
9.	K. MOHAN	91.18	37.22	41.11	9.22	5.88	21.48	8.52	168.10	116.48	284.59	7.47	17.08	1.90	83.96	12.55	52.52
10.	K. LALIT	84.66	49.11	45.78	11.44	5.38	16.39	10.51	154.17	87.87	242.04	7.84	14.52	2.35	79.22	10.10	49.76
11.	K. NEELKANTH	81.33	38.00	47.00	9.02	5.67	22.71	9.81	189.51	75.11	264.62	6.76	15.88	1.45	90.75	11.31	57.22
12.	K. CHIPSONA-3	87.61	47.00	51.44	11.89	8.22	24.44	11.83	80.95	45.00	125.95	6.64	7.56	3.17	77.44	5.60	50.67
13.	K. HIMALINI	90.18	36.67	42.67	8.98	5.21	20.74	9.33	101.83	43.82	145.65	6.43	8.74	2.35	91.39	6.51	36.34
14.	K. ASHOKA	83.70	40.78	51.33	10.42	6.27	23.10	9.28	121.25	44.12	165.37	7.23	9.92	2.31	76.56	7.37	68.53
15.	K. GARIMA	80.78	44.67	48.44	9.89	8.11	19.36	10.53	199.07	66.29	265.36	7.23	15.92	2.57	81.15	11.22	81.89
16.	K. ARUN	87.22	48.00	47.11	9.33	7.00	23.13	11.07	182.62	43.32	225.94	6.98	13.56	3.43	82.46	9.87	60.79
17.	K. LALIMA	77.78	49.67	49.78	10.50	6.78	22.22	9.49	146.31	124.42	270.74	6.33	16.24	1.63	88.79	11.44	71.85
18.	K. LIMA	87.74	36.78	48.78	9.22	5.68	20.57	9.14	95.92	69.01	164.94	6.71	9.90	2.74	92.56	7.31	91.41
19.	K. KHYATI	80.38	40.67	51.33	9.06	7.89	22.39	9.97	114.89	93.58	208.47	7.06	12.51	2.07	92.44	9.21	45.98
20.	K. CHIPSONA-1	82.30	47.33	59.56	10.30	6.17	18.97	10.41	158.41	81.27	239.68	6.28	14.38	2.37	88.72	10.49	76.31
	MEAN	83.00	43.17	48.92	10.15	6.36	21.26	9.88	134.09	65.78	199.87	6.85	11.99	2.49	85.57	10.58	64.99
	CD 5%	2.00	1.72	1.79	0.81	0.76	1.23	0.81	12.21	11.46	12.32	0.77	10.74	0.21	1.02	8.24	3.59
	CV	2.59	4.26	3.92	8.58	12.73	6.19	8.75	8.69	9.47	11.10	12.05	9.92	9.02	1.28	14.23	4.26

PE- Plant Emergence (%), PH-Plant Height at maturity (cm), NLPP-Number of leaves Plant^{-1}, NBPP- Number of branches plant^{-1}, NSPP-Number of shoots plant^{-1}, DMCS-Dry matter content of shoot (%), NTPP-Number of tubers plant^{-1}, NEPT- Number of eyes tuber^{-1}, TTY-Total tuber yield (Kg plot^{-1}), TE(HR)-Tuberization efficiency (Tuber: haulm ratio), HI- Harvest index (%), NUE-Nitrogen use efficiency (%), NRA-Nitrate reductase activity (µmol/hour/g fresh weight).

Table-3 : Genetic variability parameters for yield and yield attributing traits in potato genotypes.

S. No.	Genetic Parameters	Range		GCV	PCV	h^2 (Broad Sense)	Genetic Advancement 5%	Gen. Adv as % of Mean 5%
		Max.	Min.					
1.	Plant Emergence (%)	91.18	67.78	6.97	7.44	87.80	11.17	13.46
2.	Plant Height(cm)	53.00	36.67	15.48	16.05	93.00	13.28	30.76
3.	Number of Leaves Plant^{-1}	59.56	41.11	14.54	15.07	93.10	14.15	28.92
4.	Number of Branches Plant^{-1}	12.89	8.67	15.76	17.91	77.40	2.90	28.56
5.	Number of Shoot Plant^{-1}	8.22	4.79	20.94	24.42	73.50	2.35	36.99
6.	Dry Mater content of shoot (%)	24.92	16.39	13.99	15.30	83.60	5.60	26.35
7.	Number of Tubers Plant^{-1}	12.10	8.37	19.81	21.70	83.30	3.68	37.25
8.	Marketable Tuber Yield Plant^{-1}(g)	243.09	54.56	19.40	19.88	95.20	12.11	38.98
9.	Unmarketable Tuber Yield Plant^{-1}(g)	124.00	26.39	17.13	18.15	89.10	8.68	33.32
10.	Tuber Yield Plant^{-1}(g)	305.92	97.13	18.82	19.25	95.50	12.76	37.89
11.	Number of Eye Tuber^{-1}	8.00	4.96	16.39	20.31	65.10	1.87	27.24
12.	Total Tuber Yield (Kg/Plot)	18.36	5.83	18.82	19.25	95.50	7.66	37.89
13.	Tuberization Efficiency (Haulm: tuber ratio)	3.67	1.45	27.98	29.38	90.70	1.37	54.90
14.	Harvest Index (%)	92.56	77.44	6.87	7.00	96.20	11.87	13.87
15.	Nitrogen Use Efficiency (%)	13.33	4.52	77.12	78.68	96.10	22.16	15.57
16.	Nitrate Reductase Activity (µ mol/ hour/g fresh weight)	91.52	36.34	27.10	27.43	97.60	35.85	55.16

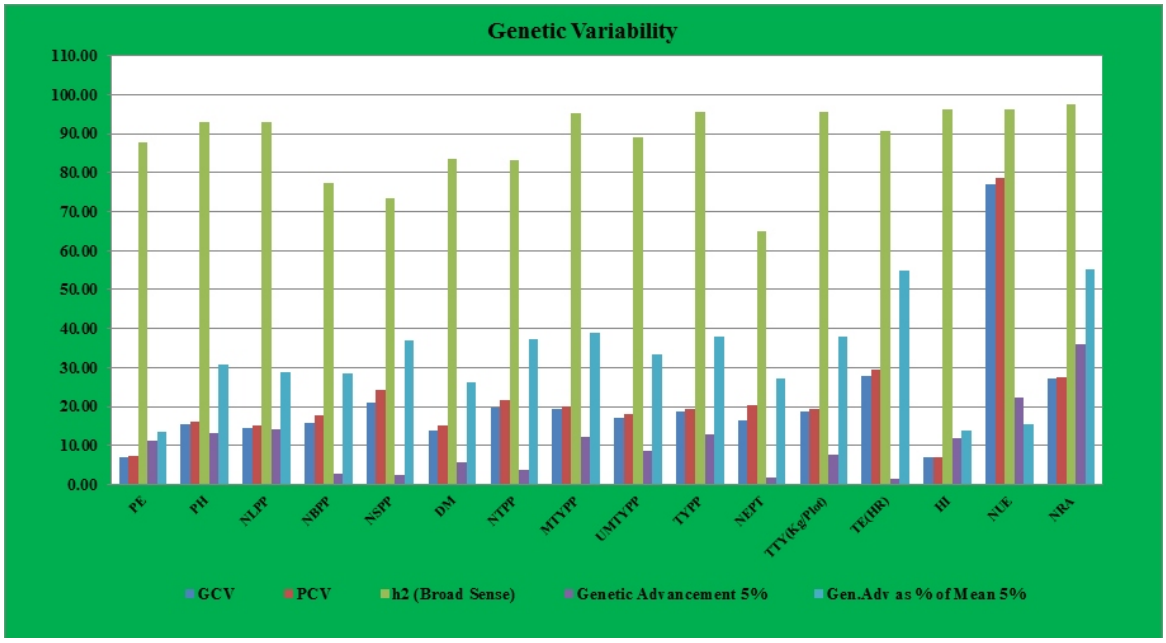


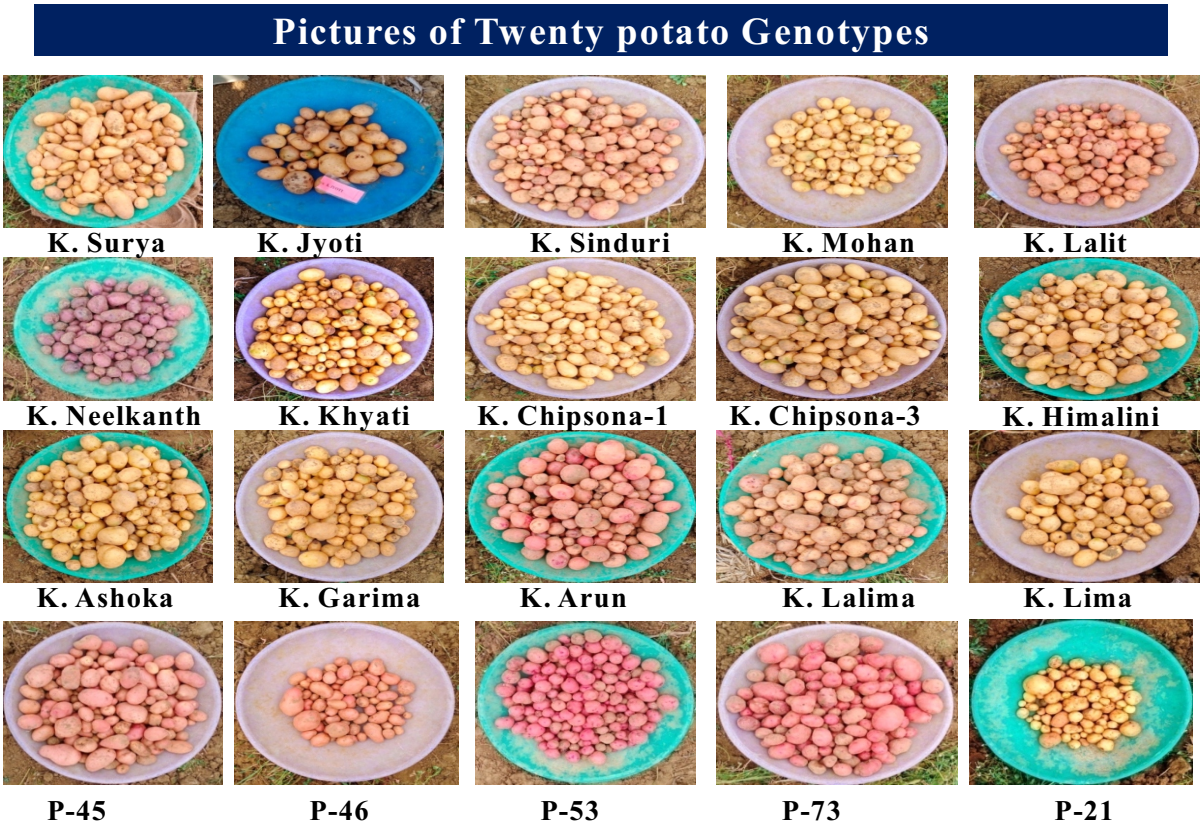
Fig.-1 : Genetic variability parameters for yield and yield attributing traits in potato genotypes.

yield plant^{-1} (g), Tuber yield plant^{-1} (g) and Total tuber yield (kg plot^{-1}). The high GCV (%) and PCV (%) were recorded for tuberization efficiency and number of shoots plant^{-1}.

High heritability was recorded for all the traits *viz*., plant emergence (%) plant height at maturity(cm), number of leaves plant^{-1}, number of branches plant^{-1}, dry matter content of shoot (%), dry matter content of shoot (%), number of tubers plant^{-1} (g), marketable tuber yield plant^{-1}(g), unmarketable tuber yield plant^{-1} (g), Tuber yield plant^{-1} (g), Total tuber yield (kg plot^{-1}), tuberization efficiency, harvest index, nitrogen use efficiency and nitrate reductase activity except for number of eye tuber^{-1}. High to medium range of coefficient of variation provides great scope for the selection of desirable genotypes.

Similar findings were reported by (8, 9, 10).

Heritability and Genetic Advance : The estimates of heritability in broad sense (h^2) heritability and genetic advance as present of mean (GA) for 20 genotypes for 16 characters are presented in table-3. The estimate of heritability along with high genetics advance is more useful than heritability alone in productivity the effectiveness of selection. The heritability broad sense (h^2) and genetic advance ranged from 65.10 to 96.20 and



1.37 to 14%. Genetic advance as present of mean ranged from 13.46 to 55.16.

The high heritability was observed in traits viz., nitrate reductase activity (97.60%), Harvest index (96.20%), nitrogen use efficiency (96.10%), Tuber yield plant^{-1}(95.50%), Total tuber yield (95.50%), Marketable tuber yield plant^{-1} (95.20%), Number of leaves Plant^{-1} (93.10%), Plant Height at maturity (93.00%), Tuberization efficiency (90.70%), Unmarketable tuber yield plant^{-1} (89.10%), Plant emergence (87.80%), Dry matter content of shoot (83.60%), Number of tubers plant^{-1} (83.30%), Number of branches plant^{-1} (77.40%) and Number of shoot plant^{-1} (73.50%). The moderate heritability was exhibited by Number of eye tuber^{-1} (65.10%).

High genetic advance was noted in traits viz., nitrate reductase activity and nitrogen use efficiency. Moderate genetic advance was recorded in number of leaves plant^{-1}, plant height at maturity, tuber yield plant^{-1}, marketable tuber yield plant^{-1} and harvest index (%) and plant emergence (%), however low was observed in traits tuberization efficiency (tuber: haulm ratio), number of eye tuber^{-1}, number of shoot plant^{-1}, number of branches plant^{-1}, number of tuber plant^{-1} and dry matter content of shoot (%).

The high genetic advance as percentage of mean showing characters are Tuberization efficiency (54.90%) followed by Marketable tuber yield plant^{-1} (38.98%), Total tuber yield (37.89%), Tuber yield plant^{-1}(37.89%), Number of tubers plant^{-1} (37.25%), Number of shoot plant^{-1} (36.99%), Unmarketable tuber yield plant^{-1} (33.32%) Plant Height at maturity (30.76%) Number of leaves Plant^{-1} (28.92%) followed by Number of branches plant^{-1} (28.56%) Number of eye tuber^{-1} (27.24%) and Dry matter content of shoot (26.35%). The moderate genetic advance as percentage of mean was recorded for Harvest index (13.87%) and Plant emergence (13.46%).

High heritability coupled with high genetic advance as % of mean was recorded for plant height at maturity, number of branches plant^{-1}, number of leaves plant^{-1}, nitrate reductase activity, Tuber yield plant^{-1}, total tuber yield, marketable tuber yield plant^{-1}, unmarketable tuber yield plant^{-1}, dry matter content of shoot, number of eye tuber^{-1}, number of tubers plant^{-1}, number of shoot plant^{-1} and tuberization efficiency (tuber: haulm ratio).

Thus, it shows that heritability is due to additive gene effects and suggested selection will be effective for these traits for the improvement of tuber yield of potato. Similar findings were reported by (7, 11, 12, 13).

Conclusions

Analysis of variance shows all characters had higher range of significant variation among genotypes. It

indicated that there is a lot of scope for selecting and exploiting various traits such as plant emergence (%) plant height at maturity (cm), number of branches plant^{-1}, number of leaves plant^{-1}, nitrate reductase activity (µ mol/min/g fresh weight), nitrogen use efficiency, tuber yield plant^{-1}, total tuber yield, marketable tuber yield plant^{-1}, unmarketable tuber yield plant^{-1}, dry matter content of shoot, number of eye tuber^{-1}, number of tubers plant^{-1}, number of shoot plant^{-1} and tuberization efficiency (tuber: haulm ratio) in a potato improvement programme. High GCV and PCV were recorded in tuberization efficiency and number of shoots plant^{-1}. High heritability coupled with high genetic advance as percentage of means was observed for plant height at maturity, number of branches plant^{-1}, number of leaves plant^{-1}, nitrate reductase activity (µ mol/min/g fresh weight), Tuber yield plant^{-1}, total tuber yield, marketable tuber yield plant^{-1}, unmarketable tuber yield plant^{-1}, dry matter content of shoot, number of eye tuber^{-1}, number of tubers plant^{-1}, number of shoot plant^{-1} and tuberization efficiency (tuber: haulm ratio). It indicates that heritability due to additive gene effect selection may be effective.

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References

1. Wang G.L., Mackill D.J., Bonman J.M., McCouch S.R., Champoux M.C. and Nelson R.J. (1994). RFLP Mapping of genes conferring complete and partial resistance to blast in a durably resistant rice cultivar. *Genetics,* 136: 1421–1434.
2. Woolfe J. (1987). The potato in the human diet. *Cambridge University Press*, Cambridge (7): 218-222.
3. Anonymous (2022). Ministry of Agriculture and farmers welfare, govt. of India.
4. Johnson H.W., Robinson H.F. and Comstock R.E. (1955). Estimates of genetic and environmental variability in soybeans. *Agron. J.,* 47(7): 314-318.
5. Singha L. and Ullah Z. (2020). Genetic variability studies for yield and its attributing traits in potato (*Solanum tuberosum* L.). *Int. J. Curr. Micr. App. Sci.,* 9(02): 1974-1983.
6. Kashyap R., Rangare N.R. and Rangare S.B. (2021). Evaluation of potato (*Solanum tuberosum* L.) germplasm for some important morphological traits using multivariate analysis. *The Pharma Innovation Journal*., 10(10): 180-185.
7. Rupakshi and Satpal Baloda (2022). Response of soil application of zinc sulphate and ferrous sulphate on leaf nutrient status of guava plants cv. Hisar safeda under high density planting. *Progressive Research : An International Journal,* 17(2): 126-129.
8. Fekadu G., Kassahun T., Kifle D. and Malatu G. (2020). Morphological traits based genetic diversity assessment of ethiopian potato. *Genetic Resources and Crop Evolution,* 67: 809-829.
9. Singh S., Mishra D.P., Singh N., Singh S. and Singh S.P. (2021). Genetic variability and associations studies for yield and its component traits in potato (*Solanum tuberosum* L.). *The Phar. Inno. Jour.,* 10(4): 658-660.
10. Rohit, Rangare N.R., Johnson L.P. and Tandekar K. (2022). Studies on genetic variability, heritability and genetic advances of potato (*Solanum tuberosum* L.) genotypes for yield and yield attributing traits. *The Pha. Inno. J.* 11(3): 260-263.
11. Workayehu M., Mohammad W. and Abebe T. (2021). Genetic variability and correlation of traits among progenies crosses in Ethiopia. *East Afri. J. Sci.,* 15(1): 1-16.
12. Zeleke A.A. (2021). Genetic diversity studies for tuber yield and yield related traits in potato (*Solanum tuberosum* L.) genotypes, *Inter. Jour. of Res. Stud. in Agri. Scie.,* 7(8): 13-22.
13. Tessema G.L., Mohammed A.W. and Abebe D.T. (2022). Genetic variability studies for tuber yield and yield attributes in Ethiopian released potato (*Solanum tuberosum* L.) varieties. *Peer J.,* 10: 1-14.