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Genetic variability in potato (*Solanum tuberosum* L.)

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ABSTRACT

The genetic variability analysis of twenty six genotypes of potato for seventeen yield and quality traits revealed that the characters namely tuber yield plant^{-1}, leaf area, average tuber weight, stolon length, total soluble solids (TSS), yield plot^{-1} and yield ha^{-1}, number of stolons and number of tubers plant^{-1} exhibited high heritability with high genetic gain indicating that these characters could be considered reliable tools for selection as they indicate dominance of additive gene effect.

Key words : : Genetic gain, Genetic variability, Heritability, Potato.

Potato, also known as white or Irish potato, is the most important and useful member of the family Solanaceae. The cultivated potato is an autotetraploid with 2n=2x= 48 (Swaminathan and Howard, 1953). It has been recognized as a wholesome food and one of the richest sources of energy in most countries of the world where it forms important part of the human diet. It is one of the efficient starch producing plants and yields more carbohydrates per unit area and time, is rich in protein, minerals, vitamins and high quality dietary fibre. Potatoes are also used as feed for livestock and in the industry for the manufacture of starch and alcohol. An insight into the magnitude of variability present in the gene pool of a crop species is of utmost importance to a plant breeder for starting a judicious plant breeding programme and selection of parents for a hybridization programme as the development of an efficient plant breeding programme is dependent upon the existence of genetic variability. The present investigation has been made to study the genetic variability of twenty six genotypes including varieties for yield and quality characters.

MATERIALS AND METHODS

Twenty six diverse genotypes of potato were evaluated for various yield and yield attributing traits at the Experimental fields of the Division of Olericulture, SKUAST-K Shalimar, Srinagar, during *Kharif* 2008. The experiment was planted in a Randomised Block Design with three replications. Each experimental plot consisted of five rows of each genotype in each replication at a spacing of 60 x 20 cm. The experimental field was well prepared and recommended cultural practices were followed to ensure a healthy crop growth. The parameters of variability were estimated as per the methods given by Burton and Dewane (1953) and Johnson *et al.* (1955).

RESULTS AND DISCUSSION

The genotypes differed significantly for all the traits under study, which indicates scope for further genetic studies. The maximum range of means was recorded for tuber yield plant^{-1} (234.87-501.58 g) followed by tuber yield ha^{-1} (155.11-323.80 q), leaf area (50.32-92.70 cm^2) and average tuber weight (39.78-70.04 g), while the minimum range was observed for specific gravity (1.04-1.10) followed by protein content (1.64-2.72 %). Wide variation among potato genotypes with respect to different characters was also reported by Basavaraj *et al.* (2005).

The estimates of phenotypic coefficients of variability were slightly higher than corresponding genotypic coefficients of variation for all the characters under study (Table 1) indicating that the genotypic influence is lessened under the influence of the given environment. Phenotypic and genotypic coefficients of variation varied from 1.33 to 26.56 and 1.26 to 25.89 per cent, respectively. The highest phenotypic and genotypic coefficient of variability was recorded for stolon length (26.56 and 25.89, respectively); followed by yield plant^{-1} (21.08 and 21.03, respectively), number of tubers plant^{-1} (19.48 and 18.28, respectively), yield ha^{-1} (18.11 and 17.34, respectively), TSS (17.66 and 17.13, respectively), number of stolons plant^{-1} (17.63 and 16.69, respectively), whereas, specific gravity exhibited the lowest range of phenotypic and genotypic coefficient of variability (1.33 and 1.26, respectively) followed by per cent emergence at 45 days

Table 1: Estimate of variability parameters for different characters in potato (*Solanum tuberosum* L.)

Sr. No.	Characters	Mean	Range	Coefficient of variability (%)		Broad sense heritability (%)	Genetic advance	Genetic gain (%)
				Phenotypic	Genotypic			
1.	Per cent emergence at 45 DAP	94.21	91.67-97.50	2.28	1.66	53.30	2.36	2.50
2.	No. of stems hill^{-1}	3.85	2.67-4.73	15.14	14.07	86.30	1.04	27.01
3.	Leaf area (cm^2)	69.14	50.32-92.70	14.52	14.47	99.20	20.53	29.69
4.	Plant height (cm)	63.04	55.66-75.23	9.15	8.86	93.70	11.14	17.67
5.	Plant spread (cm)	31.80	19.35-38.61	13.22	12.96	96.10	8.33	26.19
6.	No. of stolons plant^{-1}	5.65	3.73-7.80	17.63	16.69	89.60	1.84	32.56
7.	Stolon length (cm)	10.06	4.68-14.04	26.56	25.89	95.00	5.24	52.08
8.	No. of tubers plant^{-1}	7.08	4.33-9.20	19.48	18.28	88.00	2.50	35.31
9.	Average tuber weight (g)	53.46	39.78-70.04	15.13	14.81	95.80	15.97	29.87
10.	Yield (g plant^{-1})	372.13	234.87-501.58	21.08	21.03	99.50	160.74	43.19
11.	Yield (kg plot^{-1})	10.36	6.70-13.99	18.11	17.34	91.70	3.55	34.26
12.	Yield (q ha^{-1})	239.93	155.11-323.80	18.11	17.34	91.70	82.62	34.43
13.	Specific gravity	1.072	1.04-1.10	1.33	1.26	90.20	0.03	2.79
14.	TSS (^{O}B)	5.45	4.07-7.03	17.66	17.13	94.10	1.87	34.31
15.	Vitamin C (mg 100g^{-1})	20.79	17.89-23.78	6.37	5.41	72.20	1.97	9.47
16.	Dry matter (%)	19.69	15.96-23.26	8.98	8.39	87.30	3.18	16.15
17.	Protein (%)	1.98	1.64-2.72	17.33	15.16	76.60	0.54	27.27

after planting (2.28 and 1.66, respectively). In addition to the above characters, number of stems hill^{-1}, leaf area, plant spread, average tuber weight and protein content also exhibited high phenotypic and genotypic coefficients of variation. These results confirm the earlier findings of Mishra *et al.* (2006).

Heritability in broad sense was high for all characters except per cent emergence at 45 days after planting (DAP), vitamin C and protein content which exhibited moderate heritability. The range of heritability varied from 53. 3 per cent (per cent emergence at 45 DAP) to 99.5 per cent (yield plant^{-1}) which suggested major role of genetic constitution in the expression of the characters and least effect by environmental modifications. Heritability with genetic advance is more useful in predicting the gains under selection than heritability alone (Johnson *et al.,* 1955). High heritability alongwith high genetic advance was observed in the characters for yield plant^{-1}, yield ha^{-1} and leaf area while as high heritability and moderate to low genetic advance was found in the rest of the traits. High estimates of heritability and high genetic advance were also reported by Roy *et al.* (2006).

In the present study high heritability associated with high genetic gain was recorded for the traits namely tuber yield plant^{-1}, leaf area, average tuber weight, stolon length, total soluble solids (TSS), yield plot^{-1} and yield ha^{-1}, number of stolons and number of tubers plant^{-1}. The value of genetic gain varied from 2.50 to 52.08 per cent for all traits.

From the above discussion it is obvious that the characters *viz.,* tuber yield plant^{-1}, leaf area, average tuber weight, stolon length, total soluble solids (TSS), yield plot^{-1} and yield ha^{-1}, number of stolons and number of tubers plant^{-1} which exhibited high estimates of heritability along with high genetic gain could be considered reliable tools for selection as such characters indicate dominance of additive gene effect.

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