Journal of Crop and Weed, 10(1):186-188(2014)

Study of correlation among various characters of different potato (*Solanum tuberosum* L.) germplasm

S. DATTA, [1]R. DAS, D. SINGH, [1]U. THAPA AND [1]A. R. MANDAL

Department of Vegetable Science
G.B. Pant University of Agriculture and Technology, Pantnagar-263 145
[1]Bidhan Chandra Krishi Viswavidyalaya, Mohanpur-741 252, Nadia, West Bengal

Received: 19.9.2013 Revised: 10.2.2014 Accepted: 28.2.2014

Key words: Correlation, potato, tuber yield.

Besides its significance to human food security, potato is also a crop with fascinating genetic traits and cultural history (Swaminathan, 1999). The present-day cultivated potatoes (tetraploid; 2n=4x=48) in most part of the world represent *S. tuberosum* subsp. *tuberosum* and *S. tuberosum* subsp. *andigena*, although their numerous diploid (2n=2x=24) relatives are still under cultivation in and around its primary and secondary centre of origin in South America. Genetic variability has been considered to be the basis of plant breeding (Simmonds, 1962). So, genetic variability in any crop is the essential prerequisite for initiation of breeding work. Potato being the vegetative propagated crop, clonal selection is the important breeding method and for executing the effective selection programmes association between different characters is a pre-requisite. Complex polygenic traits e.g. tuber yield in potatoes can be improved through indirect selection for close component traits (Killick, 1977). Therefore, study of correlation coefficient among various desirable characters is one of the most important aspects for any breeding programme to elucidate the degree of favourable or unfavourable association between different useful characters. Given this back drop, the present investigation was undertaken to assess correlation among different agronomical and economically important traits of thirty five potato genotypes.

The present investigation was carried out at Vegetable Research Centre, G.B. Pant University of Agriculture and Technology, Pantnagar during spring-summer season 2010-11. Pantnagar is situated at 29.5° latitude and 79.3°E longitude and at an altitude of 243.84 meters above the mean sea level in sub-mountainous region of Shivalik hills, known as *Tarai*. The climate of this place is humid and sub-tropical and frost can be expected from last week of December to end of the January. The experimental materials comprised of thirty five genotypes of potato including twelve commercially released varieties from Central Potato Research Institute (CPRI), Shimla, Himachal Pradesh and one commercially released variety from G. B. Pant University of Agriculture and Technology, Pantnagar and twenty two breeding lines under trial at Central Potato Research Institute (CPRI), Shimla, Himachal Pradesh. The tubers were planted (60 cm x 20 cm) on 30th October, 2009 in a 5.4 m^2 plots for each of the three replications of each genotype in this centre. The recommended package of practice suitable for Pantnagar region was followed. Morphological traits were recorded visually on whole population basis while for other traits; five plants per plot were selected randomly for each genotype. Correlation coefficients were calculated by the method of Al-Jibouri *et al.* (1958).

$$r = \frac{\left(X_i - \overline{X}\right)\ \left(Y_i - \overline{Y}\right)}{\sqrt{\left(X_i - \overline{X}\right)^2\ \left(Y_i - \overline{Y}\right)^2}}$$

Where r is correlation coefficient between character X and Y.

For calculation of phenotypic, genotypic and environmental correlation coefficients, the phenotypic, genotypic and environmental covariance in the numerator and the phenotypic, genotypic and environmental variance in the denominator are used, respectively.

Correlation coefficients was worked out among different characters in all possible combinations and presented in Table 1. In the present investigation, tuber yield witnessed positive significant correlation with average tuber weight per plant (0.967), average tuber weight (0.575), number of stolon hill^{-1} (0.403) and ascorbic acid (0.460). This indicates that selection for these traits would be effective to improve tuber yield in potato. Positive correlation of tuber yield has also been reported with plant height (Luthra, 2001 and Uniyal and Mishra, 2003), number of shoots per plant (Patel *et al.*, 2002a), number of leaves per shoot

Email: sanjayveg34063@gmail.com
Short communication

Table 1: Correlation among different agronomical and economically important traits

Characters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1.000	0.06	0.005	-0.251	0.264	-0.05	0.246	-0.294	0.071	0.158	0.109	0.185	0.362*	-0.037	-0.107
2		1.000	-0.059	0.329	-0.344*	0.026	0.099	-0.052	0.469**	0.706**	-0.249	0.318	0.325	0.215	0.170
3			1.000	0.569**	0.117	-0.176	0.232	0.261	-0.178	-0.156	0.434**	0.176	0.183	-0.046	-0.051
4				1.000	-0.059	-0.007	0.231	0.628**	0.202	0.078	0.273	0.259	0.215	0.401*	0.169
5					1.000	-0.186	0.200	0.211	0.020	-0.355*	0.375*	0.010	0.063	-0.106	-0.044
6						1.000	-0.060	0.220	-0.104	-0.226	-0.099	-0.249	-0.287	0.531**	0.339*
7							1.000	-0.005	0.078	0.115	-0.035	0.031	0.048	0.182	-0.091
8								1.000	0.128	-0.216	0.125	-0.072	-0.082	0.285	0.102
9									1.000	0.497**	-0.037	0.398*	0.403*	-0.175	-0.228
10										1.000	-0.336*	0.514**	0.529**	0.013	0.180
11											1.000	0.613**	0.575**	-0.041	-0.087
12												1.000	0.967**	0.108	0.287
13													1.000	-0.071	-0.129
14														1.000	0.543**
15															1.000

Characters	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	0.171	0.254	-0.051	0.034	0.031	0.188	0.227	0.295	0.138	0.257	0.241	0.340*	0.489**	0.216	0.056
2	0.154	0.546**	0.242	-0.220	-0.202	-0.165	-0.088	-0.200	-0.119	-0.242	-0.170	-0.054	0.160	0.452**	0.050
3	-0.041	-0.078	-0.156	0.143	0.131	0.076	0.246	0.094	-0.015	0.174	0.199	0.311	-0.107	0.127	0.326
4	0.091	0.111	0.132	-0.260	-0.186	-0.120	0.076	-0.218	-0.021	-0.077	-0.225	0.174	-0.269	0.224	0.195
5	0.070	-0.362*	-0.288	-0.119	-0.092	0.270	0.421*	0.298	0.268	0.432**	0.109	0.001	0.228	-0.012	-0.142
6	0.327	0.076	-0.063	-0.225	-0.182	-0.147	-0.145	-0.278	-0.134	-0.189	-0.333	-0.238	-0.245	-0.271	0.062
7	0.232	0.125	-0.013	-0.314	-0.202	-0.371*	0.070	0.096	-0.087	-0.247	0.027	0.307	0.198	0.058	0.140
8	0.009	-0.043	0.158	-0.262	-0.164	-0.100	-0.121	-0.126	0.063	-0.081	-0.206	-0.041	-0.301	0.073	0.171
9	-0.066	0.133	0.092	-0.484**	-0.455**	-0.300	0.040	0.204	0.180	-0.252	-0.034	-0.156	0.335*	0.219	-0.092
10	-0.144	0.436**	-0.012	-0.087	-0.147	-0.307	-0.206	0.096	-0.009	-0.381*	0.069	-0.117	0.226	0.415*	0.199
11	0.090	-0.308	-0.232	0.257	0.359*	0.262	0.471**	0.324	0.172	0.378*	0.285	0.234	0.213	0.045	0.235
12	0.150	-0.113	-0.317	0.172	0.013	0.335	0.014	-0.008	0.262	0.274	-0.053	-0.347	-0.247	0.231	-0.240
13	-0.045	0.460	-0.248	0.163	0.198	-0.065	0.206	0.388*	0.140	-0.047	0.294	0.111	0.373*	0.291	0.365*
14	0.407*	0.247	0.010	-0.203	-0.116	0.070	-0.004	-0.402*	-0.198	-0.061	-0.359*	-0.039	-0.252	0.009	0.153
15	0.468**	0.233	-0.036	-0.208	-0.010	0.146	0.018	-0.449**	-0.221	0.051	-0.389*	-0.311	-0.291	0.175	-0.018
16	1.000	0.168	0.089	-0.389*	-0.188	0.070	0.157	-0.057	-0.082	-0.162	0.134	0.196	0.194	0.170	-0.088
17		1.000	0.356*	-0.282	-0.227	-0.138	-0.150	-0.270	-0.096	-0.110	-0.231	-0.016	0.114	0.509**	0.124
18			1.000	-0.270	-0.131	-0.006	-0.092	-0.049	-0.164	-0.063	-0.011	0.112	-0.023	0.222	-0.022
19				1.000	0.830**	0.390*	-0.099	-0.048	-0.230	0.216	0.411*	0.095	-0.110	-0.107	0.334
20					1.000	0.231	0.065	0.029	-0.075	0.118	0.552**	0.142	-0.161	-0.038	0.338*
21						1.000	0.232	-0.116	-0.043	0.817**	0.033	-0.135	0.039	0.139	-0.236
22							1.000	0.369*	0.397*	0.498*	0.308	0.211	0.299	-0.187	-0.014
23								1.000	0.412*	0.016	0.710**	0.216	0.441**	0.053	0.118
24									1.000	0.184	0.333	0.179	0.310	0.073	-0.163
25										1.000	0.069	-0.044	0.273	0.124	-0.222
26											1.000	0.324	0.274	0.065	0.227
27												1.000	0.164	-0.020	-0.011
28													1.000	0.234	-0.088
29														1.000	-0.010
30															1.000

__1:__ Emergence percentage at 30 DAP, __2:__ Number of stems arises from each tuber; __3:__ Number of leaves shoot^{-1}, __4:__ Plant height(cm), at 40 DAP, __5:__ Shoot girth (cm), __6:__ Plant dry matter Content in percentage, __7:__ Number of internode shoot^{-1} at 80 DAP, __8:__ Internodal length (cm), __9:__ Number of stolons plant^{-1}, __10:__ Number of tubers plant^{-1}, __11:__ Average tuber weight(g), __12:__ Average tuber weight plant^{-1} (g), __13:__ Tuber yield ha^{-1} (t ha^{-1}), __14:__ Tuber dry matter(%), __15:__ Specific gravity of tuber (g/cm^3), __16:__ Total soluble solid (TSS) of tuber, __17:__ Ascorbic acid content (mg100g^{-1} of tuber), __18:__ Protein percentage of tuber, __19:__ Rottage percentage by number(60 DAS), __20:__ Rottage percentage by number (90 DAS), __21:__ Rottage percentage by weight (60 DAS), __22:__ Rottage percentage by weight (90 DAS), __23:__ Physiological weight loss by percentage (60 DAS), __24:__ Physiological weight loss by percentage (90 DAS), __25:__ Total weight loss by percentage (60 DAS), __26:__ Total weight loss by percentage (90 DAS), __27:__ Initiation of sprouting (DAS), __28:__ Sprouting percentage (60DAS), __29:__ Sprouting percentage (90 DAS), __30:__ Sprout weight (g kg^{-1} tuber).

** : at 5% level of significant ** : at 1% level of significant*

(Kumar and Kang, 2000), number of tubers per plant (Luthra, 2001). These results an also in good conformity with the observations of Ghosh and De (2011).

Non significant negative correlations of tuber yield were observed with internodal length (-0.082), plant dry matter content (-0.287) and TSS of tuber (-0.045). Significant inverse relationship of tuber dry matter content with major yield contributing traits indicated that major tuber yield components and tuber dry matter could not be improved but biparental mating (i.e. full sib recurrent selection), should be employed to break this inverse relationship by bringing about the desired combination of characters in population (Bansal *et al.,* 1980).

Number of tubers per plant was positively correlated with number of stolon per hill (0.497), emergence percentage at 30 DAP (0.158), number of stem arises from each tuber (0.706). Identical results were also reported by Desai and Jaimini (1998).

Number of tubers per plant showed significant and negative correlation with average tuber weight (-0.336), the major contributing factors to tuber yield. The results are in good agreement with the findings of Luthra (2001). This may be attributed to the fact that genotypes with higher number of tubers have to partition their photosynthates to more number of sinks leading to weaker tubers, while genotypes with lesser tuber per plant resulted into development of bigger tubers. Similar findings in garlic have also been reported by Shridhar (2000).

Non significant negative association was observed for TSS of tuber (-0.144), protein content (-0.012), rottage percentage by number (-0.087 at 60 DAS and -0.147 at 90 DAS) and weight (-0.307 at 90 DAS and -0.206 at 90 DAS) of tuber, total weight loss (-0.381 at 60 DAS and -0.069 at 90 DAS) and initiation of sprouting (-0.117) with number of tubers per plant. Similar findings have also been reported by Desai and Jaimini (1998).

From the present experiment it is quite evident that yield and quality cannot be improved simultaneously rather independent selection for both may be beneficial. Similarly, number of tubers per plant and average tuber weight has revealed negative correlation indicated that these two components could not be brought together in population and therefore; independent selection should be practiced for these traits.

REFERANCES

Al-Jibouri, H. A., Miller, P. A. and Robinson, H. F. 1958. Genotypic and environmental variances and co variances in an upland cotton cross of inter specific origin. *Agron. J.,* **50** : 633-36.

Bansal, H. C., Singh, R. P., Bhaskaran, S., Santha, I. M. and Murty, B. R.1980. Hybridization and selection for improving seed protein in barley. *Theor. Appl. Genet*., **58** : 129-36.

Desai, N.C. and Jaimini, S.N. 1998. Correlation and path analysis of some economic characters in potato. *J. Indian Potato Assoc*., **25** : 25-29.

Ghosh, M and De. B. 2011 Comparative study of potato (solanum tuberosum t.) cultivars in terai agroclimatic region of West Bengal. In. *Ext. Summ. Int. Symp, "System Intensification towards Food and Environmental Security"* Crop and Weed Sci. Soc., Feb-24-27, 2011 p.30.

Killick, R. J. 1977. Genetic analysis of several traits in potatoes by means of a diallel cross. *Ann. Appl. Biol*., **86** : 276-89.

Kumar, R. and Kang, G. S. 2000. Path-coefficient and stability analysis studies in *andigena* potaoes. *Indian J. Agric. Sci*., **70** : 158-62.

Luthra, S. K. 2001. Heritability, genetic advance and character association in potato. *J. Indian Potato Assoc*., **28** :1-3.

Patel, P. B., Patel, N. H. and Patel, R. N. 2002. Correlation and path analysis of some economic characters in potato. *J. Indian Potato Assoc*., **29** : 163-64.

Shridhar, 2000. Genetic variability and character association in garlic. In : *Nat. Symp. Onion-Garlic Production and Post-harvest Management, Challenges and Strategies,* Nov. **19-21**, 2000. Nashik. pp. 193.

Simmonds, N. W. 1962. Variability in crop plants its use and conservation. *Biol. Rev.*, **37** : 422-65.

Swaminathan, M. S. 1999. Potato for global food security. In: *Potato: Global Research and Development, Vol.* 1 (Eds. S.M. Paul Khurana, G.S. Shekhawat, B.P. Singh, and S.K. Pandey,), Ind. Potato Assoc., Shimla. pp 8-12.

Uniyal, S. P. and Mishra, A. C. 2003. Response of potato to soil moisture and temperature as affected by different mulches. *J. Indian Potato Assoc*., **30** : 315-17.