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Research Article

Character association and Path coefficient analysis of Pod Yield and Yield Components in Spanish bunch Groundnut (*Arachis hypogaea* L.)

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Abstract

Correlation studies with 20 Spanish bunch genotypes indicated that days to maturity, number of mature pods per plant, biological yield per plant, biological yield per hectare, harvest index, 100 kernel weight, kernel yield per plant, kernel yield per hectare, oil yield per hectare and pod yield per hectare showed significant positive association with pod yield per plant both at phenotypic and genotypic levels. Path analysis studies revealed that 100 kernel weight, kernel yield per plant and biological yield per hectare exerted maximum positive direct effect on pod yield per plant.

Key words: Character association, Path analysis, Yield, Groundnut

Introduction

Pod yield, being the most important and complex character governed by quantitative genes and is much more influenced by environmental factors in which the plant is grown. Therefore selection based on only yield performance may create confusion and give a biased result. A study on the nature and degree of association of yield contributing component traits with yield assumes greater importance for fixing up characters that are likely to play a decisive role in influencing yield. The knowledge of interrelationship between yield and its components themselves are useful, if selection for simultaneous improvement in these characters is to be effective. As more variables are included in the correlation study, the associations become more complex. In such a situation, the path coefficient analysis provides an effective means of finding out direct and indirect causes and effects of association and permits a critical examination of the specific forces acting to produce a given correlation and measures the relative importance of each factor. Therefore, the present study on Spanish bunch genotypes was conducted to study the correlation and path coefficients.

Materials and methods

The experimental material for the present study consisted of twenty Spanish bunch groundnut genotypes obtained from Agricultural Research Station, Kadiri. The genotypes were evaluated in a randomized block design with three replications in three environments viz., late K*harif*, 2012, *Rabi* 2012-13 and *Summer* 2013 at Agricultural College Farm, Bapatla, Andhra Pradesh. Each entry was sown in three rows of 5 meter length spaced at 30cm and a plant to plant spacing of 10 cm was maintained. Data was recorded on ten randomly selected plants for each genotype in each location. The data generated over seasons was pooled and analyzed for estimating the correlation coefficients suggested by Snedecor and Cochran, (1965) and direct and indirect effects of yield components on yield were computed through path coefficient analysis as suggested by Dewey and Lu (1959).

Results and discussion

The phenotypic and genotypic correlations among the pod yield and yield component characters in Spanish bunch genotypes were presented in Table 1. Correlation studies revealed that genotypic correlation coefficients were higher than phenotypic correlation coefficients for most of the characters under study indicating the strong inherent association between the characters which governed largely by genetic causes and generally less subjected to environmental forces. Genotypic correlation revealed the existence of real association where as the phenotypic correlations may occur by chance. The low phenotypic correlations could have resulted due to the modifying effect of environment on the association of characters at the genotypic level.

Pod yield per plant was found to be significantly and positively associated with days to maturity (r_g = 0.4884; r_p= 0.3592), number of mature pods per plant (r_g = 0.7588; r_p= 0.5994), biological yield per plant (r_g = 0.6613; r_p= 0.4245), biological yield per hectare (r_g = 0.6675; r_p= 0.4261), harvest index (r_g = 0.6294; r_p= 0.5139), 100 kernel weight (r_g = 0.4003; r_p= 0.1944), kernel yield per plant (r_g = 0.9884; r_p= 0.9786), Kernel yield per hectare (r_g = 0.9892; r_p= 0.9777), oil yield per hectare (r_g = 0.9569; r_p= 0.9435) and pod yield per hectare (r_g = 0.9981; r_p= 0.9970) at both genotypic and phenotypic level. It exhibited strong positive significant association with SCMR at 40 DAS (r_g = 0.4040) and SCMR at 60 DAS (r_g = 0.3016) at genotypic level. It exhibited negative significant association with shelling percentage (r_g = -0.3072) at genotypic level. However, characters which were correlated genotypically but not phenotypically may not be of practical value in selection since selection is based on phenotypes as observed in case of relationship

between biological yield and pod yield. Similar results were obtained by Pradhan and Patra (2011), Channayya *et al.* (2011),Babariya and Dobariya (2012) and Ravikumar *et al.* (2012).

Estimates of direct and indirect effects of individual characters towards pod yield are presented in Table 2 & 3. The path coefficients revealed largest direct effects of 100 kernel weight, kernel yield per plant and biological yield per hectare on pod yield. The high direct effect of these traits appeared to be the main factor their strong association with pod yield. Hence, direct selection for these traits would be effective. Days to 50% flowering exhibited positive direct effect with pod yield per plant at genotypic level. Its positive indirect effect was mainly through kernel yield per plant and biological yield per plant in positive direction. These findings were in agreement with the reports of Garjappa (2005), Vaithiyalingan *et al.* (2010), John *et al.* (2011b) and Zaman *et al.* (2011). SCMR at 40 DAS exhibited positive direct effect (0.0032) with pod yield per plant at genotypic level. Its positive indirect effect was mainly through kernel yield per plant (0.9201) and biological yield per hectare (0.3226) in positive direction. At phenotypic level, it showed positive association (0.1041) and negative direct effect (-0.0056) on pod yield per plant. These findings were in agreement with the reports of Ravikumar *et al.* (2012). SCMR at 60 DAS exhibited positive direct effect (0.0651) and positive correlation (0.3016) with pod yield per plant at genotypic level. Its positive indirect effect was mainly through kernel yield per plant (0.9685) and biological yield per hectare (0.2811) in positive direction. At phenotypic level, it showed positive association (0.1416) and negative direct effect (-0.0019) on pod yield per plant. Apart from its direct effect, it also displayed positive indirect effect *via* kernel yield per plant (0.1142). The indirect effects were positive mainly through biological yield per hectare and kernel yield per plant at genotypic level. These findings were in agreement with the reports of Vaithiyalingan *et al.* (2010). Days to maturity exhibited negative direct effect with pod yield per plant at genotypic level.The indirect effects were positive mainly through biological yield per hectare and kernel yield per plant at genotypic level. Similar findings were reported by Garjappa (2005), Vaithiyalingan *et al.* (2010) and Thirumala *et al.* (2012). Biological yield per hectare expressed positive direct effect (0.9332) and significant positive association (0.6675) with pod yield per plant. It also exerted positive indirect effect through kernel yield per plant (0.8992).This character showed positive direct effect (0.0279) and significant positive association (0.4261) with pod yield per plant at phenotypic level. Its positive indirect effect was mainly through kernel yield per plant (0.3551). This character exhibited positive direct effect and positive association at both genotypic and phenotypic levels. This explains a true relationship and direct selection can be done, this will be rewarding for improvement of pod yield. Shelling percentage exhibited negative direct effect and negative association at both genotypic and phenotypic level. In these situations, the indirect causal factors are to be considered for yield improvement. Similar findings were earlier reported by Durgarani *et al.* (1987), Prasad *et al.* (2001), Izge *et al.* (2004) and Mane *et al.* (2008).

Kernel yield per plant exhibited positive direct effect and positive association at both genotypic and phenotypic levels respectively. High direct effects and positive correlations with pod yield suggest kernel yield per plant as one of the major contributors towards pod yield and direct selection based on this trait for yield will be rewarding. Similar results were earlier reported by Makhan *et al.* (2003), Garjappa (2005), Sumathi and Muralidharan (2007), Babariya and Dobariya (2012) and Ravikumar *et al.* (2012). Kernel yield per hectare exhibited negative direct effect and positive association and positive direct effect and positive association at genotypic and phenotypic level respectively. 100 Kernel weight exhibited positive direct effect and positive association at both genotypic and phenotypic levels respectively. High direct effects and positive correlations with pod yield suggest 100 kernel weight as one of the major contributors towards pod yield and direct selection based on this trait for yield will be rewarding. Similar results were earlier reported by Sumathi and Muralidharan (2007), Vaithiyalingan *et al.* (2010), Ravikumar *et al.* (2012) and Thirumala *et al.* (2012). Oil content exhibited positive direct effect and negative association at both genotypic and phenotypic level. In these situations, the indirect causal factors are to be considered for yield improvement. Similar findings were earlier reported by Siddiquey *et al.* (2006) and Sumathi and Muralidharan (2007).

A perusal of the results obtained from character association and path coefficient analysis, revealed that 100 kernel weight, kernel yield per plant and biological yield per hectare were found to have significant influence on pod yield and also have high positive direct and indirect effects through many other characters. Hence, simultaneous selection based on 100 kernel weight, kernel yield per plant and biological yield per hectare seems to be more promising in improving the pod yield in Spanish bunch groundnut.

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Table 1: Phenotypic (above diagonal) and genotypic (below diagonal) correlation among 19 characters in Spanish bunch genotypes in pooled environments.

Character	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	**1.0000**	0.1139	0.0574	0.2042**	0.0793	0.0849	0.2543**	-0.0778	-0.0155	-0.0203	-0.0339	0.1288	-0.0284	-0.0936	-0.0994	0.0253	-0.0801	-0.0824	-0.0881
2	0.3196**	**1.0000**	0.1922**	0.0556	0.0767	-0.0776	0.2033**	-0.0035	0.1093	0.1046	0.0391	0.1248	-0.1714*	0.0737	0.0678	-0.0276	0.0626	0.1041	0.0980
3	0.6248**	0.3612**	**1.0000**	0.0422	0.0051	-0.0619	0.0066	-0.0114	0.1705*	0.1655*	-0.1892*	-0.0271	0.1398	-0.0174	-0.0226	0.0715	-0.0040	-0.0428	-0.0464
4	0.6613**	0.0298	0.8231**	**1.0000**	0.2768**	0.4135**	0.2923**	0.2162**	-0.0398	-0.0375	0.1417	0.0298	-0.0207	0.1370	0.1363	-0.0002	0.1338	0.1416	0.1404
5	0.7536**	-0.3749**	0.4694**	0.9369**	**1.0000**	0.3114**	0.3649**	0.0780	-0.0457	-0.0422	0.1342	-0.1368	-0.1037	0.0712	0.0691	-0.0154	0.0635	0.0940	0.0909
6	0.1333	-0.4067**	-0.2390**	0.0946	0.3227**	**1.0000**	0.3642**	0.0801	-0.2107**	-0.2000**	0.1323	-0.0411	0.0842	0.0326	0.0351	-0.0888	0.0134	0.0168	0.0197
7	0.5219**	0.1268	-0.0156	0.9918**	0.4356**	0.4450**	**1.0000**	0.0719	0.0652	0.0611	0.2845**	0.1815*	-0.0556	0.3468**	0.3386**	-0.0282	0.3369**	0.3592**	0.3500**
8	0.0926	0.1966**	0.0611	0.4421**	0.9925**	-0.0588	0.3700**	**1.0000**	0.2559**	0.2582**	0.2753**	-0.0757	-0.1974**	0.5594**	0.5645**	-0.1754*	0.4992**	0.5994**	0.6035**
9	-0.0949	0.1838*	0.6872**	0.2102**	-0.7075**	-0.3275**	0.0059	0.3966**	**1.0000**	0.9969**	-0.5212**	0.3648**	-0.0236	0.4268**	0.4257**	-0.0198	0.4234**	0.4245**	0.4240**
10	-0.1071	0.1746*	0.6752**	0.2136**	-0.8132**	-0.3301**	0.0551	0.4008**	0.9978**	**1.0000**	-0.5179**	0.3605**	-0.0310	0.4267**	0.4309**	-0.0180	0.4288**	0.4261**	0.4309**
11	0.2789	0.3769**	-0.7147**	0.1623	0.8682**	0.1663*	0.5858**	0.5331**	-0.1503*	-0.1428	**1.0000**	-0.1676*	-0.1482*	0.4816**	0.4803**	-0.0254	0.4602**	0.5139**	0.5099**
12	0.2284	0.2110**	0.3976**	0.4143**	-0.1006	0.1916*	0.5786**	-0.0128	0.4256**	0.4194**	0.0727	**1.0000**	0.1338	0.2276**	0.2218**	0.0735	0.2385**	0.1944*	0.1897*
13	0.0037	-0.3244**	-0.0450	-0.0048	-0.2238**	0.4443**	0.0661	-0.4727	-0.0463	-0.0450	-0.4858**	0.2507**	**1.0000**	0.0726	0.0637	0.0484	0.0722	-0.1287	-0.1386
14	0.0699	0.3634**	-0.0902	0.3116**	0.0644	0.0350	0.5141**	0.7123**	0.6682**	0.6753**	0.5832**	0.4519**	-0.1603*	**1.0000**	0.9970**	-0.0637	0.9645**	0.9786**	0.9732**
15	0.0680	0.3600**	-0.0956	0.3073**	0.0610	0.0354	0.5143**	0.7138**	0.6646**	0.6701**	0.5884**	0.4466**	-0.1620*	0.8612**	**1.0000**	-0.0653	0.9645**	0.9777**	0.9782**
16	0.0421	-0.0430	0.0199	0.0538	-0.2148**	-0.1193	-0.0795	-0.3272	-0.0432	-0.0464	-0.0975	0.0860	-0.1232	-0.1678	-0.1757	**1.0000**	0.1825*	-0.0728	-0.0732
17	0.0673	0.3644**	-0.0756	0.3344**	0.0368	0.0061	0.5110**	0.6205**	0.6659**	0.6708**	0.5602**	0.4834**	-0.1959*	0.9622**	0.9593**	0.1080	**1.0000**	0.9435**	0.9435**
18	0.0813	0.4040**	-0.0462	0.3016**	0.0995	-0.0403	0.4884**	0.7588**	0.6613**	0.6675**	0.6294**	0.4003**	-0.3072**	0.9884**	0.9892**	-0.1444	0.9569**	**1.0000**	0.9970**
19	0.0792	0.4008**	-0.0443	0.2976**	0.1012	-0.0407	0.4880**	0.7591**	0.6592**	0.6639**	0.6331**	0.3962**	-0.3084**	0.9890**	0.9884**	-0.1499*	0.9545**	0.9981**	**1.0000**

1: Days to 50% flowering 2: SCMR at 40 DAS 3: SCMR at 50 DAS 4: SCMR at 60 DAS 5: SCMR at 70 DAS 6: SCMR at maturity
7: Days to maturity 8: No. of mature pods per plant 9: Biological yield per plant (g 10: Biological yield per hectare (q) 11: Harvest index 12: 100 Kernel weight (g)
13: Shelling (%) 14: Kernel yield per plant (g) 15: Kernel yield per hectare (q) 16: Oil content (%) 17: Oil yield per hectare (q) 18: Pod yield per plant (g)
19: Pod yield per hectare (q)

* = Significant at 0.05 level ** = Significant at 0.01 level

Table 2: Direct and indirect (phenotypic) effects of component characters on pod yield in Spanish bunch genotypes in pooled environments.

Characters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	**0.0047**	0.0005	0.0003	0.0010	0.0004	0.0004	0.0012	-0.0004	-0.0001	-0.0001	-0.0002	-0.0001	-0.0004	-0.0005	0.0001	-0.0004	0.0006
2	-0.0006	**-0.0056**	-0.0011	-0.0003	-0.0004	0.0004	-0.0011	0.0000	-0.0006	-0.0006	-0.0002	0.0010	-0.0004	-0.0004	0.0002	-0.0004	-0.0007
3	0.0002	0.0008	**0.0040**	0.0002	0.0000	-0.0002	0.0000	0.0000	0.0007	0.0007	-0.0008	0.0006	-0.0001	-0.0001	0.0003	0.0000	-0.0001
4	-0.0004	-0.0001	-0.0001	**-0.0019**	-0.0005	-0.0008	-0.0006	-0.0004	0.0001	0.0001	-0.0003	0.0000	-0.0003	-0.0003	0.0000	-0.0003	-0.0001
5	0.0000	0.0000	0.0000	0.0000	**0.0001**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
6	0.0001	-0.0001	-0.0001	0.0005	0.0004	**0.0012**	0.0004	0.0001	-0.0002	-0.0002	0.0002	0.0001	0.0000	0.0000	-0.0001	0.0000	0.0000
7	0.0013	0.0016	0.0000	0.0015	0.0018	0.0018	**0.0051**	0.0004	0.0003	0.0003	0.0014	-0.0003	0.0018	0.0017	-0.0001	0.0017	0.0009
8	-0.0005	0.0000	-0.0001	0.0015	0.0005	0.0005	0.0005	**0.0067**	0.0017	0.0017	0.0019	-0.0013	0.0038	0.0038	-0.0012	0.0034	-0.0005
9	-0.0001	0.0006	0.0009	-0.0002	-0.0003	-0.0012	0.0004	0.0014	**0.0055**	0.0055	-0.0029	-0.0001	0.0023	0.0023	-0.0001	0.0023	-0.00 18
10	-0.0006	0.0029	0.0044	-0.0010	-0.0012	-0.0056	0.0017	0.0072	0.0278	**0.0279**	-0.0145	-0.0009	0.0119	0.0120	-0.0005	0.0120	0.0101
11	-0.0014	0.0016	-0.0078	0.0058	0.0055	0.0054	0.0117	0.0113	-0.0214	-0.0212	**0.0410**	-0.0061	0.0197	0.0197	-0.0010	0.0189	-0.0069
12	0.0054	0.0326	-0.0260	0.0039	0.0198	-0.0160	0.0106	0.0376	0.0045	0.0059	0.0282	**-0.1905**	-0.0138	-0.0121	-0.0092	-0.0138	-0.0255
13	-0.0780	0.0614	-0.0145	0.1142	0.0593	0.0272	0.2893	0.4665	0.3557	0.3551	0.4013	0.0605	**0.8333**	0.8309	-0.0530	0.8038	0.0020
14	-0.0164	0.0112	-0.0037	0.0225	0.0114	0.0051	0.0559	0.0933	0.0704	0.0712	0.0794	0.0105	0.1651	**0.1653**	-0.0108	0.1597	0.0367
15	0.0003	-0.0003	0.0008	0.0000	-0.0002	-0.0010	-0.0003	-0.0020	-0.0002	-0.0002	-0.0003	0.0005	-0.0007	-0.0007	**0.0113**	0.0021	0.0008
16	0.0038	-0.0028	0.0002	-0.0060	-0.0029	-0.0006	-0.0152	-0.0225	-0.0191	-0.0193	-0.0207	-0.0023	-0.0434	-0.0435	-0.0082	**-0.0450**	-0.0107
17	-0.0002	-0.0002	0.0000	-0.0001	0.0002	0.0001	-0.0003	0.0001	-0.0007	-0.0007	0.0003	-0.0002	-0.0004	-0.0004	-0.0001	-0.0004	**0.1897**
18	**-0.0824**	**0.1041**	**-0.0428**	**0.1416**	**0.0940**	**0.0168**	**0.3592****	**0.5994****	**0.4245****	**0.4261****	**0.5139****	**-0.1287**	**0.9786****	**0.9777****	**-0.0728**	**0.9435****	**0.1944***

1: Days to 50% flowering
2: SCMR at 40 DAS
3: SCMR at 50 DAS
4: SCMR at 60 DAS
5: SCMR at 70 DAS
6: SCMR at maturity
7: Days to maturity
8: No. of mature pods per plant
9: Biological yield per plant (g)
10: Biological yield per hectare (q)
11: Harvest index
12: Shelling (%)
13: Kernel yield per plant (g)
14: Kernel yield per hectare (q)
15: Oil content (%)
16: Oil yield per hectare (q)
17: 100 Kernel weight (g)
18: Pod yield per plant (g)

* = Significant at 0.05 level
** = Significant at 0.01 level
Residual effect = 0.0453

Table 3: Direct and indirect (genotypic) effects of component characters on pod yield in Spanish bunch genotypes in pooled environments.

Characters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	**0.0186**	0.0059	0.0116	0.0123	0.0229	0.0025	0.0097	0.0017	-0.0018	-0.0020	0.0052	0.0001	0.0013	0.0013	0.0008	0.0013	0.0042
2	0.0010	**0.0032**	0.0012	0.0001	-0.0012	-0.0013	0.0004	0.0006	0.0106	0.0006	0.0012	-0.0010	0.0012	0.0012	-0.0001	0.0012	0.0007
3	0.0103	0.0959	**0.0165**	0.0135	0.0077	-0.0039	-0.0003	0.0010	0.0113	0.0112	-0.0118	-0.0007	-0.0015	-0.0016	0.0003	-0.0011	0.0065
4	0.0430	0.0019	0.0535	**0.0651**	0.0609	0.0062	0.0645	0.0998	0.0137	0.0139	0.0006	-0.0003	0.0903	0.0300	0.0035	0.0918	-0.0134
5	-0.0023	0.0107	-0.0009	-0.0017	**-0.0019**	-0.0006	-0.0022	-0.0011	0.0126	0.0025	-0.0029	0.0004	-0.0001	-0.0001	0.0004	-0.0001	0.0002
6	0.0035	-0.0108	-0.0063	0.0025	0.0085	**0.0265**	0.0118	-0.0016	-0.0087	-0.0088	0.0045	0.0118	0.0609	0.0479	-0.0032	0.0771	0.0051
7	-0.0307	-0.0075	0.0009	-0.0583	-0.0698	-0.0262	**-0.0588**	-0.0118	-0.0032	-0.0032	-0.0345	-0.0039	-0.0102	-0.0103	0.0047	-0.0301	-0.0340
8	-0.0106	-0.0225	-0.0070	-0.0505	-0.1133	0.0067	-0.0423	**-0.1142**	-0.0453	-0.0458	-0.0609	0.0540	-0.0813	-0.0714	0.0374	-0.0909	0.0015
9	0.1376	-0.2665	-0.9963	-0.3047	0.5421	0.4748	-0.0782	-0.3749	**-0.8450**	-0.4511	0.2179	0.0672	-0.3687	-0.2131	0.0627	-0.3654	-0.6171
10	-0.1426	0.3226	0.8995	0.2811	-0.8103	-0.4392	0.0734	0.9146	0.9281	**0.9332**	-0.1402	-0.0599	0.9992	0.9920	-0.0618	0.9979	0.6569
11	-0.0309	-0.0417	0.0791	-0.0180	-0.1736	-0.0183	-0.0648	-0.0390	0.0162	0.0158	**-0.1107**	0.0538	-0.0346	-0.0511	0.0108	-0.0320	-0.0081
12	-0.0009	0.0994	0.0110	0.0012	0.0600	-0.1085	-0.0162	0.1005	0.0111	0.0110	0.3168	**-0.2447**	0.0989	0.0992	0.0302	0.1999	-0.0614
13	0.2157	0.9201	-0.2810	0.9685	0.6928	0.1090	0.9602	0.8213	0.9701	0.8992	0.9008	-0.4992	**0.9852**	0.9965	-0.5229	0.9978	0.9078
14	-0.0978	-0.5178	0.1376	-0.4420	-0.0877	-0.0510	-0.1398	-0.3268	-0.1560	-0.3640	-0.3464	0.2330	-0.4195	**-0.5385**	0.2528	-0.4799	-0.2424
15	0.0040	-0.0041	0.0019	0.0051	-0.0205	-0.0114	-0.0076	-0.0212	-0.0041	-0.0044	-0.0093	-0.0117	-0.0160	-0.0168	**0.0953**	0.0903	0.0082
16	-0.0336	-0.1820	0.0378	-0.1670	-0.0184	-0.0030	-0.2137	-0.3000	-0.2427	-0.3351	-0.0798	0.0978	-0.3106	-0.2700	-0.0539	**-0.4995**	-0.2415
17	-0.0031	-0.0028	-0.0053	-0.0055	0.0013	-0.0026	-0.0077	0.0100	-0.0057	-0.0056	-0.0210	-0.0033	-0.0060	-0.0060	-0.0011	-0.0015	**0.0270**
18	**0.0813**	**0.4040****	**-0.0462**	**0.3016****	**0.0995**	**-0.0403**	**0.4884****	**0.7588****	**0.6613****	**0.6675****	**0.6294****	**-0.3072****	**0.9884****	**0.9892****	**-0.1444**	**0.9569****	**0.4003****

1: Days to 50% flowering
2: SCMR at 40 DAS
3: SCMR at 50 DAS
4: SCMR at 60 DAS
5: SCMR at 70 DAS
6: SCMR at maturity
7: Days to maturity
8: No. of mature pods per plant
9: Biological yield per plant (g)
10: Biological yield per hectare (q)
11: Harvest index
12: Shelling (%)
13: Kernel yield per plant (g)
14: Kernel yield per hectare (q)
15: Oil content (%)
16: Oil yield per hectare (q)
17: 100 Kernel weight (g)
18: Correlation with pod yield per plant (g)

* = Significant at 0.05 level
** = Significant at 0.01 level
Residual effect = 0.0191