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Research Article

CORRELATION AND PATH ANALYSIS FOR YIELD AND ITS CONTRIBUTING TRAITS IN GROUNDNUT (*Arachis hypogaea* L.)

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Abstract- Ninety genotypes along with three check varieties *viz*., JL TG37A, PM-2 and UG-5 were evaluated for association analysis at Instructional Farm, College of Technology and Engineering, MPUAT, Udaipur, Rajasthan, India during kharif 2014-15 in Augmented Design. Association estimates revealed that dry pod yield per plant showed positive and significant correlation at both genotypic and phenotypic levels with kernel yield per plant, 100-kernel weight, sound mature kernels and biological yield per plant. Correlation for dry pod yield per plant was divided into direct and indirect effects of different characters. Highest positive direct effect on dry pod yield was exhibited by kernel yield per plant (2.28) followed by days to maturity (0.57), oil content (0.31) and days to 50% flowering (0.22). This indicates that increase in kernel yield per plant, 100-kernel weight and sound mature kernels would improve the dry pod yield per plant of groundnut.

Keywords- Augmented design, Correlation, Direct and Indirect Effects, Groundnut.

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Introduction

Groundnut (*Arachis hypogaea* L.) is not only the bakery food in India but also it used as a source of edible oil, fodder and green manuring crop for improvement of soil health and 46 and 32 percent of monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA), respectively [1]. Groundnut oil is also used in many preparations like soap making, fuels, cosmetics, shaving cream, leather dressings, furniture cream, lubricants etc. Groundnut is an unpredictable crop plant due to pods development under the ground. Nut yield is not only under polygenic control, but also influenced by its component characters. For improvement of pod yield in groundnut crop direct selection is often misleading. The knowledge of degree of association between yield contributing characters and their relative contribution in yield is very essential for development of high yielding genotypes in groundnut. Correlation studies provide an opportunity to study the magnitude and direction of association of yield with its components traits and also among various components. Path coefficient is essential to accumulate optimum characters combination of yield contributing characters and to know the implication of the interrelationships of various characters in a single groundnut genotype. Considering the above points, the present study was undertaken to evaluate the genotypes for yield and yield components and to estimate the inter-relationship among the agronomic, quality and biochemical traits in groundnut [2].

Material and Methods

The present investigation was carried out in Groundnut (*Arachis hypogaea* L.) during *kharif*, 2014 at the Instructional Farm, College of Technology and Engineering (CTAE), Maharana Pratap University of Agriculture and Technology, Udaipur. Geographically, Udaipur is situated at an elevation of 582.17 meter above the mean sea level on latitude of 24° 34' North and longitude of 73° 42' East. The experimental material consisted of 90 diverse genotypes along with 3 checks (JL TG37A, PM-2 and UG-5) were sown in six blocks in augmented design. Each genotype was accommodated in a one row plot of 5.0 m length with a spacing of 30 cm between rows and 10 cm between plants. The fertilizer in the experimental area was applied at the rate of 20 kg N ha^{-1} and 60 kg P ha^{-1} as it is a recommended dose for kharif cultivation of groundnut in the region. Estimation of oil content and protein content were done as per method suggested by Soxhlet's Ether Extraction method developed by A.O.A.C., 1965 [3] and Micro kjeldahl's method given by Linder, 1944 [4], respectively. Observations for all fifteen traits (days to 50% flowering, days to maturity, plant height, number of branches per plant, number of mature pods per plant, dry pod yield per plant, shelling percentage, 100-kernel weight, sound mature kernel, biological yield per plant, kernel yield per plant, harvest index, dormancy, oil content and protein content) were recorded on five randomly selected competitive plants of each entry in each replication except for days to 50% flowering and dormancy. The analysis of variance for different characters in augmented RBD was done method suggested by Federer, 1956 [5]. The phenotypic and genotypic correlation coefficients of all the characters were worked-out as per Dewey and Lu, 1959 [6] and path coefficient analysis was suggested by Al-Jibouri *et al.,* 1958 [7].

Results and Discussion

In the present investigation, correlation coefficients were estimated among 15 characters to find out association of dry pod yield per plant with its components at genotypic (r_g) as well as phenotypic (r_p) levels. The perusal of [Table-1] revealed that, genotypic correlation coefficients were relatively higher than their corresponding phenotypic correlations for all the characters studied indicating negligible effect of environment. Dry pod yield per plant was positively and significantly correlated at both genotypic as well as phenotypic level with kernel yield per plant (r_g =0.96**, r_p =0.95**), 100-kernel weight (r_g =0.75**, r_p =0.39**), Sound mature kernels (r_g =0.62**, r_p =0.50**) and biological yield per plant (r_g =0.81**, r_p =0.69**) . These findings are in accordance with Kahate *et al.,* 2014

and Rao *et al.,* 2014 [8, 9].

Kernel yield per plant was positively and significantly correlated at both genotypic as well as phenotypic level with number of mature pods per plant (r_g=0.91**, r_p=0.68**), dry pod yield per plant (r_g=0.96**, r_p=0.95**), 100-kernel weight. (r_g=0.73**, r_p=0.38**), sound mature kernels (r_g=0.60**, r_p=0.50**), shelling percentage (r_g=0.38**, r_p=0.35**) and biological yield per plant (r_g=0.72**, r_p =0.65**). These findings are in accordance with Awatade *et al.,* 2010 and Shoba *et al.,* 2012 [10, 11]. Existence of significant positive correlation of days to 50 per cent flowering with number of branches per plant (r_g =0.29**) at genotypic level while positive correlation at phenotypic level (r_p =0.15) and dormancy (r_g =0.25*) at genotypic level while positive correlation at phenotypic level (r_p =0.15). However negative correlation between days to 50 per cent flowering and 100-kernel weight was also reported by Mane *et al.* 2008 [12]. Days to maturity exhibited significant positive correlation with dormancy (r_g=0.27**) at genotypic level while positive correlation at phenotypic level (r_p=0.12). Further, plant height exhibited significant positive correlation with protein content (r_g=0.22**) at genotypic level while positive correlation at phenotypic level (r_p=0.15). Number of branches per plant showed significant positive correlation with sound mature kernel (r_g=0.32**, r_p=0.36**) and biological yield per plant (r_g=0.89**, r_p=0.42**) at both genotypic as well as phenotypic level. Similarly, 100- kernel weight also exhibited positive correlation with number of branches per plant (r_g=0.30**, r_p=0.18), sound mature kernel (r_g =1.13, r_p=0.76**), biological yield per plant (r_g=1.37, r_p=0.35**) and harvest index (r_g=0.17, r_p=0.24**) at genotypic and phenotypic levels. Whereas, biological yield per plant exhibited significant positive correlation with number of branches per plant (r_g=0.51**, r_p=0.33**), number of mature pods per plant (r_g=0.89**, r_p=0.42**), 100- kernel weight (r_g= 1.37, r_p=0.35**), sound mature kernel (r_g=0.67**, r_p=0.40**), harvest index (r_g=0.75**, r_p=0.08) and dormancy (r_g=0.39**, r_p=0.15) either at genotypic or at both the level. Harvest index showed positive correlation with number of mature pods per plant (r_g=1.01, r_p =0.66**), 100- kernel weight (r_g= 0.17, r_p=0.24*), sound mature kernel (r_g = 0.48**, r_p=0.33**), shelling percentage (r_g =0.33**, r_p =0.05**) and biological yield per plant (r_g = 0.75**, r_p=0.08) at both phenotypic and genotypic levels.

Table-1 *Genotypic (above diagonal) and Phenotypic (below diagonal) correlation coefficients among different characters in Groundnut (Arachishypogaea L.)*

VV s. no.	Character	Days to 50 % flowering	Days to maturity	Plant height (cm)	Number of branches per plant	Number of mature pods per plant	Dry pod yield per plant (g)	Kernel yield per plant (g)	100-Kernel weight (g)	Sound mature kernel (SMK) %	Shelling percentage (%)	Biological yield per plant (g)	Harvest index (%)	Dormancy	Oil content (%)	Protein content (%)
1	Days to 50 percent flowering		0.05	-0.02	0.29**	0.03	0.08	-0.02	-0.09	-0.19	-0.30**	-0.03	0.15	0.25*	-0.05	0.17
2	Days to maturity	0.02		-0.24*	0.01	-0.07	-0.47**	-0.49**	0.21	-0.31**	-0.13	-0.49**	-0.35**	0.27*	0.04	-0.05
3	Plant height (cm)	0.05	-0.06		-0.18	-0.19	-0.08	-0.04	0.02	-0.15	0.20	-0.26*	0.09	-0.18	0.17	0.22*
4	Number of branches per plant	0.15	0.03	-0.13		0.10	0.21	0.16	0.30**	0.20	-0.12	0.51**	0.01	-0.11	-0.15	0.07
5	Number of mature pods per plant	-0.02	-0.13	-0.07	0.17		1.02	0.91**	0.15	0.32**	-0.11	0.89**	1.01	0.07	-0.67**	-0.38**
6	Dry pod yield per plant (g)	0.06	-0.20	-0.03	0.21*	0.75**		0.96**	0.75**	0.62**	0.11	0.81**	1.03	0.08	-0.77**	-0.34**
7	Kernel yield per plant (g)	-0.00	-0.21*	0.06	0.13	0.68**	0.95**		0.73**	0.60**	0.38**	0.72**	1.04	0.09	-0.74**	-0.33**
8	100-Kernel weight (g)	-0.10	-0.12	-0.11	0.18	0.18	0.39**	0.38**		1.13	0.10	1.37	0.17	-0.42**	-0.28**	-0.31**
9	Sound mature kernel (SMK)(%)	-0.17	-0.17	-0.10	0.17	0.36**	0.50**	0.50**	0.76**		0.12	0.67**	0.48**	0.06	-0.44**	-0.37**
10	Shelling percentage (%)	-0.17	-0.09	0.31**	-0.20	-0.03	0.04	0.35**	0.06	0.13		-0.17	0.33**	0.05	-0.12	-0.03
11	Biological yield per plant (g)	0.04	-0.01	-0.02	0.33**	0.42**	0.69**	0.65**	0.35**	0.40**	0.00		0.75**	0.39**	-0.94**	-0.43**
12	Harvest index (%)	0.05	-0.24*	-0.02	0.01	0.66**	0.77**	0.73**	0.24*	0.33**	0.05	0.08		-0.14	-0.60**	-0.24*
13	Dormancy	0.15	0.12	-0.25*	-0.00	0.13	0.10	0.06	-0.13	0.03	-0.10	0.15	0.03		-0.14	-0.01
14	Oil content (%)	-0.04	0.04	0.09	-0.14	-0.57**	-0.65**	-0.64**	-0.26*	-0.27**	-0.11	-0.50**	-0.48**	-0.15		0.24*
15	Protein content (%)	0.19	-0.04	0.15	0.02	-0.32**	-0.30**	-0.30**	-0.28**	-0.29**	-0.05	-0.20	-0.25*	-0.01	0.25*	

*, ** Significant at 5% and 1% level of significance, respectively

Correlation studies alone can't provide a clear cut picture of cause and effect of relationship between yield attributes and their extent of association. Out of these fourteen characters only two i.e. kernel yield per plant and sound mature kernel exhibited positive significant association with dry pod yield per plant, hence only these characters were described for path analysis study. The description is as under. Highly significant positive correlation of kernel yield per plant with dry pod yield per plant (0.96**) was mainly due to its high direct effect (2.28). These results are in accordance with the findings of Nandini and Savithramma, 2012 and Kahate *et al.,* 2014 [13, 8]. Significant positive correlation of sound mature kernel with dry pod yield per plant (0.62**) was mainly due to its indirect effect through kernel yield per plant (1.37). While direct effect of sound mature kernel with dry pod yield per plant was negative in magnitude (-0.11). Similar results were also reported by Sumathi and Muralidharan, 2007 [14].

The value of residual effect of undefined factors [Table-2] was 44 %. This residual effect of path analysis indicated that 95 % variability for dry pod yield could be attributed to variation in 10 independent characters considered in this study and 5 % variation in yield was attributable to some undefined factors. Highest positive direct effect on dry pod yield was exhibited by kernel yield per plant (2.28). Highest positive indirect effect on dry pod yield was exhibited by number of matured pods per plant through kernel yield per plant (2.07). Similarly, oil content

through number of matured pods per plant (0.50) and number of branches per plant through kernel yield per plant (0.37) also showed high indirect effects.

Table-2 *Direct (diagonal) and indirect effects of different correlated characters towards dry pod yield per plant in Groundnut (Arachishypogaea L.)*

SN	Character	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of branches/ plant	Number of mature pods/ plant	Kernel yield/ plant (g)	Sound mature kernel (SMK) %	Dormancy	Oil content (%)	Protein content (%)	Genotypic Correlation Coefficient
1	Days to 50% flowering	**0.22**	0.03	0.00	-0.05	-0.02	-0.04	0.02	-0.07	-0.02	0.01	0.08
2	Days to maturity	0.01	**0.57**	0.04	-0.00	0.06	-1.11	0.03	-0.08	0.01	-0.00	-0.47**
3	Plant height (cm)	-0.01	-0.13	**-0.16**	0.03	0.14	-0.09	0.02	0.05	0.05	0.01	-0.08
4	Number of branches per plant	0.06	0.01	0.03	**-0.16**	-0.07	0.37	-0.02	0.03	-0.05	0.00	0.21
5	Number of mature pods per plant	0.01	-0.04	0.03	-0.02	**-0.75**	2.07	-0.04	-0.02	-0.21	-0.02	1.02
6	Kernel yield per plant (g)	-0.00	-0.28	0.01	-0.03	-0.68	**2.28**	-0.07	-0.03	-0.23	-0.01	0.96**
7	Sound mature kernel (SMK) %	-0.04	-0.18	0.02	-0.03	-0.24	1.37	**-0.11**	-0.02	-0.14	-0.02	0.62**
8	Dormancy	0.05	0.15	0.03	0.02	-0.05	0.21	-0.01	**-0.28**	-0.04	-0.00	0.08
9	Oil content (%)	-0.01	0.02	-0.03	0.02	0.50	-1.69	0.05	0.04	**0.31**	0.01	-0.77**
10	Protein content (%)	0.04	-0.03	-0.03	-0.01	0.28	-0.75	0.04	0.00	0.08	**0.04**	-0.34**

Residual effect = 0.4420

Conclusion

Association estimates revealed that dry pod yield per plant showed positive and significant correlation at both genotypic and phenotypic levels with kernel yield per plant, 100-kernel weight, sound mature kernels and biological yield per plant. Correlation for dry pod yield per plant was divided into direct and indirect effects of different characters. Highest positive direct effect on dry pod yield was exhibited by kernel yield per plant (2.28) followed by days to maturity (0.57), oil content (0.31) and days to 50% flowering (0.22).While, high indirect effect on dry pod yield was exhibited by number of mature pods per plant (2.07), oil content (0.50), number of branches per plant (0.37) and protein content (0.28). Therefore, these characters are the important characters which could be used in selection for higher yield of groundnut.

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Author's Contributions

Tulsi Ram Dhakar is main researcher of the present study for whole research work and Dr. Hemlata Sharma is my Major Advisor and Ramesh Kumar is my classmate which helps me from starting of my research work to till publication of this research paper

Conflict of Interest: None declared

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