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Correlation and Path Analysis for Yield and Yield Contributing Characters in Groundnut (*Arachis hypogaea* L.)

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ABSTRACT: The purpose of this study was to determine the amount of correlation and path analysis. During the *kharif* of 2020, 30 genotypes of experimental material were examined at the Oilseeds Research Station in Latur. On July 1, 2020, the material was planted in a RBD with two replications. Observations were recorded for ten characters *viz.*, days to 50% flowering, days to maturity, plant height, number of mature pods per plant, pod yield per plant (g), kernel yield per plant (g), shelling percentage, 100-kernel weight, sound mature kernel (%) and oil content (%). The number of mature pods per plant, kernel yield per plant, and 100 kernel weight all exhibited a highly significant positive relationship with pod production per plant, according to correlation studies. Days to 50% flowering, plant height, shelling percentage, and oil content, on the other hand, had a non-significant negative relationship. In terms of pod production per plant, path coefficient analysis indicated a strong positive direct influence of kernel yield per plant, followed by number of mature pods per plant, 100 kernel weight, sound mature kernel, and days to 50% flowering.

Keywords : Positive correlation, Negative correlation, Direct path analysis, Indirect path analysis.

I. INTRODUCTION

The annual legume cum oilseed crop groundnut (*Arachis hypogaea* L.) is also known as peanut, earthnut, monkeynut, and moongfali (hindi). It is the world's 13th most significant food crop and the fourth most important oilseed crop. It is a member of the Fabaceae family that is native to South America (Brazil) and is widely grown in tropical, subtropical, and mild temperate climates across the world. It's a self-pollinating annual legume that's segmental allotetraploid (2n=40). The oil content of the groundnut kernel is 40-50 percent, the protein content is 22-30 percent, and the carbohydrate content is 10-20 percent. The kernels are an excellent source of all B vitamins (B_1, B_2, B_3, B_6) except B_{12} and are low in water soluble A and Vitamin C. Phosphorus, calcium, and magnesium are abundant in groundnut kernels, as are micronutrients such as ferrous, zinc, and potassium. It's also utilised as animal feed (oil pressings, green and dry haulms) and as a raw material in the manufacturing industry (for oil cakes and fertilizers). Oilcake contains 7.3 percent nitrogen, 1.5 percent P_2O_5, and 1.3 percent potassium. The groundnut shell is commonly utilised as a fuel source as well as a litter source for poultry and livestock. Estimates of correlation between yield and other characteristics are important in deciding which plant kinds to breed and in planning an effective breeding programme. The variables are said to be correlated when a change in one produces a commensurate change in the other variable in either direction. The correlation coefficient indicates the degree of genetic or non-genetic connection between two or more characteristics used in selection. Correlation studies are critical in this setting for choosing better genotypes. Although correlation studies do not provide a perfect picture of causality, i.e. the relative relevance of direct and indirect impacts of various component characteristics on yield, they do provide an indication of their relative importance. Wright's (1921) path co-efficient analysis simplifies the splitting of correlation coefficients into direct and indirect effects of factors on the dependent variable. In order to isolate superior genotypes, criteria created following the study of character association and route analysis would be beneficial [18].

II. MATERIALS AND METHODS

During the kharif of 2020, the current research was carried out at the Oilseed Research Station in Latur. 30 groundnut genotypes were acquired from the Oilseeds Research Station in Latur for the study. During the kharif of 2020, genotypes were seeded at the Oilseeds Research Station's research farm. The experimental material was tested in two replications in a Randomized Block Design (RBD) under rainfed conditions during the kharif of 2020. Dibbling was used to sow the seeds, with a 30 cm row spacing and a 10 cm plant spacing, respectively. In each treatment and replication, observations were made on five randomly chosen plants. Plant height (cm), number of mature pods per plant, pod yield per plant (g), kernel yield per plant (g), Shelling percentage, Sound mature kernel (percent), 100 kernel weight (g), and Oil content (percent). Except for the border rows, the plants were chosen from the centre of the row. For all 10 yield and yield contributing characteristics utilised in the analysis, the replication means based on chosen plants were employed. The study was based on Panse and Sukhatme's (1985) proposed paradigm [12]. Based on analysis of variance, the phenotypic and genotypic components of variances were calculated [8]. As recommended by Allard, heritability in the wide sense (h2bs) was estimated using equation (1960). Using the formula proposed by Allard, the predicted genetic advance (GA) under selection was calculated (1960).

III. RESULT AND DISCUSSION

Correlation Analysis Studies: A study of the relationship between yield components and yield is important for selecting features that have a clear influence on yield and may benefit in breeding material selection. Through correlation, a greater knowledge of the role of such characteristics in forming the genetic composition of the crop may be gained. In general, genotypic correlations were higher than phenotypic correlations. This might be owing to the genotypes' greater stability, given the bulk of them have been exposed to some kind of selection [9]. Correlation studies are used to determine the appropriateness of several characteristics for indirect selection, because selection on one feature might result in undesired changes in other characters. The correlation estimations derived for ten groundnut yield component characteristics are described in the following study. Table 1 shows the relationship between pod yields per plant and several yield characteristics, as well as the qualities themselves.

The traits number of mature pods per plant, pod yield per plant, kernel yield per plant, and 100 kernel weight all had a negative non-significant relationship with the character days to 50% flowering. Plant height, number of mature pods per plant, Sound mature kernel, and oil content were all found to be similar [10, 17]. According [2, 17], this trait had a negative significant relationship with pod production per plant. The number of ripe pods per plant, kernel production per plant, and 100 kernel weight all exhibited a non-significant positive relationship with days to maturity. Kumari *et al.* (2020) [10] for number of mature pods per plant, kernel yield per plant, and 100 kernel weight, Babariya & Dobariya [3] for number of mature pods per plant and 100-kernel weight, and Wadikar *et al.* (2018) [17] for 100-kernel weight. This characteristic has a non-significant negative relationship with pod yield per plant. Wadikar *et al.* (2018) [17]; Kumari *et al.* (2020) [10] obtained the same result. The number of mature pods per plant, kernel yield per plant, 100 seed weight, sound mature kernel (percent), and pod yield per plant all had a negative non-significant relationship with plant height. Wadikar *et al.* (2018), Kumari *et al.* (2020) [8]; Raghuwanshi *et al.* (2015) [13]. Kernel yield per plant, 100-kernel weight, and pod yield per plant all exhibited a strong positive relationship with the number of ripe pods per plant. Kumari *et al.* (2020) [10]; Wadikar *et al.* (2018) [17] for kernel yield and pod yield, and Solanki *et al.* (2019) [15] for pod yield per plant all agreed with these findings. The attribute kernel yield per plant was shown to have a strong positive relationship with the number of pods per plant and the 100-kernel weight. This feature exhibited a strong positive correlation with pod yield per plant [8, 10]. Days to 50% flowering, 100 kernel weight, oil content, and sound mature kernel all exhibited a non-significant positive relationship with shelling. For 100-kernel weight, [6, 8, 10] for oil content, Wadikar *et al.* (2018) [17] for sound mature kernel, [5] for days to 50% flowering. Similar results were reported by Giri *et al.* (2018) [6] when they looked at the negative correlation for pod production per plant. Days to kernel yield per plant and pod yield per plant both exhibited a strong positive relationship with 100-kernel weight. This characteristic was shown to be positive significant connection with pod yield per plant, in agreement with [8]; Wadikar *et al.* (2018) [17], both of whom found a positive significant association. The number of mature pods per plant, kernel yield per plant, and pod yield per plant all had a non-significant positive relationship with the character sound mature kernel (percent).For day to maturity, [8, 17] found similar findings, as did Channayya *et al.* (2011) [7] for pod yield per plant. Days to 50% blooming, days to maturity, kernel yield, 100-kernel weight, and pod yield per plant all exhibited a non-significant negative relationship with oil content. The same results were found by John *et al.* (2015) [8] for kernel yield per plant and Solanki *et al.* (2019) [15] for pod yield per plant. The number of mature pods per plant, kernel yield per plant, and 100-kernel weight all had a positive significant relationship with pod production per plant. Days to 50% flowering, plant height, oil content, and shelling percentage all had a non-significant negative correlation with this characteristic, whereas days to maturity and sound mature kernel had a positive non-significant association. Number of matured pods per plant, kernel yield per plant, and 100-kernel weight may be considered extremely closely linked features with pod yield per plant based on magnitude of correlation coefficient values. As a result, applying selection pressure on any of these characteristics might result in a greater yield.

Path Analysis Studies: Days to 50% flowering had a favourable direct influence on pod yield and a negative correlation. As a result, based on this character, selection is undesired. These findings were accepted by Raza *et al.* (2018) [14]. Days to maturity had a negative direct influence, but the positive association with pod yield per plant is owing to the greater positive indirect effects of days to 50% flowering and kernel yield per plant. As a result, indirect causal elements are taken into account while making a decision. For this characteristic, [8, 11] reported comparable results. The direct effect of plant height on pod yield per plant was positive, but the negative correlations were attributable to unfavourable negative indirect effects. As a result, restricted simultaneous selection is used to eliminate the unwanted indirect effects. These findings matched those of Ganvit (2018) [5]; Raghuwanshi *et al.* (2015) [13]. The number of mature pods per plant had a positive direct influence and a positive association with pod production per plant, suggesting that this characteristic was useful for selection. These findings matched those of Ganvit *et al.* (2018) [5]. Kernel yield per plant had a strong direct beneficial influence and a favourable connection with pod yield per plant. This characteristic indicates the efficiency of selection. These findings matched [3, 6, 8, 14]. Negative direct impacts of the trait number of shelling % on pod yield per plant were seen, however the negative correlations were attributable to unfavourable negative indirect effects. As a result, restricted simultaneous selection is used to eliminate the unwanted indirect effects. These findings [6, 10]. The weight of 100 kernels showed a direct positive effect and a positive association with pod yield per plant. These findings matched [4, 16]. Direct effects are nearly identical to correlation coefficients in this example, demonstrating a real link and efficacy of direct selection via this characteristic. The efficiency of selection through this characteristic was demonstrated by a favourable direct effect and a positive association with seed yield. Giri *et al.* (2009) [6]; John *et al.* (2009) [8] reported similar results (2015). Oil content had a strong negative direct influence on pod yield per plant, as well as a negative association. As a result, using this character to make a selection will be useless. Mandal *et al.* (1017) [11] published these findings (2017). At both the genotypic and phenotypic levels, a significant number of residual effects were identified, showing that other characteristics contribute to pod yield per plant in addition to those studied in this work.

Table 1: Estimates of genotypic (G) and phenotypic (P) correlations for yield and yield contributing traits in groundnut.

Sr. No.	Name of the Character		Days to 50%flowering	Days to maturity	Plant height(cm)	No. of mature pods per plant	Kernel yield per plant (g)	Shelling (%)	100 kernel weight(g)	Sound mature kernel (%)	Oil content (%)	Pod yield per plant (g)
1	**Days to 50%flowering**	r_g	1.000	0.705**	-0.058	-0.154	-0.099	0.164	-0.172	-0.347**	-0.194	-0.146
		r_p	1.000	0.547**	-0.008	-0.135	-0.084	0.110	-0.141	-0.240	-0.135	-0.106
2	**Days to maturity**	r_g		1.000	0.309*	0.185	0.141	0.105	0.145	-0.134	-0.102	0.129
		r_p		1.000	0.175	0.171	0.140	0.096	0.155	-0.078	-0.105	0.127
3	**Plant height(cm)**	r_g			1.000	-0.066	-0.065	-0.029	0.218	-0.108	0.104	-0.039
		r_p			1.000	-0.039	-0.060	-0.030	0.192	-0.138	0.117	-0.035
4	**No. of mature pods per plant**	r_g				1.000	0.867**	0.046	0.319*	0.226	0.083	0.848**
		r_p				1.000	0.857**	0.120	0.290*	0.204	0.073	0.853**
5	**Kernel yield per plant (g)**	r_g					1.000	0.115	0.623**	0.212	-0.031	0.964**
		r_p					1.000	0.248	0.525**	0.173	-0.022	0.961**
6	**Shelling (%)**	r_g						1.000	-0.121	0.152	0.468**	-0.089
		r_p						1.000	-0.128	0.091	0.380**	0.032
7	**100 kernel weight(g)**	r_g							1.000	0.126	-0.073	0.664**
		r_p							1.000	0.131	-0.075	0.594**
8	**Sound mature kernel (%)**	r_g								1.000	0.315*	0.241
		r_p								1.000	0.302*	0.212
9	**Oil content (%)**	r_g									1.000	-0.125
		r_p									1.000	-0.104
10	**Pod yield per plant(g)**	r_g										1.000
		r_p										1.000

* Indicates significance at 5% level ** Indicates significance at 1% level

Table 2: Genotypic and phenotypic path analysis for Direct (Diagonal) and Indirect (off diagonal) effects of yield Components on seed yield.

Sr. No.	Name of the Character		Days to 50% flowering	Days to maturity	Plant height(cm)	No. of mature pods per plant	Kernel yield per plant (g)	Shelling (%)	100 kernel weight(g)	Sound mature kernel (%)	Oil content (%)	Correlation with Pod yield per plant (g)
1	**Days to 50%flowering**	G	**0.0450**	-0.0268	-0.0014	-0.0201	-0.0794	-0.0273	-0.0166	-0.0288	0.0096	-0.146
		P	**0.0427**	-0.0193	-0.0001	-0.0159	-0.0717	-0.0191	-0.0117	-0.0161	0.0054	-0.106
2	**Days to maturity**	G	0.0317	**-0.0380**	0.0074	0.0242	0.1127	-0.0175	0.0140	-0.0111	0.0050	0.129
		P	0.0233	**-0.0353**	0.0035	0.0201	0.1199	-0.0167	0.0129	-0.0052	0.0043	0.127
3	**Plant height (cm)**	G	-0.0026	-0.0117	**0.0241**	-0.0086	-0.0518	0.0048	0.0211	-0.0090	-0.0051	-0.039
		P	-0.0003	-0.0061	**0.0201**	-0.0045	-0.0517	0.0052	0.0160	-0.0092	-0.0048	-0.035
4	**No. of mature pods per plant**	G	-0.0069	-0.0070	-0.0016	**0.1308**	0.6948	-0.0076	0.0309	0.0188	-0.0041	0.848**
		P	-0.0057	-0.0060	-0.0007	**0.1177**	0.7343	-0.0210	0.0242	0.0136	-0.0030	0.853**
5	**Kernel yield per plant (g)**	G	-0.0044	-0.0053	-0.0015	0.1134	**0.8014**	-0.0192	0.0603	0.0176	0.0015	0.964**
		P	-0.0035	-0.0049	-0.0012	0.1009	**0.8568**	-0.0432	0.0438	0.0116	0.0009	0.961**
6	**Shelling (%)**	G	0.0073	-0.0039	-0.0007	0.0059	0.0919	**-0.1673**	-0.0117	0.0126	-0.0230	-0.089
		P	0.0046	-0.0033	-0.0006	0.0141	0.2123	**-0.1746**	-0.0107	0.0060	-0.0157	0.032
7	**100 seed weight (g)**	G	-0.0077	-0.0055	0.0052	0.0417	0.4994	0.0203	**0.0968**	0.0104	0.0036	0.664**
		P	-0.0060	-0.0054	0.0038	0.0341	0.4496	0.0224	**0.0836**	0.0087	0.00311	0.594**
8	**Sound mature kernel (%)**	G	-0.0156	0.0051	-0.0026	0.0295	0.1696	-0.0254	0.0121	**0.0832**	-0.0155	0.241
		P	-0.0102	0.0027	-0.0027	0.0240	0.1484	-0.0158	0.0109	**0.0670**	-0.0125	0.212
9	**Oil content (%)**	G	-0.0087	0.0038	0.0025	0.0108	-0.0248	-0.0782	-0.0071	0.0262	**-0.0493**	-0.125
		P	-0.0056	0.0037	0.0023	0.0085	-0.0186	-0.0662	-0.0062	0.0202	**-0.0415**	-0.104

Residual (G): 0.02349, Residual (P): 0.02314

CONCLUSION

Much variability is present in the material for all the characters which can be used in the future by simple selection. All the promising genotypes obtained were early in days to 50 per cent flowering, days to maturity with maximum, number of pods per plant, kernel yield per plant and 100 kernel weight. The characters with high GCV, PCV, heritability and genetic advance as per cent of mean such as number of pods per plant, kernel yield per plant, 100 kernel weight and pod yield per plant will be better responded for selection.

The trait number of kernel yield per plant should be considered as the best character for improving pod yield per plant because of its nearly equal values of direct effects and correlations with pod yield per plant. Characters having high magnitude of positive indirect effects such as days to days to maturity, sound mature kernel per plant and 100-kernel weight should be considered simultaneously for selection for the improvement of pod yield per plant.

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