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# Genetic Parameters, Correlation and Path Analysis for Yield and Yield Contributing Traits in Post Rainy Groundnut (*Arachis hypogaea* L.)

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**ABSTRACT: Direct selection for yield is misleading because of complex nature of trait and due to varied influence of environment. Indirect selection through yield contributing traits can greatly enhance efficiency of plant breeding. During post rainy (2019-20), thirty-six elite groundnut genotypes were evaluated in alfa lattice design for different genetic parameters. The observations were recorded on days to 50 % flowering, days to maturity, fresh pod yield per plant, dry pod yield per plant, hundred seed weight and shelling percentage. The analysis of variance revealed significant differences among the selected genotypes for all the traits under study at 0.01 probability levels indicate significant variability among the genotypes evaluated. Dry pod yield per plant and fresh pod yield per plant reported higher GCV and PCV estimates. High heritability coupled with high genetic advance were reported for fresh pod yield per pant, dry pod yield per plant and hundred seed weight. Dry pod yield per plant showed significant and positive connection with fresh pod yield per plant and hundred seed weight and significant negative association with shelling percentage. Path coefficient analysis revealed that traits such as fresh pod yield per plant, shelling percentage and hundred seed weight exhibited high direct effect on dry pod yield per plant indicating true and perfect relationship between them.**

**Keywords:** Groundnut, variability, heritability, correlation.

## INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is a self-pollinating crop with 10 basic chromosomes and allotetraploid genome (2n=4x=40). It is also known as peanut, earthnut and monkeynuts. It is 13$^{th}$ most important food crop and 4$^{th}$ most important oilseed crop of the world, being cultivated in more than 100 countries spread across six continents. It is an annual legume crop grown, mainly for its high-quality edible oil (44-56 %) and easily digestible protein (22-30 %) in its seeds. It is considered as an important crop by virtue of its contribution towards satisfying the protein needs of many poor families who cannot afford animal protein. Groundnut oil contains high amount of oleic and linoleic acid (Engin *et al*., 2017). Higher yield is terminal goal of any breeding programme. But yield is governed by several genes and which is also influenced by the environment in present days. Presence of genetic variability is essential for starting any crop improvement programme, because selection depends mainly on genetic variability present in given germplasm. The genetic architecture of grain yield is depending on the overall net effect produced by various yield components, which are interacting with each other. The connection of different component characters among themselves and with yield is quite important for making an efficient selection criterion for yield. So, it's necessary to select the component character which is directly related to yield for better improvement of groundnut crop.

## MATERIALS AND METHODS

The experimental material consists of thirty-six groundnut genotypes derived from different origins. The genotypes were obtained from Groundnut Breeding Unit, ICRISAT, Hyderabad. Selected groundnut genotypes were evaluated in alfa lattice design with three replications at ICRISAT research farm, Hyderabad. Each replication was divided into four homogenous blocks to reduce heterogeneity among the experimental material and to reduce inter-block effect. Double row plots were planted with 4 m length in such a way that inter row and inter plant distance with 30 and 10 cm respectively. Forty seeds were sown in each

4 m row. Observations on six component characters viz. days to 50 % flowering, days to maturity, fresh pod yield per plant, dry pod yield per plant, hundred seed weight and shelling percentage were recorded on three randomly selected plants from each genotype and mean values used for the statistical analysis.

Analysis of variance was performed to test the significance of difference among the genotypes for the characters studied. Genetic variability parameters were worked out as proposed by (Johnson *et al*. 1955) and correlation coefficient as per Dewey and Lu (1959) using SAS software program (version 7.5).

## RESULTS AND DISCUSSION

Analysis of variance revealed significant differences among the genotypes for all the traits under study at 0.01 probability levels indicating sufficient genetic variability present for all character studied. The estimates of PCV were higher than GCV for all the characters studied but differences are very tiny, indicates that there is effect of environment in expression of all the characters. Fresh pod yield per plant, dry pod yield per plant and hundred seed weight recorded highest GCV and PCV values. This clearly indicates that improvement of these characters through selection become very easy. Hampannavar *et al.* (2018) reported moderate to high GCV and PCV values for dry pod yield per plant and hundred seed weight. Likewise, similar results reported by Sabiel *et al*. (2014); Yadav *et al*. (2014); Vasanthi *et al.* (2015). Low GCV values and moderate PCV values were recorded for shelling percentage. Hampannavar *et al.* (2018) observed low GCV and PCV value for shelling percentage.

High PCV and GCV indicate that direct selection may be easy based on these characters and their phenotype would be good indication of the genotype (Table 1). The characters like days to 50 % flowering and days to maturity having low GCV and PCV indicating that these characters having very less variation, so selection for such characters are difficult. The results for low GCV and PCV confirmed with Ganesh and Sudhakar (1995) for days to 50 % flowering. Heritability is the ratio of genetic variance to total or phenotypic variance indicate pattern of transmission of characters from parents to offspring. The estimates of heritability can be utilized in various ways such as for the prediction of genetic gain, which indicates the genetic improvement that would result from the selection of best individuals. High heritability coupled with high genetic advance were reported for fresh pod yield per plant, dry pod yield per plant and shelling percentage, it indicates that additive genetic variance would be rewarding for selection of these traits (Table 2). Similar results obtained by Sabiel *et al*. (2014); Yadav *et al*. (2014); Vasanthi *et al.* (2015); Hampannavar *et al.* (2018).

**Correlation Studies.** The correlation studies (Table 3) revealed that dry pod yield per plant had significant positive genotypic and phenotypic association with fresh pod yield per plant and hundred seed weight and, significant negative correlation with shelling percentage. With days to maturity it is positively associated but non-significant whereas with days to 50 % flowering it is negatively associated. This implies that selection of genotypes with fresh pod yield per plant and hundred seed weight can improve groundnut yield at considerable level. Vaithiyalingan and Yogameenakshi (2018); Rao and Venkanna (2019); Chishti *et al.* (2010); Sumathi *et al.* (2007); Dhaliwal *et al*. (2010); Ladole *et al.* (2009); Shankar *et al.* (2018); Kumar *et al.* (2012) observed significant positive association between dry pod yield per plant and hundred seed weight. Hampannavar *et al.* (2018) reported that dry pod yield has significant negative correlation with shelling percentage. Kadam *et al.* (2018) reported that dry pod yield per plant has significant positive association with fresh pod yield per plant. Patel *et al*. (2021) also investigated that pod yield per plant have significant and positive correlation with shelling percentage and kernel yield per plant. That kernel yield per plant had significant and positive correlation with 100 seed weight, shelling percentage, harvest index and pod yield per plant. Kannappan *et al*. (2022) also found out that kernel yield per plant has significant and positive correlation with 100 seed weight, no. of pods per plant, pod yield per plant and shelling percentage. This implies that simultaneous selection for these characters may help to increase the dry pod yield of groundnut to considerable extent.

**Path analysis.** The association of different component characters among themselves and with yield is quite important for devising an efficient selection criterion for yield. Correlation gives only the relation between two variables, whereas path coefficient analysis allows separation of the direct effect and their indirect effects through other attributes by partitioning the correlations (Wright, 1923). Based on the data recorded on the genotypes in the present investigation, the genotypic and phenotypic correlation coefficients were estimated to determine direct and indirect effects of yield and its contributing characters. Our results indicate days to 50 % flowering had negative and direct effect (-0.0607/-0.0045) on dry pod yield per plant at both genotypic and phenotypic level. It showed indirect negative effects on dry pod yield per plant through days to maturity (-0.0177/-0.0009) at both genotypic and phenotypic levels. It had indirect positive effects on dry pod yield per plant through fresh pod yield per plant (0.0056/0.0003), hundred seed weight (0.0196/0.0013) and shelling percentage (0.0024/0.0001) at both genotypic and phenotypic levels. Days to maturity had negative and direct effect (-0.0045) on dry pod yield per plant at phenotypic level. Fresh pod yield per plant had positive and direct effect (0.8117/0.7981) on dry pod yield per plant at both genotypic and phenotypic level. Hundred seed weight had positive and direct effect (0.1445/0.0996) on dry pod yield per plant at both genotypic and phenotypic level.

Shelling percentage had positive and direct effect (0.0122/0.0154) on dry pod yield per plant at both genotypic and phenotypic level. Positive direct effect on dry pod yield per plant were reported by Rao *et al.* (2014); Siddiquey *et al.* (2006); Deshmukh *et al.* (1986); Awatade *et al.* (2009); Arunachalam and Bandyopadhyay (1984); Vaithiyalingan and

Yogameenakshi (2018); Badwal and Singh (1973); Parameshwarappa *et al*. (2008); Sardar *et al.* (2017); Kumar *et al.* (2012) for hundred seed weight and by Singh *et al.* (2017); Hampannavar *et al.* (2018); Awatade *et al.* (2009) for shelling percentage. Patel *et al*. (2021) reported that kernel yield per plant has significant positive effect on pod yield per plant. The significant and positive direct effect on kernel yield per plant from shelling percentage, harvest index and pod yield per plant. Kannappan *et al.* (2022) reported that significant and positive effect on kernel yield per plant by 100 seed weight and shelling outturn.

The findings of the present investigation revealed that fresh pod yield per plant exerted highest positive direct effect followed by hundred seed weight and shelling percentage on the dry pod yield per plant indicating that selection for these characters is likely to bring about an overall improvement in dry pod yield per plant directly. Further, studies on correlation and path co-efficient analysis revealed the importance of fresh pod yield per plant and hundred seed weight, which showed highly significant positive correlation and positive direct effect with dry pod yield per plant, thus can be used as selection criteria for effective yield improvement.

**Table 1: Analysis of variance for yield and its component traits among thirty-six groundnut genotypes studied during post rainy 2019-20.**

| SV | df | DF | DM | FPD | DPP | HSW | SP |
|---|---|---|---|---|---|---|---|
| TRT | 35 | 12.38** | 36.64** | 55.08** | 16.92** | 183.3** | 111.3** |
| REP | 2 | 0.39 | 6.84 | 6.43 | 3.26 | 1.25 | 60.19 |
| BLK(REP) | 24 | 0.97 | 3.33 | 1.45 | 1.59 | 19.35 | 58.43 |
| Error | 46 | 1.11 | 3.70 | 2.47 | 1.02 | 15.44 | 38.73 |

** indicate significant at the 0.01 probability levels. **Abbreviations:** DF- Days to 50% flowering, DM- Days to maturity, FPD- Fresh pod yield per plant (g), DPP- Dry pod yield per plant (g), HSW- Hundred seed weight (g), SP- Shelling percentage (%), SV- Source of variation.

**Table 2: Genetic variability parameters for yield and yield contributing characters in thirty-six groundnut genotypes studied during post rainy 2019-20.**

| Sr. No. | Traits | GM | Range | CV (%) | | $h^2$ | GA (at 5%) |
|---|---|---|---|---|---|---|---|
| | | | | PCV | GCV | | |
| 1. | DF | 39.62 | 35.33-47 | 5.76 | 5.14 | 79.6 | 9.46 |
| 2. | DM | 115.75 | 101-121.6 | 3.79 | 3.42 | 81.5 | 6.37 |
| 3. | FPD | 11.94 | 5.79-29.06 | 40.20 | 38.32 | 90.9 | 75.25 |
| 4. | DPP | 7.06 | 3.14-13.8 | 39.12 | 35.91 | 84.3 | 67.91 |
| 5. | HSW | 42.38 | 25.22-72.03 | 23.48 | 21.41 | 83.1 | 40.20 |
| 6. | SP | 59.18 | 41.75-71.4 | 14.84 | 9.50 | 41.0 | 12.54 |

DF- Days to 50% flowering, DM- Days to maturity, FPD- Fresh pod yield per plant (g), DPP- Dry pod yield per plant (g), HSW- Hundred seed weight (g), SP- Shelling percentage (%), GM- General mean, CV- Coefficient of variation, $h^2$- Heritability (broad sense), GV- genetic advance as percent of mean.

**Table 3: Genotypic and phenotypic correlation coefficient for six characters in thirty-six genotypes of groundnut genotypes studied during post rainy 2019-20.**

| Traits | r | DF | DM | FPD | HSW | SP | DPP |
|---|---|---|---|---|---|---|---|
| DF | $r_g$ | **1.000** | 0.28* | -0.09 | -0.32** | -0.03 | -0.17 |
| | $r_p$ | **1.000** | 0.19 * | -0.06 | -0.29* | -0.01 | -0.08 |
| DM | $r_g$ | | **1.00** | 0.10 | -0.22* | -0.40** | 0.06 |
| | $r_p$ | | **1.00** | 0.08 | -0.16 | -0.22 * | 0.02 |
| FPD | $r_g$ | | | **1.00** | 0.45** | -0.33** | 0.88** |
| | $r_p$ | | | **1.00** | 0.41 ** | -0.26 * | 0.83** |
| HSW | $r_g$ | | | | **1.00** | -0.15 | 0.52** |
| | $r_p$ | | | | **1.00** | -0.05 | 0.43** |
| SP | $r_g$ | | | | | **1.00** | -0.29* |
| | $r_p$ | | | | | **1.00** | -0.19* |

**Abbreviations:** DF- Days to 50% flowering, DM- Days to maturity, FPD- Fresh pod yield per plant (g), DPP- Dry pod yield per plant (g), HSW- Hundred seed weight (g), SP- Shelling percentage (%), $r_g$- Genotypic correlation, $r_p$ - phenotypic correlation r – Correlation, **–Significance at 0.01 probability level, *- Significance at 0.05 probability level

**Table 4: Phenotypic and Genotypic path coefficients of yield and its component traits for thirty-six groundnut genotypes studied during post rainy 2019-20.**

| Traits | G/P | DF | DM | FPD | HSW | SP | DPP |
|---|---|---|---|---|---|---|---|
| DF | G | **-0.0607** | -0.0171 | 0.0056 | 0.0196 | 0.0024 | -0.1735 |
| | P | **-0.0045** | -0.0009 | 0.0003 | 0.0013 | 0.0001 | -0.0890 |
| DM | G | 0.0093 | **0.0329** | 0.0035 | -0.0073 | -0.0134 | 0.0647 |
| | P | -0.0059 | **-0.0302** | -0.0027 | 0.0049 | 0.0068 | 0.0209 |
| FPD | G | -0.0750 | 0.0861 | **0.8117** | 0.3733 | -0.2709 | 0.8831 |
| | P | -0.0493 | 0.0718 | **0.7981** | 0.3316 | -0.2097 | 0.8330 |
| HSW | G | -0.0467 | -0.0322 | 0.0664 | **0.1445** | -0.0224 | 0.5281 |
| | P | -0.0291 | -0.0163 | 0.0414 | **0.0996** | -0.0050 | 0.4368 |
| SP | G | -0.0005 | -0.0049 | -0.0041 | -0.0019 | **0.0122** | -0.2921 |
| | P | -0.0002 | -0.0034 | -0.0040 | -0.0008 | **0.0154** | -0.1925 |

Bold values are direct effects; G – Genotypic correlation coefficient; P – Phenotypic correlation coefficient, Residual effect (P) – 0.54; Residual effect (G) - 0.44

## CONCLUSIONS

Direct selection for yield is not possible because yield is complex trait and which were affected by environmental effect in great extent. Yield can be enhanced by indirect selection of traits which are linked to traits. Dry pod yield per plant showed significant and positive association with fresh pod yield per plant and hundred seed weight and significant negative association with shelling percentage. Path coefficient analysis reveal that traits such as fresh pod yield per plant, shelling percentage and hundred seed weight exhibited high direct effect on dry pod yield per plant indicating true and perfect relationship between them.

## FUTURE SCOPE

Selection has vital importance in plant breeding as almost all the activities of plant breeding starts from selection itself. Sometimes direct selection for yield is misleading since yield is complex trait and which affected by environment. With the help of correlation and path analysis selection work become easy. It is possible to select genotypes based on yield related traits and which can be used in further breeding programmes.

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