***Original Research Article***

# GENETIC VARIABILITY AND CHARACTER ASSOCIATION FOR YIELD AND RELATED ATTRIBUTES IN GROUNDNUT (*Arachishypogaea*L. )

## ABSTRACT

The present study was designed to assess the extent ofvariability,geneticadvance,heritabilityandcorrelationofdifferenttraitsof20groundnut genotypesusingrandomizedblockdesignwiththreereplications.Theobservationswererecorded on five randomly selected plants from each treatment and replication for 15 differentquantitativetraits.Basedonthemeanperformance,highpodyieldperplantwereidentifiedfor the genotype SC-28, VG-17 (CHECK). High estimates of GCV and PCV wererecorded for number of branches per plant followed bydays to germination, number of pegs per plant, plant height. Genetic parameters revealed that heritability and geneticadvance as % mean values are high were recorded for number of pegs per plant followed byplant height, biological yield per plant, 100 kernel weight. Correlation coefficient analysis revealed that pod yield per plant exhibited positive and significant association with number of branches and days to germination at genotypic and phenotypic levels. Path coefficient analysisrevealed that character's harvest index, biological yield per plant, number of branches per plant, number of pods per plant,kernel yield per plant have positive directeffecton pod yield per plant at genotypic andphenotypiclevels.

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**Keywords**: Variability, Genetic advance, Heritability, correlation, coefficient, GCV, PCV,Pathcoefficient.

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## INTRODUCTION

Groundnut (*Arachishypogaea* L.) is one of the most important legume crops of the world which is native to Brazil in the South American leguminous oilseed (Hammons 1982). Groundnut (*Arachishypogaea*L.) is a vital oil seed crop. It is an annual, herbaceous, and self-pollinated legume that is classified under the sub-family Papilionaceae and family Fabaceae.

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Groundnut covers 31.3% of the total cropped area under oilseeds and accounts for 36.1% of the overall oilseed production in the world. The maximum share of groundnut production is contributed by China, India and USA. According to latest available data (2016-17), groundnut cultivation occupies ~27.6 million ha in the world, with an annual production of 43.9 million tons (with shell). The average worldwide yield is 1590 kg/ha (with shell*)*Food and Agriculture Organization Corporate Statistical Database (**FAOSTAT**).

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Genetic variability is important indices for plant breeders because it provides a source ofvariation as well as raw material for yield enhancement (Gaur *et al*., 2020; Verma*et al*., 2018).Theselectionofyieldcontributingcharactersisimportantforcropimprovementandtheselection of such characters depends mainly on heritable variation as well as the heritability ofthe traitconcerned.

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Genetic variability is important indices for plant breeders because it provides a source ofvariation as well as raw material for yield enhancement (Gaur *et al*., 2020; Verma*et al*., 2018).Theselectionofyieldcontributingcharactersisimportantforcropimprovementandtheselection of such characters depends mainly on heritable variation as well as the heritability ofthe traitconcerned.

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For improvement of yield in groundnut direct selection is often misleading. The knowledge of existing variability and degree of association between yield contributing characters and their relative contribution in yield is essential for developing high yielding genotypes in groundnut. The observed variability is a combined measure of genetic and environmental causes (Patel *et al*. 2009). The genetic variability is heritable from generation to generation. Heritability and genetic advance is a useful tool for breeders in determining the direction and magnitude of selection. Correlation studies provide an opportunity to study the magnitude and direction of association of

**Comment [M14]:** Missing in references yield with its components and also among various components. Path coefficient is essential to accumulate optimum combination of yield contributing characters and to know the implication of the interrelationships of various characters in a single genotype. Considering the above points, the present study was undertaken to evaluate the genotypes for yield and its components and to estimate the inter-relationship among the agronomic traits in groundnut. Thepresent investigation hasbeen madewiththefollowing objectives:-

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1. To estimate genetic parameters for genetic variability in groundnut crop.
2. To study the correlation in groundnut germplasm to obtain high yield.
3. To study direct and indirect effect of yield contributing character on seed yield.

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## 2. MATERIALS AND METHODS

### 2.1. Description of study area

The experiment was conducted during *Kharif*season of 2022. The experiment was conducted using Randomized Block Design consisting of 15 treatments with three replication in field condition at the department of Genetics & Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh. Prayagraj is located in the south eastern part of Uttar Pradesh, India. This region has subtropical Climate with extreme of summer and winter. The temperature falls to as low as 2-3$^0$c during winter season especially in the month of December and January.

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### 2.2 Experimental design and treatment details

Experimental material, for the present study consists of groundnut, 20 genotypes was receivedfromDepartmentofgeneticsandPlantBreeding,SHUATS,duringKharif-2022andexperiment will be carried out in Randomized block design with 3 replications was conducted attheExperimentalFarmoftheDepartmentofGeneticsandPlantBreeding,NainiAgriculturalInstitute, SamHigginbottomUniversityofAgriculture,TechnologyandSciences,Prayagraj, Uttar Pradeshduring***Kharif*,2022.**

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**Table 1. List of genotypes used for the study**

| SL.NO | GENOTYPES | SL.NO | GENOTYPES |
|---|---|---|---|
| 1 | FSICC-37AxCS-319 | 11 | SC-28 |
| 2 | NRCG-12177 | 12 | TMV-10 |
| 3 | LGN-184 | 13 | RG-614 |
| 4 | LGN-01 | 14 | ICGV-7247 |
| 5 | JL-1186 | 15 | TG-37A |
| 6 | NRCG-1374 | 16 | AVK-4 |
| 7 | ICGV-98170 | 17 | IVK-2013-23 |
| 8 | JL-27 | 18 | RG-562 |
| 9 | NARAYANI | 19 | GG-21 |
| 10 | RG-638 | 20 | VG-17(CHECK) |

## RESULTS AND DISCUSSION

Analysisofvarianceshowsthateverytreatmentisdifferfromeachothersogeneticvariabilityexists.1%levelofsignificanceishighestNumber of Branches per plant (144.12**)and lowestfor Pod yield per plant (2.15**).

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**Table 2. Analysis of Variance of 20 genotype for 15 characters**

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| Sl.No | Source | Mean Sum of Squares (MSS) | | |
|---|---|---|---|---|
| | | **Replication** | **Treatment** | **Error** |
| | **Degreesoffreedom** | **2** | **19** | **38** |
| 1 | Days to Germination | 0.1920 | 2.15** | 0.096 |
| 2 | Days to initial flowering | 0.3640 | 5.56** | 0.677 |
| 3 | Days to 50% flowering | 1.4010 | 16.559** | 2.048 |
| 4 | Plant height (cm) | 2.8750 | 77.101** | 5.811 |
| 5 | Number of Branches per plant | 0.790 | 10.792** | 0.396 |
| 6 | Number of pegs per plant | 25.5860 | 144.12** | 10.551 |
| 7 | Number of pods per plant | 8.3690 | 27.768** | 4.202 |
| 8 | 100 pod weight | 31.0430 | 37.705** | 15.567 |
| 9 | Kernel yield per plant | 5.3860 | 7.993** | 2.698 |
| 10 | 100 kernel weight | 25.5170 | 46.635** | 8.254 |
| 11 | Shelling (%) | 8.7550 | 10.537** | 4.351 |
| 12 | Sound Mature Kernels (%) | 5.2170 | 27.67* | 12.146 |
| 13 | Harvest Index (%) | 30.2310 | 36.492* | 15.117 |

| | | | | |
|---|---|---|---|---|
| 14 | Biological yield per plant | 4.0370 | 70.17** | 12.253 |
| 15 | Pod yield per plant | 10.3780 | 16.546** | 5.16 |

*5%LevelofSignificance

**1%LevelofSignificance

## Table 3. Mean table of 20 genotype for 15 characters

| Sl. No. | Variety Name | Days to Germination | Days to initial flowering | Days to 50% flowering | Plant height (cm) | Number of Branches per plant | Number of pegs per plant | Number of pods per plant | 100 pod weight | Kernel yield per plant | 100 kernel weight | Shelling (%) | Sound Mature Kernels (%) | Harvest Index (%) | Biological yield per plant | Pod yield per p |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | FSICC-37AxCS-319 | 5.6 | 14.133 | 24.667 | 39.6 | 6.4 | 43.333 | 23.6 | 78.997 | 21.27 | 44 | 71 | 70.667 | 43.327 | 39.81 | 30.4 |
| 2 | LGN-184 | 5.467 | 15.667 | 25.997 | 39.6 | 9.133 | 53.533 | 23.8 | 83 | 22.997 | 40 | 68.333 | 65 | 45.317 | 40.66 | 33.4 |
| 3 | LGN-01 | 5.533 | 14.4 | 24.667 | 40.933 | 9.867 | 54.797 | 30.133 | 81.663 | 22.27 | 41 | 71.667 | 65.667 | 48.433 | 34.71 | 32.733 |
| 4 | JL-1186 | 5.667 | 14.53 | 25.667 | 40.737 | 11.4 | 60.933 | 28.267 | 78.667 | 19.333 | 40 | 67.67 | 67.333 | 46.097 | 41.42 | 34.933 |
| 5 | NRCG-1374 | 4.547 | 14.467 | 24.667 | 49.267 | 8.2 | 61.397 | 26.6 | 81.333 | 22.067 | 39.667 | 70.67 | 65.667 | 48.19 | 34.383 | 32 |
| 6 | ICGV-98170 | 5.13 | 14.6 | 26.333 | 54.933 | 10.533 | 57.863 | 27.267 | 79.333 | 20.663 | 40.333 | 67.333 | 69 | 43.78 | 40.913 | 31.667 |
| 7 | JL-27 | 5 | 14.667 | 24.333 | 52.133 | 8 | 63.93 | 28.4 | 78.333 | 22.933 | 40.333 | 70.333 | 71.333 | 47.18 | 36.457 | 32.867 |
| 8 | NARAYANI | 6.467 | 16.267 | 26.997 | 43.133 | 11.267 | 64.133 | 27.133 | 89.667 | 20.867 | 45.333 | 67 | 67.667 | 38.983 | 48.053 | 30.67 |
| 9 | RG-638 | 4.533 | 15.133 | 25.333 | 38.933 | 9.003 | 45.403 | 23.333 | 79.337 | 21.733 | 39 | 65.333 | 64.333 | 45.297 | 40.297 | 33.6 |
| 10 | SC-28 | 5.6 | 14.93 | 24.333 | 43.53 | 5.733 | 54.067 | 33.597 | 78.667 | 25.2 | 43 | 69.337 | 67 | 43.503 | 49.247 | 37.933 |
| 11 | TMV-10 | 5.6 | 16.067 | 27.67 | 43.6 | 8.2 | 66.867 | 27.933 | 78.997 | 21.867 | 44 | 71.667 | 70.333 | 43.707 | 40.257 | 31.137 |
| 12 | RG-614 | 6.6 | 18 | 30.333 | 45.4 | 10.667 | 53.063 | 27 | 84 | 19.463 | 36.667 | 67.333 | 68.667 | 38.233 | 46.73 | 28.867 |
| 13 | ICGV-7247 | 6.733 | 17.667 | 29.667 | 49.933 | 11 | 61.4 | 28.67 | 78.333 | 20.67 | 42 | 70 | 69.667 | 38.93 | 47.21 | 30.333 |
| 14 | TG-37A | 4.467 | 14.8 | 25.667 | 52.333 | 6.8 | 55 | 33.733 | 80.333 | 24.663 | 44.333 | 70.67 | 70.667 | 42.37 | 47.82 | 35.47 |
| 15 | AVK-4 | 5.333 | 18.2 | 30.997 | 51.267 | 10.667 | 66.333 | 33.533 | 82 | 19.867 | 40 | 68.67 | 73.667 | 42.883 | 46.857 | 35.2 |
| 16 | IVK-2013-23 | 5.597 | 15.067 | 25.333 | 43.93 | 7.397 | 55.403 | 28.003 | 77.667 | 19.867 | 47.333 | 67.333 | 72.667 | 36.957 | 49.32 | 29.533 |
| 17 | RG-562 | 7.4 | 17.733 | 30.667 | 42.467 | 10.667 | 63.197 | 30.533 | 85.003 | 22.13 | 50 | 69.667 | 74 | 42.883 | 42.973 | 32.2 |
| 18 | GG-21 | 5.533 | 15.6 | 28.333 | 39.4 | 6.13 | 66.6 | 29.8 | 85 | 21 | 40.333 | 69 | 74 | 39.42 | 47.643 | 31.337 |
| 19 | NRCG-12177 | 7.4 | 17.6 | 30.667 | 40 | 11.6 | 50.067 | 30.797 | 89.333 | 22.867 | 52.667 | 72 | 66.667 | 43.43 | 41.693 | 32.467 |
| 20 | VG-17 (CHECK) | 5.937 | 16.263 | 27.667 | 43.2 | 8.933 | 64.067 | 29.4 | 79.667 | 23.6 | 45.333 | 67.333 | 67.333 | 48.75 | 37.967 | 36.067 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 5.71 | 15.79 | 27 | 44.72 | 9.08 | 58.07 | 28.58 | 81.47 | 21.77 | 42.77 | 69.12 | 69.07 | 43.38 | 42.72 | 32.64 |
| CV | 5.43 | 5.21 | 5.3 | 5.39 | 6.93 | 5.59 | 7.17 | 4.84 | 7.55 | 6.72 | 3.02 | 5.05 | 8.96 | 8.19 | 6.96 |
| SEm | 0.18 | 0.47 | 0.83 | 1.39 | 0.36 | 1.88 | 1.18 | 2.28 | 0.95 | 1.66 | 1.2 | 2.01 | 2.24 | 2.02 | 1.31 |
| CDat5% | 0.51 | 1.36 | 2.37 | 3.98 | 1.04 | 5.37 | 3.39 | 6.52 | 2.71 | 4.75 | 3.45 | 5.76 | 6.43 | 5.79 | 3.75 |
| Minimum | 4.47 | 14.13 | 24.33 | 38.93 | 5.73 | 43.33 | 23.33 | 77.67 | 19.33 | 36.67 | 65.33 | 64.33 | 36.96 | 34.38 | 28.87 |
| Maximum | 7.4 | 18.2 | 31 | 54.93 | 11.6 | 66.87 | 33.73 | 89.67 | 25.2 | 52.67 | 72 | 74 | 48.75 | 49.32 | 37.93 |

Table 4. **Estimates of PCV, GCV, Heratability, and Genetic Advance & Genetic Advance as percent of mean for 15 characters**

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| Sl.No. | Parameters | GCV | PCV | h²(BroadSense)% | GeneticAdvancement5% | Gen.Advas%ofMean5% |
|---|---|---|---|---|---|---|
| 1 | Days to Germination | 14.497 | 15.479 | 87.713 | 1.596 | 27.97 |
| 2 | Days to initial flowering | 8.08 | 9.614 | 70.639 | 2.209 | 13.99 |
| 3 | Days to 50% flowering | 8.146 | 9.718 | 70.251 | 3.797 | 14.064 |
| 4 | Plant height (cm) | 10.901 | 12.162 | 80.35 | 9.001 | 20.13 |
| 5 | Number of Branches per plant | 20.502 | 21.64 | 89.755 | 3.633 | 40.012 |
| 6 | Number of pegs per plant | 11.491 | 12.78 | 80.843 | 12.359 | 21.283 |
| 7 | Number of pods per plant | 9.808 | 12.151 | 65.148 | 4.66 | 16.307 |
| 8 | 100 pod weight | 3.334 | 5.88 | 32.159 | 3.173 | 3.895 |
| 9 | Kernel yield per plant | 6.104 | 9.705 | 39.55 | 1.721 | 7.907 |
| 10 | 100 kernel weight | 8.364 | 10.727 | 60.786 | 5.745 | 13.433 |
| 11 | Shelling (%) | 2.078 | 3.664 | 32.155 | 1.677 | 2.427 |
| 12 | Sound Mature Kernels (%) | 3.294 | 6.026 | 29.874 | 2.561 | 3.708 |
| 13 | Harvest Index (%) | 6.153 | 10.871 | 32.035 | 3.112 | 7.174 |
| 14 | Biological yield per plant | 10.285 | 13.15 | 61.175 | 7.079 | 16.571 |
| 15 | Pod yield per plant | 5.968 | 9.168 | 42.379 | 2.613 | 8.004 |

## Experimental Findings & Discussion

The analysis of variance for all characters revealed highly significant difference among all fifteen genotype for all the characters Pod yield, Shelling percentage, Kernel yield, Days to Maturity, 100 Kernel weight, Sound mature Kernel percentage and oil percentage, indicating the existence of considerable genetic variation among the genotypes (Table1).

Days to Germination the Genotype TG- 37A exhibited significantly least days (4.47) followed by NRCG-1374 (4.55) whilesignificantly highest days (7.40) were shown by genotype that NRCG-12177. The variation in days to initial flowering rangedbetween14.13 to 18.20.GenotypeFSICC-37AxCS-319(14.13)exhibitedsignificantlyleastdaysfollowed byLGN-01 (14.40), NRCG-1374 (14.47) while significantly highest days AVK-4 (18.20). days to 50% flowering the Genotype JL- 27 and SC-28 exhibited significantly least numberof days (24.33) followed by FSICC-37AxCS-319, NRCG-1374 (24.67).The genotypes ICGV-98170(54.93),TG-37A(52.33),JL- 27 (52.13)werethelongest plantheight. The results are the agreement with Sarvamangla (2009), John et al. (2011), Thakur et al. (2011), Vishnuvardhan et al. (2012) and Mahalakshmiet al. (2018) in groundnut.

The genotypes TG-37A (33.73),AVK-4(33.53)wererecordedhighestnumber ofpods perplant. ThegenotypesSC- 28 (25.20),TG-37A(24.66),VG-17 (CHECK)(23.60) wererecordedhighest kernelyieldcomparedto theothergenotypes. The genotypes RG-614 (36.67), RG-638 (39.00), NRCG-1374 (39.67) recorded 100 kernel weight compared to other genotypes.

ThegenotypesNRCG-12177(72.00),TMV-10(71.67),FSICC- 37AxCS-319(71.00) were recorded higher shelling %. ThegenotypesRG-562, GG-21(74.00),AVK-4(73.67),IVK-2013-23(72.67) were recorded higher sound mature kernel %. The genotypes UDAY (check) (54.6),ICC-13348 (52.15), ILC-59468 (50.3), ICC-20-08 (50.51), were recorded highest grainyieldcompared to theother genotypes. Similar findings reported by Vishnuvardhan et al. (2012) and Gupta et al. (2015)

The genotypesSC-28, VG-17 (CHECK) were recorded higher pod yieldper plant were found significantly superior over check and the genotypesIPC-08-69 (57.6), ICC-13348 (45.333), GNG-469 (42.733) were recorded higher biologicalyieldper plant. Similar results were obtained byKumar and Rajamani (2004), Ravi Kumar (2005), John et al. (2007), Rout et al. (2010), Rao et al. (2012), Zaman et al. (2011) and Mahalakshmi et al. (2018).

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The component of variance revealed that the phenotypic coefficient of variance were higher than the genotypic coefficient of variance for all the character studied indicating the role of environmental variance in the total variance. The magnitude of PCV and GCV was high for the charactersnumber of branches per plant followed bydays to germination, number of pegs per plant, biological yield per plant, number of pods per plant. Similar findings were reported by Zaman *et al.* (2011), John *et al.* (2007). In the present investigation it is depicted that in general, estimates of phenotypic coefficient ofvariationwasfoundhigherthantheircorrespondinggenotypiccoefficientofvariation,indicatingthat the influenceof environment on theexpression ofthesecharacters.

High heritability along with high genetic advance percent was observed for the character Highest heritability in genetic parameters ranged number of branches per plant followed bydays to germination, number of pegs per plant, plant height, days to initial flowering, days to 50% flowering, number of pods per plant, biological yield per plant. The same trend was also observed byZaman *et al.* (2011), John *et al.*(2007) and Narsimulaet al. (2012). High heritability with high genetic advance and high genetic advance in percentage of mean could be further improved through individual plant selection.

The results of correlation studies indicated that genotypic correlation coefficients were higher in magnitude than their corresponding phenotypic correlation coefficients analysis revealed that pod yield per plant exhibited positive and significant association withharvest index followed by biological yield atgenotypicandphenotypiclevels. For maximizing the Pod yield per plant, emphasis should be given in selection of characters such asbiological yield, sound mature kernel, kernel yield, Shelling percentage and 100 kernel weight for further improvement of groundnut crop. Path Analysis is used to partition contributing character to yield through direct and indirect effect. As evident from the table that maximumdirectpositiveeffectonpodyieldperplantwasobservedinbiological yield per plant followed by harvest index, 100 kernel weight, kernel yield per plant and number of pegs per plant, days to flowering, days to initial flowering, number of pods per plantat genotypic and phenotypic levels. Maximumnegativedirecteffectonpod yieldperplantwasobservedfrom days to germination followed by plant height, 100 pod weight, shelling, sound mature kernel. Hence utmostimportanceshouldbegiventothesecharactersduringselectionforpod yieldperplant. The result were comparable to the result reported by (Paven*et al*, 2014)

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## CONCLUSION

From the presentinvestigation itisconcluded thatamong20 genotypesof groundnut on thebasis of mean performance SC-28 was found to be superior in seed yield over the checkfollowed by VG-17 (CHECK), The early days to flowering wasrecorded by FSICC- 37AxCS-319 that may fit for multiple cropping system. High estimates of GCV andPCV were recorded for number of branches per plant, days to germination, number of pegs per plant. Genetic parameters revealed that heritability andgenetic advance as % mean values are highwere recorded for plant height, biological yield per plant.Correlationcoefficientanalysis revealed that seed yield per plant exhibited positive and significant association withharvest index followed by biological yield atgenotypicandphenotypiclevels.Hence these characters may be effective for selection of high pod yield genotypes. Highly significant correlation was observed for the character pod yield. Pathcoefficient analysis revealed that characters harvest index, biological yield havepositive direct effect on pod yield per plant at genotypic and phenotypic levels.

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## References

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