Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(4): 794-799
Received: 28-05-2020
Accepted: 30-06-2020

Nistha Mohapatra
Department of Genetics and Plant Breeding, College of Agriculture, University of Agricultural Sciences, Raichur, Karnataka, India

Hasan Khan
College of Agriculture, Kalburagi, University of Agricultural Sciences, Raichur, Karnataka, India, India

Corresponding Author:
Nistha Mohapatra
Department of Genetics and Plant Breeding, College of Agriculture, University of Agricultural Sciences, Raichur, Karnataka, India

Character association and path analysis in F_3 segregating generations for yield and its component traits in groundnut (*Arachis hypogaea* L.)

Nistha Mohapatra and Hasan Khan

Abstract
Pod yield in groundnut is a complex trait and depends upon the interplay of a number of components attributes. In this study, four F_3 crosses of groundnut genotypes were evaluated to investigate the interrelationship among the yield attributing traits and physiological traits. In all the crosses, dry pod yield per plant reported a highly significant positive association with number of mature pods per plant, kernel yield per plant, haulm yield per plant and shelling per cent indicating the importance of these traits while selection is under consideration for dry pod yield. Path analysis study indicated a high positive direct effect by kernel yield per plant in two crosses *viz.*, Kadri-9 × GPBD-4 and ICGV-00351 × Sunoleic-95R. This association indicates that these yield related parameters can be used as preliminary screening tools for selecting high yielding genotypes for the next generation.

Keywords: Groundnut, correlation coefficient, path analysis, direct effect, indirect effect

Introduction
Groundnut is a self-pollinating allotetraploid crop with basic chromosome number X=10 belonging to the family Leguminosae, subfamily Papillionoidae. It is commonly called as ‘King’ of oilseeds. The groundnut seeds contain about 48 per cent oil, 25 per cent protein and 18 per cent carbohydrates and are a rich source of B-complex vitamins, minerals, antioxidants, biologically active polyphenols, flavanoids and isoflavones (Desai *et al*., 1999) [1]. It is an unpredictable crop due to its underground pods development. Kernel yield being a quantitative trait is not only polygenically controlled, but also influenced by many of its component traits. Understanding the relationships between yield and yield components is of paramount importance for making the best use of these relationships in selection. Correlation is a biometrical approach which brings out the intensity of the association between two pairs of characters and provides information on those components that could serve as criteria for selection of candidates in a breeding program while path analysis splits the correlation coefficient into direct and indirect effect so as to measure the relative contribution of each variable towards yield (Saeidi *et al*., 2011) [2]. Phenotypic correlation is the association between two characters which can be observed directly and is subjected to changes in the environment. It measures the environmental deviations together with non additive gene actions. Traits that are positively correlated with yield are considered effective because selection for such traits would result in the simultaneous improvement in yield. Unfavourable associations between the desired attributes under selection may limit genetic advance. Hence a sound knowledge of associations between the yield components is essential for planning an effective selection programme (John *et al.*, 2015) [7].

Material and Method
The present scientific investigation on groundnut was carried out during *kharif* 2018 at Main Agriculture Research Station, College of agriculture, University of Agricultural Sciences, Raichur. The experimental material consisted of four released/advanced breeding parents *viz.*, Kadri-9, GPBD-4, ICGV-00351 and Sunoleic-95R. Four F_3 populations derived from the crosses of above mentioned parents’ *viz.*, Kadri-9 x GPBD-4, ICGV-00351 x GPBD-4, Kadri-9 x Sunoleic-95R and ICGV-00351 x Sunoleic-95R were utilised for the present study. All the parents and F_3 progenies were evaluated in non-replicated trial. Recommended cultural practices were followed throughout the crop growing period. The spacing put into practice was 30 × 10 cm. Ten characters *viz*, plant height (cm), number of mature pods per plant, kernel yield per plant, haulm yield per plant, shelling per cent, HKW, SMK, oil content, protein content and dry pod yield per plant were studied

Statistical analysis

The data were subjected to statistical analysis using Windostat software. Phenotypic correlation coefficient was estimated as per Johnson *et al*. (1955) [8]. Path coefficient analysis was carried out using phenotypic correlation values to ascertain the direct and indirect effect of the yield components on yield as suggested by Dewey and Lu (1959) [9].

Result and Discussion

Correlation Analysis

The results of the Correlation Coefficient among the traits studied in F_3 generation are shown in Table 1, 2, 3 and 4.

Among the F_3 population studied dry pod yield per plant recorded a significant positive correlation with number of mature pods per plant, kernel yield per plant, haulm yield per plant, and shelling per cent in all the crosses indicating the importance of these traits while selection is under consideration for dry pod yield. Similar results were reported by Hyndavi (2015) [10] for mature pods per plant, Nazeer *et al*. (2000) [11] for shelling per cent and kernel yield per plant, Raut *et al.* (2010) [12] for kernel yield per plant, number of mature pods per plant and shelling out turn.

Plant height had recorded significant positive correlation in three crosses except in cross Kadri-9 × GPBD-4 indicating, it is also an important trait to be considered as selection criteria in some of the crosses. Venkataravana *et al.* (2000) [3] and John *et al.* (2015) [7] reported pod yield had significant positive correlation with plant height.

Apart from the traits above mentioned HKW (g) and oil content in cross Kadri-9 × GPBD-4 and ICGV-00351 × Sunoleic-95R; SMK and protein content in cross ICGV-00351 × GPBD-4; HKW, SMK, oil content and protein content in cross Kadri-9 × Sunoleic-95R also had a significant positive association with pod yield. Narashimulu *et al.* (2012) [13], Mukhesh *et al.* (2014) [14] and Dandu *et al.* (2012) [15] also reported similar results. Hence importance should be given to respective characters in respective crosses in order to improve yield.

Table 1: Correlation coefficient between yield and yield attributing traits in groundnut F_3 generation Cross 1- Kadri-9 × GPBD-4

Traits	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
X_1	1	0.093	0.073	0.148*	-0.039	-0.061	0.022	-0.058	-0.042	0.080
X_2		1	0.686**	0.555**	-0.026	0.032	-0.152**	0.179*	-0.067	0.721**
X_3			1	0.883**	0.300**	0.459**	0.118	0.277**	-0.180*	0.983**
X_4				1	0.134	0.374**	0.071	0.274**	-0.117	0.895**
X_5					1	0.306**	0.154*	0.143*	-0.172**	0.141*
X_6						1	0.319**	0.114	0.028	0.424**
X_7							1	0.111*	-0.104	0.096
X_8								1	-0.287**	0.276**
X_9									1	-0.085
X_{10}										1
Significant at 0.05= * and Significant at 0.01= **, Phenotypic level =Upward right side of diagonal										

Table 2: Correlation coefficient between yield and yield attributing traits in groundnut F_3 generation Cross 2- ICGV-00351 × GPBD-4

Traits	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
X_1	1	0.278**	0.416**	0.141**	0.146**	0.121*	0.142**	-0.188**	0.372**	0.381**
X_2		1	0.423**	0.021	0.026	0.011	0.176**	-0.209*	0.733**	0.719**
X_3			1	0.023	0.338**	0.116*	0.154**	-0.261**	0.743**	0.732**
X_4				1	0.112*	0.137**	0.037	0.006	0.031	0.147*
X_5					1	0.195**	0.133*	0.100*	0.342**	0.358**
X_6						1	0.121*	-0.036	0.075	0.092
X_7							1	-0.283**	0.187**	0.196*
X_8								1	-0.220**	-0.217*
X_9									1	0.989**
X_{10}										1
Significant at 0.05= * and Significant at 0.01= **, Phenotypic level =Upward right side of diagonal										

Table 3: Correlation coefficient between yield and yield attributing traits in groundnut F_3 generation Cross 3- Kadri-9 × Sunoleic-95R

Traits	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
X_1	**1**	0.297**	0.277**	0.031	-0.043	-0.005	0.313**	-0.148*	0.321**	0.319**
X_2		**1**	0.494**	0.062	-0.005	0.179*	0.286**	0.022	0.671**	0.678**
X_3			**1**	0.036	0.315**	0.112*	0.248**	0.173**	0.846**	0.832**
X_4				**1**	0.137	0.280**	-0.021	0.029	0.047	0.192*
X_5					**1**	0.208*	-0.090	-0.313*	0.232**	0.236**
X_6						**1**	-0.105**	-0.380**	0.132	0.135*
X_7							**1**	-0.149*	0.355**	0.349**
X_8								**1**	0.135	0.126*
X_9									**1**	0.983**
X_{10}										**1**
Significant at 0.05= * and Significant at 0.01= **, Phenotypic level =Upward right side of diagonal										

Table 4: Correlation coefficient between yield and yield attributing traits in groundnut F_3 generation Cross 4-ICGV-00351 × Sunoleic-95R

Traits	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
X_1	1	0.119	0.096	0.187*	-0.074	-0.084	0.311*	-0.029	-0.163*	0.109*
X_2		1	0.690**	0.558**	0.048	0.033	-0.035	0.176*	-0.035	0.721**
X_3			1	0.897**	0.296**	0.450**	0.196*	0.259**	-0.139**	0.985**
X_4				1	0.153*	0.376**	0.187**	0.264**	-0.069	0.904**
X_5					1	0.280**	0.093	0.118	-0.094	0.148*
X_6						1	0.281**	0.104	0.333**	0.123*
X_7							1	0.004	-0.114*	0.088
X_8								1	-0.268*	0.262**
X_9									1	-0.040
X_{10}										1
Significant at 0.05= * and Significant at 0.01= **, Phenotypic level =Upward right side of diagonal										

Where,
X_1=Plant height (cm) X_2=No. of mature pods/plant X_3=Kernel yield/plant (g) X_4=Haulm yield/plant (g) X_5=Shelling (%) X_6=HKW (g) X_7=SMK (%) X_8=Oil content (%) X_9=Protein content (%) X_{10}=Dry pod yield/plant (g)

Path coefficient analysis
The results of the path co-efficient analysis among the traits studied in F_3 generation are shown in Table 5, 6, 7 and 8.
Study indicated a high positive direct effect for pod yield per plant was highly manifested by kernel yields per plant in two crosses *viz.*, Kadri-9 × GPBD-4 and ICGV-00351 × Sunoleic-95R. These results are in accordance with the reports of Gomes *et al.* (2005) [5] and Dolma *et al.* (2010) [4] for the kernel yield per plant.
Indirect effects of kernel yield per plant on pod yield through number of mature pods per plant, haulm yield per plant and HKW in cross Kadri-9 × GPBD-4 and ICGV-00351 × Sunoleic-95R; protein content on pod yield through plant height, number of mature pods per plant, kernel yield per plant and shelling per cent in cross ICGV-00351 × GPBD-4 and Kadri-9 × Sunoleic-95R were important contributing traits. Thus targeting the above said parameters will help accelerate groundnut improvement programme. Meta and Monpara (2010) [6] reported kernel yield per plant contributed major share to pod yield per plant, indirectly through other traits.

Conclusion
It could be inferred from the present study that mature pods per plant, kernel yield per plant, haulm yield per plant, shelling percentage and 100-kernel weight are the major yield contributing characters in groundnut. Therefore, due emphasis should be given to these traits in formulating the criterion for further selection and advancement of progenies.

Table 5: Phenotypic path co-efficient among dry pod yield and its attributing characters in groundnut F_3 generation Cross 1-Kadri-9 × GPBD-4'

Traits	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
X_1	-0.0047	-0.0004	-0.0003	-0.0007	0.0002	0.0003	-0.0001	0.0003	0.0002	0.0804
X_2	0.0041	0.0441	0.0303	0.0245	0.0012	0.0014	-0.0023	0.0079	-0.0030	0.7210
X_3	0.0712	0.6614	0.9634	0.8515	0.2899	0.4427	0.1138	0.2672	-0.0778	0.9838
X_4	0.0046	0.0172	0.0273	0.0309	0.0042	0.0116	0.0022	0.0085	-0.0036	0.8950
X_5	0.0064	-0.0043	-0.0485	-0.0217	-0.1613	-0.0494	-0.0249	-0.0231	0.0117	0.1419
X_6	-0.0010	0.0005	0.0077	0.0063	0.0051	0.0168	0.0054	0.0019	0.0005	0.4248
X_7	0.0000	-0.0001	0.0002	0.0001	0.0003	0.0005	0.0017	0.0000	-0.0002	0.0969
X_8	-0.0006	0.0019	0.0030	0.0029	0.0015	0.0012	0.0001	0.0107	-0.0031	0.2762
X_9	0.0004	0.0007	0.0008	0.0012	0.0007	-0.0003	0.0010	0.0028	-0.0099	-0.0851
Residual effect at phenotypic level= 0.0696										

Table 6: Phenotypic path co-efficient among dry pod yield and its attributing characters in groundnut F_3 generation Cross 2- ICGV-00351 × GPBD-4

Traits	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
X_1	-0.0004	-0.0001	-0.0002	-0.0001	-0.0001	-0.0001	-0.0001	0.0001	-0.0002	0.3817
X_2	-0.0046	-0.0166	-0.0071	-0.0004	-0.0004	-0.0002	-0.0029	0.0035	-0.0122	0.7190
X_3	-0.0060	-0.0060	-0.0143	-0.0003	-0.0048	-0.0017	-0.0022	0.0037	-0.0106	0.7320
X_4	0.0165	0.0025	0.0027	0.1162	0.0131	0.0160	0.0044	0.0007	0.0036	0.1479
X_5	0.0007	0.0001	0.0017	0.0006	0.0050	0.0010	0.0007	0.0005	0.0017	0.3585
X_6	0.0001	0.0000	0.0001	0.0002	0.0002	0.0012	0.0001	0.0000	0.0001	0.0927
X_7	0.0011	0.0013	0.0012	0.0003	0.0010	0.0009	0.0074	-0.0021	0.0014	0.1964
X_8	0.0004	0.0004	0.0005	0.0000	-0.0002	0.0001	0.0006	-0.0020	0.0004	-0.2173
X_9	0.3740	0.7374	0.7472	0.0314	0.3447	0.0754	0.1884	-0.2216	1.0053	0.9896
Residual effect at phenotypic level=0.0827										

Where,
X_1=Plant height (cm) X_2=No. of mature pods/plant X_3=Kernel yield/plant (g) X_4=Haulm yield/plant (g) X_5=Shelling (%) X_6=HKW (g) X_7=SMK (%) X_8=Oil content (%) X_9=Protein content (%) X_{10}=Dry pod yield/plant (g)

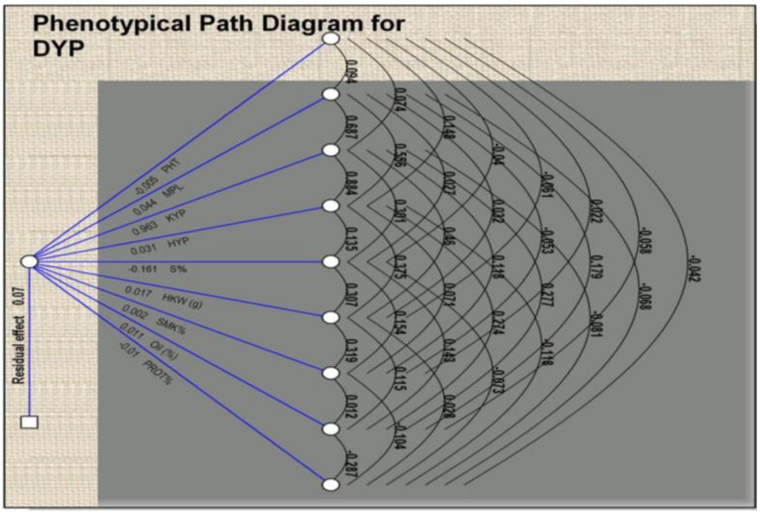

Fig 1: Phenotypic path diagram showing the influence of yield and its component for dry pod yield per plant Cross 1-Kadri-9 × GPBD-4

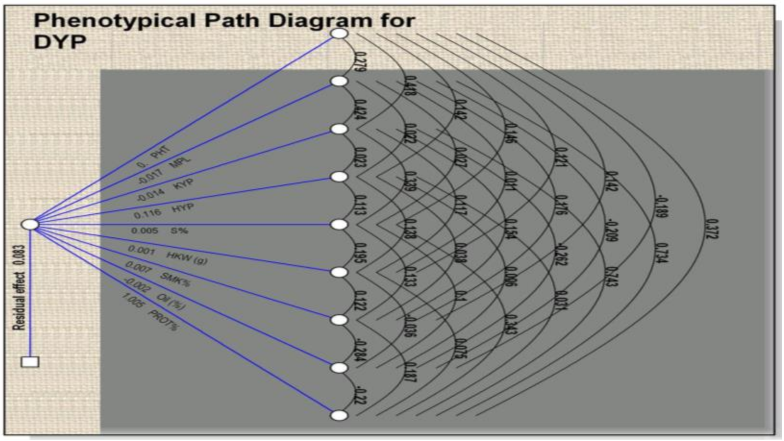

Fig 2: Phenotypic path diagram showing the influence of yield and its component for dry pod yield per plant Cross 2- ICGV-00351 × GPBD-4

Table 7: Phenotypic path co-efficient among dry pod yield and its attributing characters in groundnut F_3 generation Cross 3- Kadri-9 × Sunoleic-95R

Traits	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
X_1	-0.0042	-0.0013	-0.0012	-0.0001	0.0002	0.0000	-0.0013	0.0002	-0.0014	0.3197
X_2	0.0066	0.0221	0.0109	0.0014	-0.0001	0.0018	0.0063	0.0005	0.0149	0.6784
X_3	0.0037	0.0066	0.0134	0.0005	0.0042	0.0015	0.0033	0.0023	0.0114	0.8320
X_4	0.0047	0.0092	0.0053	0.1466	0.0201	0.0118	-0.0031	0.0043	0.0070	01920
X_5	0.0004	0.0000	-0.0030	-0.0013	-0.0095	-0.0020	0.0009	0.0001	-0.0022	0.2360
X_6	0.0000	-0.0004	-0.0006	-0.0004	-0.0011	-0.0052	0.0005	0.0004	-0.0007	0.1352
X_7	0.0006	0.0006	0.0005	0.0000	-0.0002	-0.0002	0.0020	-0.0003	0.0007	0.3498
X_8	0.0005	-0.0003	-0.0019	-0.0003	0.0001	0.0009	0.0017	-0.0112	-0.0015	0.1260
X_9	0.3073	0.6417	0.8085	0.0457	0.2223	0.1266	0.3394	0.1296	0.9551	0.9833
Residual effect at phenotypic level= 0.1072										

Table 8: Phenotypic path co-efficient among dry pod yield and its attributing characters in groundnut F_3 generation Cross 4-ICGV-00351 × Sunoleic-95R

Traits	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
X_1	-0.0061	-0.0007	-0.0006	-0.0011	0.0005	0.0005	-0.0001	0.0002	0.0004	0.1095
X_2	0.0057	0.0475	0.0328	0.0265	0.0023	0.0016	-0.0017	0.0084	-0.0017	0.7215
X_3	0.0937	0.6606	0.9563	0.8583	0.2832	0.4309	0.0923	0.2477	-0.0382	0.9856
X_4	0.0062	0.0186	0.0299	0.0333	0.0051	0.0125	0.0029	0.0088	-0.0023	0.9046
X_5	0.0111	-0.0073	-0.0445	-0.0231	-0.1503	-0.0422	-0.0141	-0.0178	0.0142	0.1485
X_6	-0.0016	0.0006	0.0084	0.0070	0.0052	0.0186	0.0052	0.0019	0.0006	0.4233
X_7	0.0000	-0.0001	0.0002	0.0002	0.0002	0.0006	0.0021	0.0000	-0.0002	0.0880
X_8	-0.0003	0.0018	0.0027	0.0028	0.0012	0.0011	0.0000	0.0105	-0.0028	0.2626
X_9	0.0007	0.0004	0.0004	0.0008	0.0010	-0.0004	0.0012	0.0029	-0.0109	-0.0409
Residual effect at phenotypic level= 0.0691										

Where,
X_1=Plant height (cm) X_2=No. of mature pods/plant X_3=Kernel yield/plant (g) X_4=Haulm yield/plant (g) X_5=Shelling (%) X_6=HKW (g) X_7=SMK (%) X_8=Oil content (%) X_9=Protein content (%) X_{10}=Dry pod yield/plant (g)

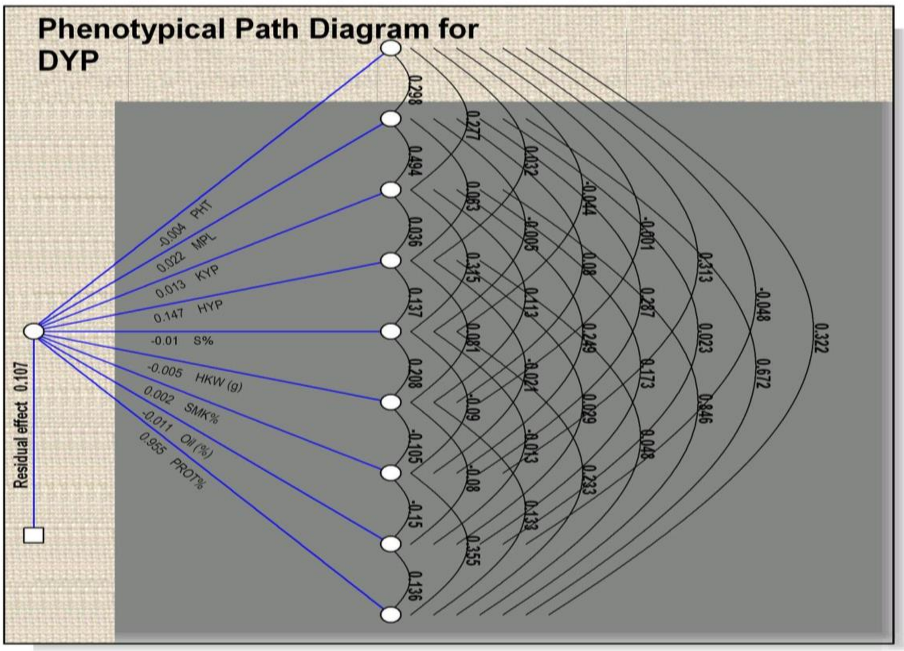

Fig 3: Phenotypic path diagram showing the influence of yield and its component for dry pod yield per plant Cross 3- Kadri-9 × Sunoleic-95R

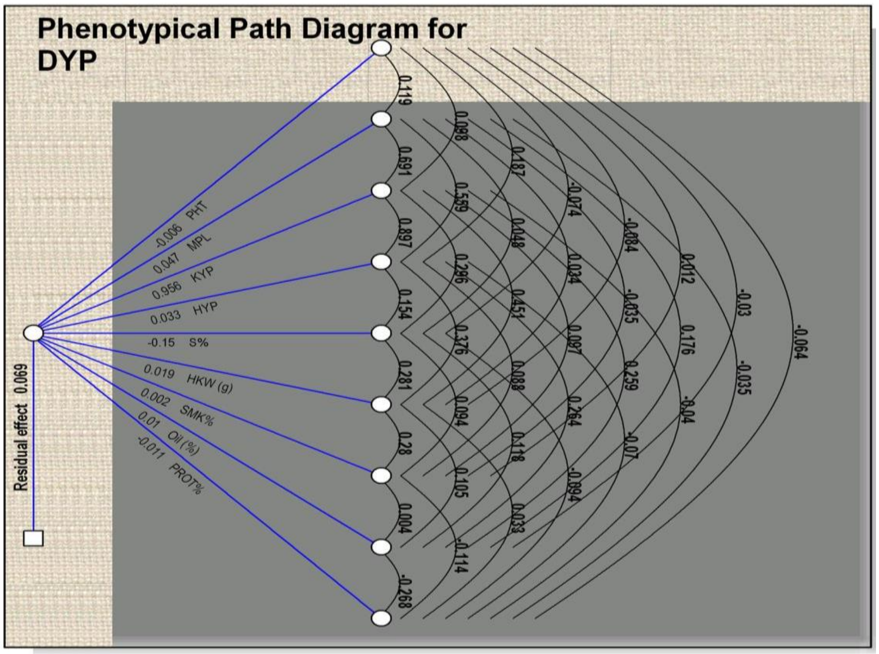

Fig 4: Phenotypic path diagram showing the influence of yield and its component for dry pod yield per plant Cross 4-ICGV-00351 × Sunoleic-95R

References

1. Desai BB, Kotecha PM, Salunkhe DK. Science and technology of groundnut: biology, production, processing and utilization. Calcutta: Naya Prokash, 1999, 677.
2. Saeidi-Nia M, Emami H, Honarnejad R, Esfahani M. American-Eurasian J Agric. & Environ. Sci. 2011; 10(6):972-977.
3. Venkataravana P, Sheriff RA, Kulkarni RS, Shankaranarayana V, Fathima PS. Correlation and path analysis in groundnut (*Arachis hypogaea* L.). Mysore J Agric Sci. 2000; 34(4):321 325.
4. Dolma T, ReddiSekhar M, Rajareddy. Genetic variability, correlation and path analysis for yield, its components and late leaf spot resistance in groundnut (*Arachis hypogaea* L.). Oilseeds Res. J. 2010; 27(2):154- 157.
5. Gomes RL, Lopes A. Correlation and path analysis in Peanut. Crop Breeding and Appl. Biotech. 2005; 5(1):105-110.
6. Meta HR, Monpara BA. Genetic variation and trait relationships in summer groundnut, *Arachis hypogaea* L. Oilseeds Res. 2010; 27(1):8-1.
7. John K, Reddy R, Reddy HP, Sudhakar P, Reddy NPE. Character association and path coefficient analysis for yield, yield attributes and water use efficiency traits in groundnut (*Arachis hypogaea* L.). Agri. Review. 2015; 36(4):277-286.
8. Johnson HW, Robinson HF, Comstock RE. Estimates of genetic and environmental variability in soybean. Agron. J. 1955; 47:314-318.
9. Dewey DR, Lu KH. Correlation and path-coefficient analysis of components of crested wheatgrass seed production. Agron. J. 1959; 51:515-518.

10. Hyndavi Y. Genetic variability studies in F_4 and F_5 populations of selected crosses for traits related to water use efficiency, pod yield and its components in groundnut (*Arachis hypogaea* L.). M.Sc. Thesis., Univ. Agric. Sci., Bangalore (India), 2015.
11. Naazer A, Malik SN, Khurrm B, Mirza MY. Genetic variability, heritability and correlation studies in groudnut. Sarhad J Agric. 2000; 16:533-36.
12. Raut RD, Dhaduk LK, Vachhani JH. Studies on genetic variability and direct selections for important traits in segregating materials of groundnut (*Arachis hypogaea* L.). Int. J Agri. Sci. 2010; 6(1):234-237.
13. Narasimhulu R, Kenchanagoudar PV, Gowda MVC. Study of genetic variability and correlations in selected groundnut genotypes. Int. J Appl. Biol. Pharma. Technol. 2012; 3(1):355-358.
14. Mukhesh KM, Prashant KR, Arvind K, Bazil AS, Chaurasia AK. Study on genetic variability and seed quality of groundnut (*Arachis hypogaea* L.) genotypes. Int. J Emerg. Tech. Adv. Eng. 2014; 4(6):818-823.
15. Dandu SJ, Vasanthi RP, Reddy KR, Sudhakar P. Variability, heritability and genetic advances in F_2 generation of 15 cross involving bold seeded genotypes in groundnut (*Arachis hypogaea* L.). IJABPT. 2012; 3(1):368-372.