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Assessment of Yield Component Traits in Cowpea (Vigna ungiculata L. Walp) Genotypes

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ABSTRACT

The ambition of this study was to assess various yield contributing parameters related to yield component traits in 13 cowpea (Vigna ungiculata L.Walp) genotypes and 16 morphological characters (10 quantitative and 6 qualitative characters) were subjected to Randomize Block Design to estimate analysis of variance, association analysis to suggest suitable breeding strategies to improve ten important traits. The analysis of variance revealed that significant differences were noticed among the genotypes for all the characters. Association studies indicated that, high correlation between number of pods per plant and seed yield per plant both phenotypic and genotypic levels which indicated that the number of pods is a reliable parameter as a yield indicator. Consequently, Path coefficient analysis of yield contributing characters clearly indicating that number of pods per plant showed the highest positive direct effect on seed yield while other characters contributed indirectly through this character**.**

Key Words: Analysis of Variance; Vigna ungiculata; Association Analysis; Single Plant Yield; Hundred Seed Weight.

I. INTRODUCTION

Cowpea is an important tropical legume with high protein and essential nutrients. It is grown throughout India for green pod as vegetable, seeds as pulse and foliage as fodder. Cowpea is a multifunctional legume providing food for man and livestock and serving as a green manure and a cover crop to minimize water losses and maintain soil fertility in rained conditions. The production of Cowpea has not improved significantly in spite of the consistent efforts of the plant breeders. Cowpea stakes extensive forbearance to most abiotic stresses comprising drought and heat stress, salinity and poor soil nitrogen status (Gerrano et al. 2020).The major constraints in its production are a wide range of the insect pests and viral, fungal and bacterial diseases (Singh, 2005; Timko et al., 2007;) apart from obvious genetic inadequacies such as viny growth habit, compulsive photoperiodism, low flowering and seed setting abilities.

Globally, 12.5 million hectares of land are cultivated under cowpea production to yield seven million tons of grain produced per annum (FAOSTAT, 2020). India is the largest cowpea producer in Asia. Cowpea is cultivated for its fresh leaves, green pods and grain which are rich sources of macro and micro-nutrients i.e, carbohydrate, protein, vitamins and minerals (Bai et al., 2020; ElMasry et al., 2021; Silva et al., 2021). It is being civilized in the drier parts of the world where other food legumes cannot withstand. This makes it the crop of choice for arid zone (Nagalakshmi et al., 2010).

In contemporary eras, cowpea breeding programmes are predominantly focused on evolving early maturing lines, short statured bushy plant type lines, lines with higher pods and lines with delayed leaf senescence. Besides these, dual purpose cultivars

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for grain and vegetable are in need. The success of any crop improvement programme depends on the breeding approach chosen, which itself depends on genetic architecture of the crop and the type of variation prevailing in the population. The current study is consequently take on Correlation and path coefficient analysis are the important biometrical techniques to determine the yield components. The characters that are positively correlated with yield are considerably important to plant breeder for selection purpose. Although the correlation figure indicates the nature of association between the diverse traits. Path analysis breaches the correlation coefficients into measure of direct and indirect effects, thus providing thoughtful of the direct and indirect contribution of each character towards the yield.

II. MATERIALS AND METHODS

The experimental material for this study comprised of 13 genotypes of cowpea viz.., VBN 1, VBN 2, VBN 3, TC 170, TC 901, GC1203, GC 1304, GC 3, PGCP 24, PGCP 28, COCP 7, RC 101 and PANT LONG 3 which were obtained from National Pulses Research Centre (TNAU), Vamban, Pudukkottai (Dt). The field plot technique was laid out in a Randomized Block Design (RBD) with four replications. Each genotype was sown in two rows with a row to row spacing of 45cm and plant to plant spacing of 20cm. Sowing was done by dibbling the seeds and all the recommended package of practices were followed to raise a healthy crop and the necessary prophylactic measures were adopted against pest and diseases. The observations were recorded on ten randomly selected plants from each replication for the quantitative traits viz., date of first flowering, days of 50% flowering, plant height, no. of branches per plant, no. of pods per plant, no. of seeds per pod, maturity date,100 seed weight, pod length, single plant yield and qualitative traits viz., plant pigmentation, plant hairness, leaf colour, flower colour, flower pigmentation, pod colour. The data recorded were imperiled to various statistical analysis such as variability and association studies are based on the standard methods Proposed by Panse and Sukhatme (1964) using WINDOSTAT (version 7.1) and TNAUSTAT statistical packages.

III. RESULTS AND DISCUSSION

Analysis of Variance

The analysis of variance revealed that significant differences were noticed among genotypes for the yield and yield contributing characters studied (table 1,2). Significant genotype effects in cowpea for different traits on yield and its contributing characters by both qualitative and quantitatively were reported via Owusu et al., 2021.

Correlation Studies

The magnitude of the genotypic correlations was higher than the phenotypic correlation in most traits (Fig.1). In this study, the results of seed yield showed significant and positive correlation with pod length, hundred seed weight, days to flowering and days to maturity (table 3,4 & Fig. 2,3). The correlation coefficient at genotypic of pod yield per plant had positive and significant correlation with number of branches per plant. The phenotypic level of pod yield per plant had positive and significant correlation coefficient. Number of branches per plant exhibited significant positive association with seed yield per plant both at phenotypic and genotypic level suggesting that the selection for their traits to the effective. Similar result was reported by Anbu selvam et al. (2000), Pushkar singh patel, Sanjay kumar (2018), and Vineeta kumar et al (2001).

Days to first flowering had positive inter correlation with days to 50 percent flowering (0.82) and days to maturity (0.51). Number of branches per plant had positive inter correlation with pod length (0.57), days to first flowering had negative correlation with number of pods per plant (0.53). It is significantly in accordance with Joghdande srinivas (2017). High correlation between number of pods per plant and seed yield per plant both phenotypic and genotypic levels which is 0.70, indicated that the number of pods is a reliable parameter as a yield indicator. This clearly indicated that increased number of pods that plant will increase seed yield hence more emphasis should be given to this character while making selection for the yield. The results were relevance with the correlation and path coefficient analyse of cowpea Tesfaye walle et al. (2018).

Path Analysis

Path coefficient analysis was carried out at phenotypic level considering seed yield as dependent character and yield attributes as independent characters (Fig.4). The phenotypic correlations were

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partitioned in to direct and indirect effect on seed yield per plant (table 5). Days to 50 percent flowering showed no positive indirect effect towards single plant yield in concurrence with the investigation shown by M. Mishra (2013). Number of branches per plant showed positive indirect effect towards single plant yield through number of pods per plant (0.24), days to first flowering (0.09), number of seeds per pod (0.08) and plant height (0.03) in relevance with the overhead experiment by Tesfaye walle et al. (2018). Plant height showed positive indirect effect towards single plant yield to number of pods per plant (0.13) with significant results of Jogdhande Srinivas (2017).

The number of pods per plant showed direct and positive effect on single plant yield per plant followed by plant height, pod length in occurrence with the reports of G.K. Sapara and R.M. Javia (2014), Burton (1952). Number of seeds per pod showed positive indirect effect towards single plant yield through days to first flowering (0.12), number of pods per plant (0.03) and it showed negative indirect effect towards single plan yield through days to 50 percent flowering (-0.01) in coordinated with the inference of Sable GR (2018). Days to maturity showed positive indirect effect towards single plant yield through plant height (0.06) and it indicated negative indirect effect towards single plant yield through number of seeds per pod (-0.02) in combination with the accounts acquiesced by U.V. Patel, V.K. Parmar (2016).Hundred seed weight had high direct positive effect on seed yield and showed negligible positive indirect effect through first flowering, 50 percent flowering, number of pods per cluster, number of pods per plant in rendering to the fallouts revealed by Manisha R. Palve, et al(2016).

IV. CONCLUSION

Handling of genotypes is precise significant in a breeding programme as it serves as a prime source to understand the genetic variation present in a variable population, fixing desirable characters and to study the nature of associations among yield and yield component traits in the early generations are of great value for crop improvement. The analysis of variance exposed that significant differences were perceived among the genotypes for the characters studied. A positive and significant correlation value of number of pods shows that plant will increase seed yield, hereafter more importance has to be given to this character while making selection for the yield.

Accordingly, path coefficient analysis of yield contributing characters evidently indicating that number of pods per plant showed the highest positive direct effect on seed yield while other characters contributed indirectly through this character. Therefore, this study clearly showed that the number of pods per plant and pod length may be considered as primary traits while selecting for getting higher yield.

REFERENCES

[1]. Anbuselvam Y, Manivannan N, Saravanan K, Ganesan J. Studies on genetic divergence in cowpea (Vigna unguiculata L. Walp.). Madras Agril. J. 2000; 87: 4-6.

[2]. Burton, G.W. 1952. Proc. 6th Int. Grassl. Cong. 1: 277-283. Dewey, D. R. and Lu, K. H. 1959. A correlation and path coefficient analysis of components of crested wheat grass seed production. Agron. J. 51: 515-518.

[3]. E.Y. Owusu, B. Karikari, F. Kusi, M. Harun a, R.A. Amoah, P. Attamah, G. Adazebra, E. K. Sie, M. Issahaku Genetic variability, heritability and correlation analysis among maturity and yield traits in Cowpea (Vigna unguiculata (L) Walp) in Northern Ghana Heliyon, 7 (2021), Article e07890.

[4]. G. ElMasry, N. Mandour, Y. Ejeez, D. Demi lly, S. AlRejaie, J. Verdier, E. Belin, D. Rou sseau.Multichannel imaging for monitoring chemical composition and germination capacity of cowpea (Vigna unguiculata) seeds during development and maturation Crop J (2021).

[5]. Gerrano A, van Rensburg W, Mathew I, Shayanowako A, Bairu M, Venter S, Swart W, Mofokeng A, Mellem J, Labuschagne M. 2020. Genotype and genotype × environment interaction effects on the grain yield performance of cowpea genotypes in dryland farming system in South Africa. Euphytica. 216:1–11.

[6]. http://www.fao.org/faostat/en/#home (2020), Accessed 4th Mar 2021.

[7]. Jogdhande Srinivas*, Vijay S. Kale and P.K. Nagre. 2017.Correlation and Path Analysis

Study in Cowpea [Vigna unguiculata (L.) Walp.] Genotypes.

[8]. Manisha R. Palve, Vijay S. Kale and Madhavi B. Bhaladhare. Genetic Variability, Heritability and Genetic Advance Studies in F5 Generation of Cowpea. J. Agric. Res. Technol., 43 (2): 348-353 (2018).

[9]. Mishra M. Genetic Variability, Correlation and Path analysis for yield and its components in Cowpea [Vigna unguiculata (L.) Walp]. M.Sc.(Ag.) thesis submitted to Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur 2013.

[10]. Nagalakshmi Ramanathan. Boranayaka M .2010. Assessment of genetic diversity in cowpea (Vigna unguiculata).

[11]. Panse, V. G. and Sukhatme, P. V. 1967. Statistical Methods for Agricultural Workers. ICAR, New Delhi, pp. 280-297.

[12]. Patel UV, Parmar VK, Patel PB, Malviya AV. Correlation and path analysis study in cowpea [Vigna unguiculata (L.) Walp.] International Journal of Science Environment. 2016; 5(6):3897-3904.

[13]. Pushkar Singh Patel, Sanjay Kumar, Rakesh Kumar Meena, Pradeep Kumar and Tribhuvan Rai.2018. Correlation and Path analysis in Cowpea [(Vigna unguiculata (L.) Walp.).

[14]. Sable GR, Bhave SG, Desai SS, Dalvi MB, Pawar PR. Variability and genetic advance studies in F2 generation of cowpea [Vigna unguiculata (L.) Walp.]. Int. J Curr. Microbiol. App. Sci. 2018; 7(9):3314-3320.

[15]. Sapara, G. K. ; Javia, R. M.2014. Correlation and path analysis in vegetable cowpea (Vigna unguiculata L.).

[16]. Singh BB (2005) Cowpea [Vigna unguiculata (L.) Walp]. In: Singh RJ, Jauhar PP (eds) Genetic resources, chromosome engineering and crop improvement, vol 1.CRC Press, Boca Raton, pp 117–162.

[17]. Timko MP, Ehlers JD, Roberts PA (2007) Cowpea. In: Kole C (ed) Genome mapping and molecular breeding in plants, pulses, sugar and tuber crops, vol 3. Springer, Berlin/Heidelberg, pp 49–67.

[18]. V.M. Silva, A.J. Nardeli, N.A. deCarvalhoM endes, M. deMouraRocha, L. Wilson, S.D. Young, M.R. Broadley, P.J. White, A.R. Do s Reis Agronomic biofortification of cowpea with zinc: variation in primary metabolism responses and grain nutritional quality among 29 diverse genotypes Plant Physiol. Biochem., 162 (2021), pp. 378-387.

[19]. Vineeta Kumari Arora R N and Singh J V (2001). Variability and path analysis in grain cowpea. Advanes in Arid Legume Research. Scientific publishers (India) Jodhpur PP. 59–62.

[20]. Walle, T., Mekbib, F., Amsalu, B. and Gedil, M. (2018) Correlation and Path Coefficient Analyses of Cowpea (Vigna unguiculata L.) Landraces in Ethiopia. American Journal of Plant Sciences, 9, 2794-2812.

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Table. 1. Analysis of variance for different characters in cowpea genotypes

S. No.	Source of variation	DF	DFF	PH	NBP	NPP	NSP	MD	HSW	SPY	PL
1.	Treatment	33.18**	10.06**	271.75**	15.75**	312.19**	24.22**	50.61**	94.99**	463.05**	55.09**
2.	Error	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

** Significant at 1% level
* Significant at 5% level

TABLE .2.

Correlation Genotypic										
CHARACTERS	**DF**	**DFF**	**PH**	**NBP**	**NPP**	**NSP**	**MD**	**HSW**	**PL**	**SPY**
DF	**1.00****	0.82**	0.15	-0.21	-0.53**	-0.29	0.51**	-0.21	0.21	-0.76**
DFF		**1.00****	-0.02	0.03	-0.28	-0.11	-0.02	-0.24	0.13	-0.58**
PH			**1.00****	0.19	0.30	0.07	0.38	0.04	0.01	0.28
NBP				**1.00****	0.55*	0.44	0.05	-0.40	0.07	0.31
NPP					**1.00****	0.09	-0.25	-0.36	-0.44	0.70**
NSP						**1.00****	-0.12	0.07	0.57**	0.24
MD							**1.00****	-0.08	-0.02	-0.26
HSW								**1.00****	0.42	0.21
PL									**1.00****	-0.25
SPY										**1.00****

**- Significance level at 1%
*- Significance level at 5%

DF- Days to first flowering
DFF- Days to 50% flowering
PH- Plant height
NBP- No. Of branches per plant
NPP- No. Of pod per plant
NSP-No. of Seeds per Pod
MD- Maturity date
HSW- Hundred seed weight
PL- Pod length
SPY- Single plant yield

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Table. 3.

Correlation Phenotypic										
CHARACTERS	**DF**	**DFF**	**PH**	**NBP**	**NPP**	**NSP**	**MD**	**HSW**	**PL**	**SPY**
DF	**1.00****	0.67**	0.15	-0.15	-0.49**	-0.24	0.47*	-0.19	0.17	-0.72**
DFF		**1.00****	-0.04	0.03	-0.24	-0.09	0.00	-0.21	0.09	-0.48**
PH			**1.00****	0.15	0.29	0.04	0.37	0.04	0.01	0.28
NBP				**1.00****	0.49**	0.37	0.03	-0.35	0.05	0.26
NPP					**1.00****	0.09	-0.24	-0.35	-0.43	0.68**
0NSP						**1.00****	-0.11	0.06	0.52**	0.22
MD							**1.00****	-0.09	-0.04	-0.25
HSW								**1.00****	0.41	0.21
PL									**1.00****	-0.23
SPY										**1.00****

**- Significance level at 1%
*- Significance level at 5%

DF- Days to first flowering
DFF- Days to 50% flowering
PH- Plant height
NBP- No. Of branches per plant
NPP- No. Of pod per plant
NSP-No.of Seeds per Pod
MD- Maturity date
HSW- Hundred seed weight
PL- Pod length
SPY- Single plant yield

TABLE. 4. Phenotypic Path Analysis Showing Direct (Diagonal) and Indirect Effects of Ten Traits on Single Plant Yield

CHARACTERS	DF	DFF	PH	NBP	NPP	NSP	MD	HSW	PL	SPY
DF	**-0.43**	0.05	0.02	-0.01	-0.23	-0.05	0.03	-0.08	-0.05	-0.43
DFF	-0.36	**0.06**	-0.00	0.00	-0.12	-0.02	-0.00	-0.10	-0.03	0.06
PH	-0.07	-0.00	**0.16**	0.01	0.13	0.01	0.02	0.01	-0.00	0.16
NBP	0.09	0.00	0.03	**0.04**	0.24	0.08	0.00	-0.16	-0.02	0.04

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NPP	0.23	-0.02	0.05	0.02	**0.44**	0.02	-0.01	-0.14	0.11	0.44
NSP	0.12	-0.01	0.01	0.02	0.03	**0.18**	-0.01	0.03	-0.14	0.18
MD	-0.22	-0.00	0.06	0.00	-0.11	-0.02	**0.06**	-0.03	0.00	0.06
HSW	0.09	-0.01	0.01	-0.02	-0.16	0.01	-0.00	**0.40**	-0.10	0.40
PL	-0.09	0.01	0.00	0.00	-0.19	0.10	-0.00	0.17	**-0.25**	-0.25

RESIDUAL EFFECT = 0 .4094315
**- Significance level at 1%
*- Significance level at 5%

DF- Days to first flowering
DFF- Days to 50% flowering
PH- Plant height
NBP- No. Of branches per plant
NPP- No. Of pod per plant
NSP-No.of Seeds per Pod
MD- Maturity date
HSW- Hundred seed weight
PL- Pod length
SPY- Single plant yield

Fig : 1 Phenotypic and Genotypic Correlation Coefficients of Yield and Yield Contributing Characters in Cowpea

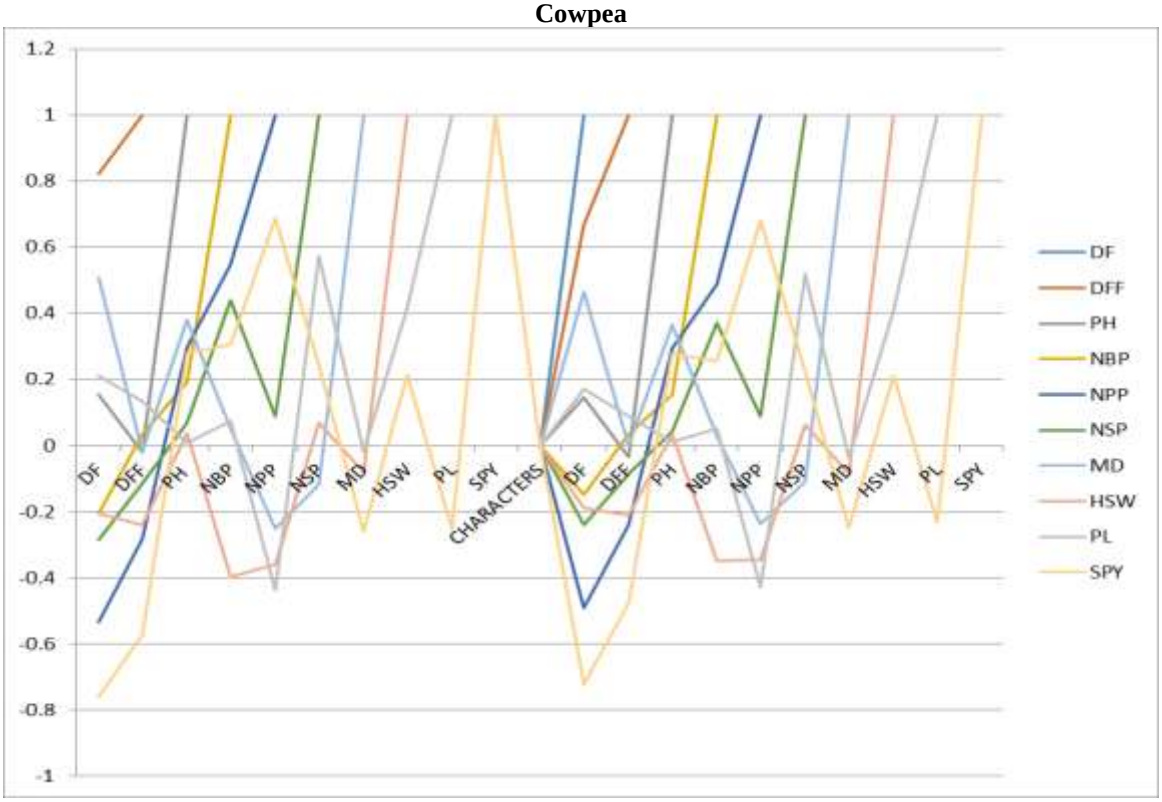

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Fig :2 Genotypic Correlation Coefficients of Yield and Yield Contributing Characters in Cowpea

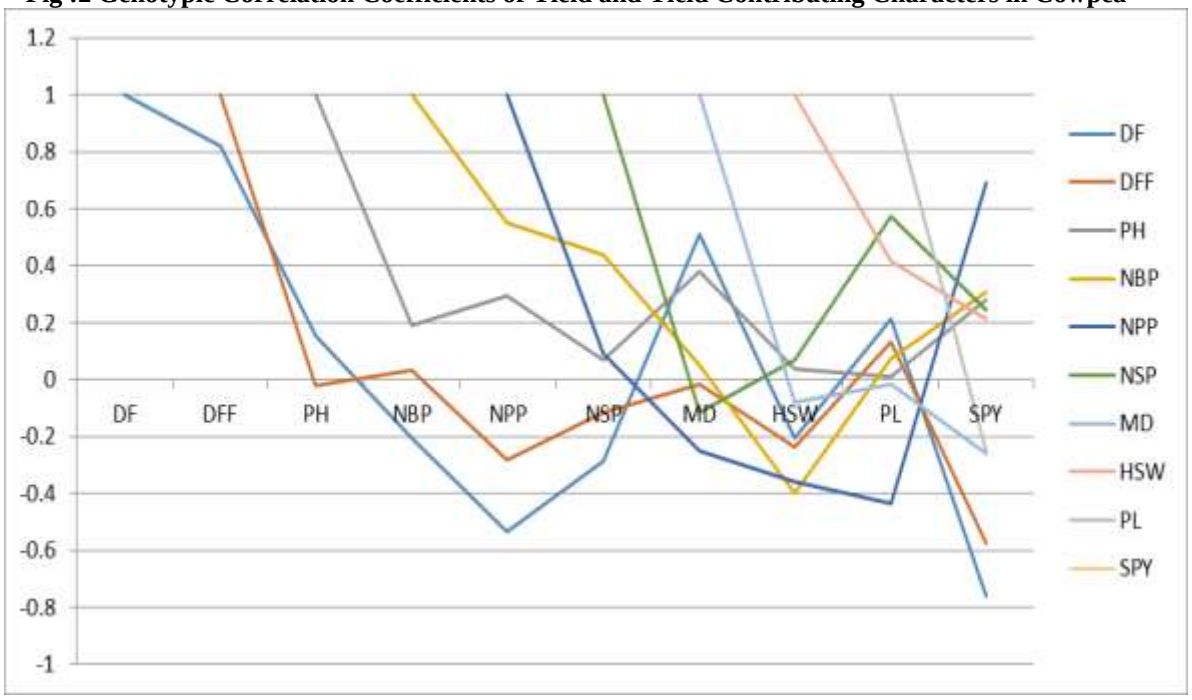

Fig: 3 Phenotypic Correlation Coefficients of Yield and Yield Contributing Characters in Cowpea

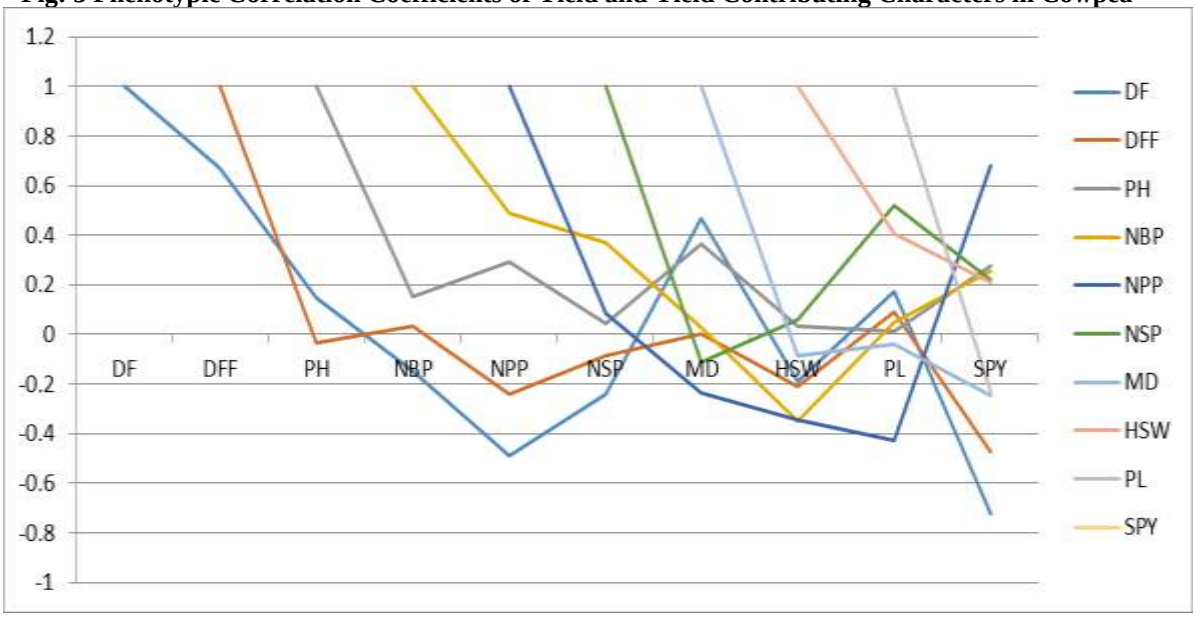

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Fig:4 Phenotypic Path Coefficient Analysis of Yield and Yield Contributing Characters in Cowpea