

Association of Characters and Path Coefficient Analysis for Yield and its Components in Horsegram (*Macrotyloma uniflorum* L. Verdc.)

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ABSTRACT

The association of characters and their direct and indirect effects on yield are important for crop improvement. Correlation and path analysis were studied in the present investigation for identifying the characters depending upon which the selection would be effective in horsegram improvement. The experimental material comprised 30 diverse genotypes of Horsegram (*Macrotyloma uniflorum* Lam. Verdc) and studied nine quantitative characters viz. days to 50 per cent flowering, days to maturity, plant height, number of branches per plant, pods per plant, seeds per pod, 100 -seed weight, harvest index and seed yield per plant. The seed yield per plant showed highly significant positive association with number of pods per plant, number of branches per plant and harvest index. The characters number of number of seeds per pod, number of days to 50 per cent flowering, days to maturity were positively associated but non-significant at the genotypic level. Seed yield per plant showed significant and positive association with 100 seed weight at the genotypic level. The character plant height was highly significant and negatively associated with seed yield per plant. The traits number of branches per plant, seeds per pod and harvest index showed high positive direct effect on seed yield per plant.

Keywords: Horsegram, Correlation coefficient, Path analysis, Yield components.

INTRODUCTION

Horsegram (*Macrotyloma uniflorum* (Lam.) Verde) locally known as hulga or kulthi, is one of the important minor, rainfed pulse crops of Maharashtra. It is drought tolerant and having good nitrogen fixing ability, but receives a low priority in cropping system, soil types etc. Horsegram is an important pulse crop especially under dry farming condition. In India, Kulthi is mainly grown in Peninsular

India (Parts of Maharashtra, Karnataka, Andhra Pradesh, Telangana and Tamilnadu) and hilly slopes in Himachal Pradesh, North Eastern hilly region, hilly districts of Uttar Pradesh and tribal hilly regions of Orissa and Madhya Pradesh. In India, It is generally sown late in the rainy season by resource poor farmers in marginal and drought-prone condition.

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The horsegram has a diploid chromosome numbers of $2n = 20, 22, 24$. Horsegram [*Macrotyloma uniflorum* Lam. verdc, previously *Dolichus biflorus*] is underutilized and unexplored food legume.

Horsegram has been called as the 'Miracle Pulse' because of its nutritional value. Grains serve as excellent source of protein, minerals (iron, calcium, molybdenum) and polyphenols which have high antioxidant capacity (Ramesh et al., 2011), and hemagglutinin which is a substance found in antibodies autoimmune functions. Horsegram is helpful in providing various health benefits such as improvement in digestion, weight loss, relieving constipation, curing fever and common cold, regulating blood sugar level in diabetics, controlling irregular menstrual cycle by boosting hemoglobin etc.

Seed yield is quantitative character with highly variable expression, which depends on numerous independent characters. Correlation analysis describes the mutual relationship between the variables and estimation of such association at both genotypic and phenotypic level shows not only the inherent relation but also indicates the level of environmental influence. Furthermore, it also helps to improve different characters simultaneously. It is therefore, the knowledge of association of different agronomical and quality traits with yield and among themselves will be very essential for planning a successful breeding programme, because the efficiency of selection mainly depends on the direction and magnitude of association between yield and its component characters. The objectives of this research were to determine the correlation among seed yield and other characters and to determine the direct and indirect effects of characters on seed yield in horsegram genotypes.

MATERIAL AND METHODS

The experimental material comprised of 30 indigenous horse gram genotypes collected from Dry land Agricultural Research Station, Solapur, Maharashtra (India). The material was grown in Randomized Block

Design with three replications at Agricultural Botany Farm, College of Agriculture, Pune (Maharashtra) during *kharif*, 2018. All the recommended agronomic and cultural practices were followed for raising a healthy crop. Sowing was carried by following dibbling method. Each entry was represented by a single row of 4 m length with a spacing of 30 cm between rows and 10 cm between the plants. All the crop management and plant protection operations were carried out as per recommended package of practices. Each entry was represented by a single row of 4 m length with a spacing of 30 cm between rows and 10 cm between the plants. Two border rows along the length of each replication were grown to avoid the border effect. All the crop management and plant protection operations were carried out as per recommended package of practices. Data were recorded on five randomly selected plants per replication of each genotype for nine quantitative characters viz., days to 50 per cent flowering, days to maturity, plant height, number of branches per plant, pods per plant, seeds per pod, 100- seed weight, harvest index and seed yield per plant. To understand the association among the different characters, genotypic and phenotypic correlation coefficient were worked out by adopting the method described by Johnson et al. (1955). To establish a cause and effect relationship the first step used was to partition genotypic and phenotypic correlation coefficient into direct and indirect effects by path analysis as suggested by Dewey and Lu (1959).

The direct and indirect effects at genotypic level for genotypes were estimated by taking seed yield as dependent variable, using path coefficient analysis suggested by Wright (1921) and Dewey and Lu (1959).

RESULT AND DISCUSSION

On the basis of result the wide range of variation in all the characters is the basis of selection in a breeding programme. The study of correlations provides the inter relationships among the quantitative traits which is useful in the choice of breeding method for crop

improvement. The genetic correlation coefficient provides close measure of association between characters, which is useful in overall crop improvement. The yield is a complex character and the result of interaction between various yield components. The success of any breeding programme depends on the efficiency of selection. Thus, it helps a breeder in selection of characters for future breeding programme. In the present study, various quantitative characters were studied and their relation with yield as well as among themselves was examined using correlation analysis. The characters days to 50 percent flowering, days to maturity, number of branches per plant, number of pods per plant, 100 -seed weight, harvest index and number of seeds per pod were highly significant and positively correlated with each other Table 1.

The present studies revealed highly significant differences among thirty genotypes for nine quantitative characters, indicating presence of wider genetic variability. The genotypic correlation were higher in magnitude than the phenotypic correlation. Genotypic correlation coefficients between yield and its related components are presented in Table 1. The seed yield per plant showed highly significant and positive association with harvest index (0.8469), number of pods per plant (0.5085) and number of branches per plant (0.4308), while seed yield per plant showed significant and positive association with 100 seed weight (0.2120) at the genotypic level. Joshi et al. (2007) confirmed the similar, results for pods per plant ; Rakesh et al. (2015) also reported that seed yield exhibited significant and positive association with Number of pods per plant, 100-seed weight and number of primary branches.

The character number of seeds per pod (0.1536), days to 50 per cent flowering (0.1129) and days to maturity (0.0073) were positively associated but non-significant at the genotypic level. The character plant height was highly significant and negatively correlated with seed yield per plant. Characters such as fruiting branches per plant, pods per plant, 100- grain weight showed significant

positive correlation among themselves. Similar, types of results were reported by Patil (1981). Significant positive association was observed between grain yield per plant with number of fruiting branches per plant, pod per plant and 100- grain weight at both genotypic and phenotypic levels. Similar, results have also been observed by Pandya et al. (2003) ; Lad et al. (1999) and Roopadevi et al. (2002) observed positive significant correlation of branches per plant with seed yield per plant; Latha et al. (2013) observed positive significant correlation of 100 seed weight with seed yield per plant; Sunil et al. (2014) reported positive significant correlation of pods per plant with seed yield per plant.

Path analysis is partial coefficient, which splits correlation coefficient into direct and indirect effects. In present investigation, path analysis was done as per the procedure given by Dewey and Lu (1959) to know the direct and indirect effects of various characters. Correlation along with path analysis proves more reliable for use in breeding programme. Yield is a complex character and the result of several component traits. Some characters contribute directly towards yield, whereas, others indirectly affect the yield. Hence, there is necessary to study direct and indirect effects of various characters on yield.

The traits branches per plant (0.3408), seeds per pod (0.2756), harvest index (0.8314) showed high positive direct effect on seed yield per plant Table 2. The character days to 50 per cent flowering (0.0851) showed positive and low direct effect on seed yield per plant. The character 100 seed weight (-0.2488) showed high negative direct effect on seed yield per plant. The character days to maturity (-0.2488) and plant height (-0.1572) showed negative and moderate direct effect on seed yield per plant. The character pods per plant (-0.0521) showed negative and low direct effect on seed yield per plant. By considering overall indirect effect of all characters pods per plant, seeds per pod and 100- seed weight contributed indirectly towards seed yield per plant.

Similar, results were reported for seeds per pod by Lad et al. (1999); branches per plant, seeds per pod and seed yield per plant by Pandya et al. (2003); Paliwal et al. (2005) for branches per plant, seeds per pod and harvest index; Bhadait (2005) reported that number of fruiting branches per plant (4.009) had the highest and positive direct effect (15.387) on grain yield per plant; Rama et al. (2007) and Savithamma (2002) reported that harvest index had positive direct effect on seed yield per plant; Khulbe et al. (2013) reported that

Pods per plant and 100 seed weight had positive direct effect, while plant height exhibited negative direct effect on seed yield per plant.

The traits branches per plant, seeds per pod, harvest index had high positive direct effect on seed yield per plant. Thus, direct selection for these traits will be beneficial in yield improvement programme. Path effects of different characters towards seed yield at genotypic level in horsegram.

Table 1: Genotypic correlation of nine characters in 30 genotypes of horsegram

Observations	Days to maturity (No.)	Plant height (cm)	Branches per plant (No.)	Pods per plant (No.)	Seeds per pod (No.)	100 seed weight (g)	Harvest Index (%)	Seed yield per plant (g)
Days to 50% flowering (No.)	0.8684**	0.0496	0.0286	-0.1116	0.2929**	-0.0582	0.1693	0.1129
Days to maturity (No.)		0.0143	-0.1900	-0.1992	0.3956**	-0.0407	0.1438	0.0073
Plant height (cm)			0.2103*	0.0447	0.1006	-0.1938	-0.4296**	-0.3677**
Branches per plant (No.)				0.9080**	-0.3829**	0.0345	0.2826**	0.4308**
Pods per plant (No.)					-0.0005	-0.0006	0.2624*	0.5085**
Seeds per pod (No.)						-0.1143	0.0829	0.1536
100 seeds weight (g)							0.5394**	0.2120*
Harvest Index (%)								0.8469**

*and ** significant at 5% and 1% level, respectively.

Table 2: Direct (diagonal) and Indirect (above and below diagonal) path effects of different characters towards seed yield at genotypic level in horsegram

Sr. No.	Character	Days to 50% flowering (No.)	Days to maturity (No.)	Plant height (cm)	Branches per plant (No.)	Pods per plant (No.)	Seeds per pod (No.)	100 seed weight (g)	Harvest index (%)	Seed yield per plant (g)
1	Days to 50% flowering (No.)	0.0851	-0.2161	-0.0078	0.0097	0.0058	0.0807	0.0147	0.1408	0.1129
2	Days to maturity (No.)	0.0739	-0.2488	-0.0022	-0.0647	0.0104	0.1090	0.0103	0.1196	0.0073
3	Plant height (cm)	0.0042	-0.0036	-0.1572	0.0717	-0.0023	0.0277	0.0489	-0.3571	-0.3677**
4	Branches per plant (No.)	0.0024	0.0473	-0.0330	0.3408	-0.0473	-0.1055	-0.0087	0.2350	0.4308**
5	Pods per plant (No.)	-0.0095	0.0496	-0.0070	0.3094	-0.0521	-0.0001	0.0002	0.2181	0.5085**
6	Seeds per pod (No.)	0.0249	-0.0984	-0.0158	-0.1305	0.2198	0.2756	0.0288	0.0689	0.1536
7	100 seed weight (g)	-0.0049	0.0101	0.0305	0.0117	0.2254	-0.0315	-0.2523	0.4485	0.2120*
8	Harvest index (%)	0.0144	-0.0358	0.0675	0.0963	-0.0137	0.0229	-0.1361	0.8314	0.8469**

(R =0.3482). * and** Significant at 5 and 1 per cent respectively)

CONCLUSION

The seed yield per plant showed highly significant and positive correlation with harvest index, number of pods per plant and number of branches per plant. Its association with rest of character was positive except plant height which showed negative correlation. The characters branches per plant, pods per plant and 100 seed weight showed positive and significant correlation with each other. The highest positive direct effect on seed yield per plant was through branches per plant, seeds per pod, harvest index. The character plant height had high negative direct effect on seed yield per plant. On the basis of character association and path analysis the main yield contributing characters in horsegram are harvest index, number of pods per plant and number of branches per plant. Therefore, breeder should give more emphasis for selection of ideal plant type in horsegram with greater pods per plant, harvest index, 100-seed weight and number of branches per plant.

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