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# GENETIC VARIABILITY, HERITABILITY, CORRELATION AND PATH ANALYSIS STUDIES IN GREEN GRAM (*VIGNA RADIATA* L.WILCZEK)

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**ABSTRACT**

The genotypes differed significantly for all the characters under study. Higher genotypic and phenotypic coefficient of variation was observed for secondary branches per plant, primary branches per plant, pods per plant, grain yield per plant. Genetic advance was highest for plant height followed by days to maturity and pods per plant. High heritability coupled with moderate genetic advance was observed for plant height, days to maturity, pods per plant, protein content, days to 50 percent flowering, secondary branches per plant, grain yield per plant, primary branches per plant. grains per pods, 100 grain weight, plant height, days to 50 percent flowering, plant height, days to maturity, primary branches per plant and secondary branches per plant was significantly and positive association with grain yield per plant. It was apparent from the path coefficient analysis that maximum direct effect as well as appreciable indirect influence were exerted by pods per plant, 100 grain weight. These suggested that emphasis should be given to these traits in selection program for improvement of seed yield in green gram.

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## INTRODUCTION

Green gram (*Vigna radiata* L. Wilczek) 2n=22 is one of the most widely adapted; drought-tolerant, versatile, green manuring and nutritious grain legumes or pulse crop. It is used as dry seed or green pod as vegetable. It is originated and domesticated in Persia (Iran), where its progenitor (*Vigna radiate* subspecies *sublobata)* occurs wild archaeology has turned up carbonized green gram on many sites in India. Green gram belongs to family *Leguminaceae*, sub family *Papilionaceae*. Green gram is a herbaceous annual with erect-semierect stem usually 40 to 120 cm in height. Roots are strong with a tap root system. The leaves are trifoliate, entire ovate and occasionally lobed with long petiole. The inflorescence is terminal or axillary raceme with about more than 10 flower per peduncle. Green gram is essentially a self pollinated crop. The flower is a typical papilionaceous with 5 sepals, 5 petals, 10 stamens in diadelphous (9)+1 condition and monocarpellary ovary with hairy style. Pod containing 9-16 seeds, are 4-16 cm long.

Seed yield is a complex character influenced by various components towards yield. Correlation and path coefficient analysis are the important biometrical techniques to determine the yield components. The knowledge on interrelationship of plant character with the seed yield and among themselves is of paramount importance to the breeder for making importance in complex character like seed yield for which direct selection is not much effective. Although the correlation coefficient indicates the nature of association among the different traits, path analysis splits the correlation coefficients into measure of direct and indirect effects, thus provides understanding of the direct and indirect contribution of each characters towards yield. By considering this view, a study was made to understand the nature of correlations among yield and yield components in order to improve the production and mitigate future demand.

## MATERIALS AND METHODS

The experiment was conducted at Agricultural Botany Farm, College of Agriculture Pune during *kharif* season 2016. material of green gram for the study consisted 30 green gram genotype *viz.,* PM707-5, PM702-8, PM402-2-1, PM504-20-27, PM601-27, PM302-46, PM601-9, PM504-20-2, PM702-1, PM816-10, PM707-12, BM2012-6, BM2011-1, BM2011-3, AKM10-21, AKM2012-23, AKM601-27, AKM12-28, AKM10-5, AKM12-24, BM2012-7, BM2012-5, SML668, IPM-2-3, K-851, Utkarsha, Vaibhav, Gujrat-4, Samrat, Golden-9.The genotype were raised in randomized block design with three replications. Each plot was of size a single row of 3 m length and with the spacing was 30x10 cm. The recommended agronomic and plant protection practices were followed.

The mean data was collected by five randomly selected plants from each experimental plot with ten traits *viz,* days to 50 percent flowering, days to maturity, plant height, number of primary branches per plant, number of secondary branches per plant, number of pods per plant, number of grains per pod, 100 grain weight, protein contain and grain yield per plant. The correlation coefficients and path analysis between yield and yield components were estimated as per the standard procedure given by Johnson *et. al.* (1955) and Dewey and Lu (1959).

## RESULTS AND DISCUSSION

The study revealed highly significant difference for yield and yield contributing characters, indicating presence of considerable amount of variability (Table 1).

plant. The highest heritability was recorded by the character plant height (89%) followed by protein content (86%), pods per plant (86%) and days to maturity (84%). Veeraswamy *et al.* (1973a), Ramna and Singh (1987), Tiwari *et al.* (1996), Das *et al.* (1998), Kousar *et al.* (2007), Gadakh *et al.* (2013), Hemavathy *et al*. (2014) and Tiwari *et al*. (2014) also reported similar results. The character, plant height showed the highest genetic advance followed by days to maturity and pods per plant. Kousar *et al.* (2007) also reported high heritability coupled with genetic advance for pods per plant and plant height. Similar findings were reported by Gadakh *et al.* (2013), Hemavathy *et al*. (2014), Bisht *et al.* (2014).

The grain yield per plant showed highly significant positive relationship with number of grains per pod, 100 grain weight, days to 50 per cent flowering, plant height, days to maturity, primary branches per plant and secondary branches per plant (Table 2). As the number of grains per pod increases, automatically number of grains in aplant increases thus yield also.

The character days to maturity, days to 50 percent flowering, primary branches per plant, secondary branches per plant, pods per plant and grains per pod showed significant negative associationwith each other except secondary branches and pods per plant which showed significant negative association with grains per pod.

**Table 1. Variability for different characters in greengram**

| Sr. No | Character | Range | Mean | G.C.V | P.C.V | Heritability %(B.S.) | Genetic advance |
|---|---|---|---|---|---|---|---|
| 1 | Days to 50%flowering | 39.67-46.00 days | 43.01days | 4.66 | 6.28 | 55 | 3.06 |
| 2 | Days to maturity | 58.67-79.67days | 64.59 days | 6.14 | 6.71 | 84 | 7.47 |
| 3 | Plant Height | 48.33-78 cm | 59.71cm | 10.81 | 11.44 | 89 | 12.56 |
| 4 | Primary branches | 2.00-7.33 | 4.07 | 24.97 | 37.59 | 44 | 1.39 |
| 5 | Secondary branches | 3.00-10.00 | 5.52 | 29.28 | 38.26 | 59 | 2.55 |
| 6 | Pods per plant | 10.00-23.67 | 15.31 | 22.60 | 24.43 | 86 | 6.59 |
| 7 | Grains per pod | 9.67-14.67 | 12.43 | 9.47 | 12.16 | 61 | 1.89 |
| 8 | 100 grain weight | 3.00-6.00 g | 4.66 g | 17.99 | 23.14 | 60 | 1.34 |
| 9 | Grain yield per plant | 5.00-12.67 g | 7.83 g | 20.21 | 29.39 | 47 | 2.24 |
| 10 | Protein content | 11.00-22.00 % | 20.04% | 13.11 | 14.11 | 86 | 5.03 |

Khairnar *et al*. (2003), Bisht *et al*. (2014) also reported genotypes differed significantly for all the character studied.A wide range of variability was observed for the character plant height (48.33 to 78.00 cm), days to maturity (58.67 to 79.67 days) and number of pods per plant (10.00 to 23.67). The estimates of genotypic and phenotypic coefficient of variation for different characters are presented in (Table 2).

The genotypic and phenotypic coefficient of variation were higher for the character secondary branches per plant had (29.28 and 38.26) followed by primary branches per plant (24.97 and 37.59) , pods per plant (22.60 and 24.43), grain yield per plant (20.21 and 29.39), 100 grain weight (17.99 and 23.14), protein content (13.11 and 14.11) and plant height (10.81 and 11.44). Gadakh *et al.* (2013) also reported similar results for the character primary branches. Hemavathy *et al*. (2014) and Tiwari *et al*. (2014) reported similar results for seed yield per plant and number of pods per plant.

These results confirmed the earlier findings of Rathnaswamy *et al.* (1978) for test weight and Veeraswamy *et al.* (1973a) for number of pods per plant and number of branches per plant and Byregowda *et al.* (1997) for grain yield per plant and pods per plant.

Similar results has been reported by Joshi and Kabaria (1973), Natarajan *et al.* (1988), Patil and Deshmukh (1988), Patil and Narkhede (1989), Hemavathy *et al.* (2014), Tiwari *et al.* (2014) and Singh *et al*. (2009) and Venkateswarlu (2001a,b). The study revealed that positive direct effect was exhibited by number of pods per plant, 100 grain weight and plant height on grain yield per plant (Table 3).

The character grains per pod, 100 grain weight, days to 50 percent flowering, plant height and days to maturity exhibited indirect effect on grain yield. Patil and Narkhede (1989) and Ebenezer Babu Rajan *et al.* (2000) for 100 seed weight. However, similar results were reported by Raturi *et.al.* (2014) for the character number of pods per plant, 100 seed weight and plant height and also reported by Thippani *et al* (2013) and Tiwari *et al*. (2014). On the basis of correlation and path analysis studies, seed yield per plant could be improved through simultaneous selection of number of pods per plant, 100 grain weight. It is desirable to give more weightage to these characters in selection programme for both seed yield and green pod yield per plant.

**Table 2. Genotypic correlations of different characters in of green gram**

| Character | Days to maturity | Plant height | Primary branches per plant | Secondary branches per plant | Pods per plant | Grains per pods | 100 grain weight | Protein content | Grain yield per plant |
|---|---|---|---|---|---|---|---|---|---|
| Days to 50% flowering | 0.9611** | 0.5457** | 0.6485** | 0.7821** | 0.3864** | 0.1842 | 0.1339 | -0.2667* | 0.4930** |
| Days to maturity | | 0.5383** | 0.4560** | 0.4602** | 0.3105** | 0.2109* | 0.1213 | 0.0250 | 0.4555** |
| Plant height | | | 0.4205** | 0.2715* | 0.0664 | 0.4883** | 0.1924 | 0.1962 | 0.4788** |
| Primary branches per plant | | | | 0.7284** | 0.2272* | -0.0144 | -0.0369 | 0.2406* | 0.2211* |
| Secondary branches per plant | | | | | 0.4491** | -0.3657** | -0.1224 | 0.1017 | 0.2099* |
| Pods per plant | | | | | | -0.4724** | -0.6726** | 0.2098* | 0.1374 |
| Grains per pod | | | | | | | 0.7668 ** | -0.2399* | 0.5232** |
| 100 grain weight | | | | | | | | -0.4387** | 0.5032** |
| Protein content | | | | | | | | | -0.1063 |

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

**Table 3. Direct and indirect effect using genotypic correlation for different characters towards yield of green gram (R= 0.5052)**

| Character | Days to 50% flowering | Days to maturity | Plant height | Primary branches per plant | Secondary branches per plant | Pods per plant | Grains per pods | 100 grain weight | Protein content | Grain yield per plant |
|---|---|---|---|---|---|---|---|---|---|---|
| Days to 50% flowering | -0.2505 | -0.2407 | -0.1367 | -0.1624 | -0.1959 | 0.0968 | 0.0461 | 0.0335 | 0.0668 | 0.4930** |
| Days to maturity | -0.1305 | 0.1357 | 0.0731 | -0.0619 | 0.0625 | 0.0421 | 0.0286 | 0.0165 | 0.0034 | 0.4555** |
| Plant height | -0.1481 | 0.1461 | 0.2713 | -0.1141 | -0.0737 | 0.0180 | 0.1325 | 0.0522 | 0.0532 | 0.4788** |
| Primary branches per plant | -0.0828 | -0.0582 | 0.0537 | 0.1277 | 0.0930 | 0.0290 | -0.0018 | -0.0047 | 0.0307 | 0.2211* |
| Secondary branches per plant | -0.1177 | -0.6920 | -0.0408 | -0.1096 | -0.1505 | 0.0676 | 0.0550 | 0.0184 | -0.0153 | 0.2099* |
| Pods per plant | -0.3721 | 0.2990 | 0.0639 | 0.2188 | 0.4325 | -0.9630 | 0.4549 | -0.6477 | 0.2020 | 0.1374 |
| Grains per pod | -0.0182 | -0.0208 | -0.0481 | 0.0014 | 0.0361 | 0.0466 | 0.0986 | -0.0756 | 0.0237 | 0.5232** |
| 100 grain weight | 0.0161 | -0.1459 | 0.2314 | -0.0444 | -0.1472 | -0.8089 | 0.9222 | 0.9325 | -0.5275 | 0.5032** |
| Protein content | -0.0151 | 0.0014 | 0.0111 | 0.0137 | 0.0058 | 0.0119 | -0.0136 | -0.0249 | 0.0567 | -0.1063 |

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