

Correlation And Path Coefficient Analysis For Yield, Yield Components And Water Use Efficiency Traits In Black gram Under Organic Fertilizer Management

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ABSTRACT

Correlation and path co-efficient analysis was carried out for yield, yield component and water use efficiency traits among 30 blackgram genotypes under organic fertilizer management. Correlation studies indicated that seed yield per plant showed highly significant and positive correlation with harvest index, followed by number of primary branches per plant, number of pods per plant. It exhibited significant negative correlation with SCMR (SPAD chlorophyll meter reading) at 35 DAS and SLA (Specific leaf area) at 50 DAS at both phenotypic and genotypic levels. Path Analysis revealed that harvest index exhibited high and positive direct effect on seed yield per plant followed by number of pods per plant and number of primary branches per plant. SCMR (SPAD chlorophyll meter reading) at 35 DAS and SLA (Specific leaf area) at 50 DAS plant exhibited low and negative direct effects on seed yield per plant. Hence selection based on these traits would be effective in increasing the seed yield and improving water use efficiency. Opting for genotypes with low to moderate SLA (Specific leaf area) readings and high SCMR (SPAD chlorophyll meter reading) at flowering stage would increase water use efficiency under organic fertilizer management.

INTRODUCTION

Black gram (*Vigna mungo* L.) is an important short duration pulse crop grown in India. But the production of blackgram is low due to higher incidence of pests and diseases, moisture stress, poor fertilizer management etc [1]. Therefore, to bring about any improvement in this crop, the knowledge of association of yield with other yield component and water use efficiency traits under organic fertilizer management will be of great significance.

Correlation studies indicate the magnitude of association between pairs of characters and are useful for selecting genotypes with desirable combinations of characters thereby assist the plant breeder in crop improvement [2]. Hence, the knowledge of association of yield components with yield and among themselves and with water use efficiency traits would be of great help to the breeder in obtaining improved yields under moisture stress conditions.

As yield is a complex character controlled by polygenes and greatly influenced by environment, selection based on yield is not effective, hence selection for yield components, which are less prone to environmental influences is very valuable. Therefore it is essential to measure the contribution of various traits to the yield through correlation and partitioning the correlation coefficient into the components of direct and indirect effects [3].

The quantity and direction of influence i.e. both direct and indirect effects are estimated by path coefficient analysis. It also reveals whether the association of these characters with yield is due to their direct effect on yield or it is a consequence of their indirect effect via some other character.

MATERIAL AND METHODS

The present investigation was carried out among 30 blackgram genotypes during Kharif, 2017 at dry land farm of Sri Venkateswara Agricultural College, Tirupati using a Randomized Block Design with three replications. In organic management trial, FYM was applied @ of 20 t ha⁻¹ at the time of field preparation and Jeevamrutha [2] was applied at 15 days interval. Seed treatment was done with 3% panchagavya [1]. On 25th and 35th days after sowing 3% panchagavya was sprayed. For control of sucking pests bramhasthrum [2] was sprayed. No inorganic chemicals were used. Cultural practices like weeding and irrigation were followed in common for both trials to maintain good crop growth.

Observations were recorded on five randomly selected plants in each genotype for plant height, number of primary branches per plant, number of clusters per plant, number of pods per cluster, number of pods per plant, pod length, number of seeds per pod, 100 seed weight, harvest index, SPAD chlorophyll meter reading at 35 DAS, SPAD chlorophyll meter reading at 50 DAS, Specific leaf area 35 DAS, Specific leaf area 50 DAS, relative water content and seed yield per plant, whereas for days to 50 % flowering and days to maturity observations were recorded on plot basis.

Genotypic and phenotypic correlation coefficients were calculated using the method given by Johnson et al. (1955). Path coefficient analysis suggested by Wright (1921) and elaborated by Dewey and Lu (1959) was used to calculate the direct and indirect contribution of various traits to yield [4].

RESULTS AND DISCUSSION

Under organic fertilizer management, the traits viz., number of primary branches per plant, number of pods per plant, harvest index exhibited significant positive correlation, whereas SCMR at 35 DAS and SLA at 50 DAS recorded significant negative association with seed yield per plant. The results indicated that selection for the genotypes with more number of primary branches per plant, more number of pods per plant leads to increased seed yield per plant and opting for genotypes with low SLA readings and high SCMR at flowering stage would increase water use efficiency under organic fertilizer management (Table 1).

Path coefficient analysis was conducted using seed yield per plant as dependent variable and five independent variables, number of primary branches per plant, number of pods per plant, harvest index, SCMR at 35 DAS and SLA at 50 DAS that exhibited significant phenotypic correlation with seed yield per plant. The results are presented in Table 2 and path diagram is furnished in Figure. 1.

Among these traits, harvest index exhibited high and positive direct effect on seed yield per plant (0.3716) followed by number of pods per plant (0.1483) and number of primary branches per plant (0.1144). SCMR at 35 DAS (-0.1627) and SLA at 50 DAS plant (-0.1176) exhibited low and negative direct effects on seed yield per plant.

Estimates of residual effect was considerably high (0.837) signifying the need for inclusion of some more traits that have been left behind in the present study.

Positive direct effect and significant positive association of harvest index with seed yield per plant indicates its importance in improving seed yield. Moreover, significant positive association of other traits viz., number of primary branches per plant, number of pods per plant, pod length with seed yield per plant was due to their positive indirect effects through harvest index. Therefore, harvest index should be given more importance during selection process under organic fertilizer management.

Among water use efficiency traits, SCMR at 35 DAS and SLA at 50 DAS must be considered as selection criteria. The genotypes with higher SCMR at 35 DAS and low SLA at 50 DAS values were considered to be more water use efficient.

CONCLUSION

Selection for the genotypes with more number of primary branches per plant, number of pods per plant and high harvest index leads to increased seed yield per plant and opting for genotypes with low to moderate SLA and high SCMR at flowering stage would increase water use efficiency under organic fertilizer management.

Table 1: Phenotypic (r_p) and genotypic (r_g) correlation coefficients among yield, yield components and water use efficiency traits in blackgram under organic fertilizer management

| | | DF | DM | PH (cm) | PB | CP | PC | PP | PL (cm) | SP | 100 SW (g) | HI (%) | SCMR 35 | SCMR 50 | SLA 35 | SLA 50 | RWC (%) | SYP (g) |
|---|-------|----|---------|---------|--------|---------|----------|---------|----------|----------|------------|----------|----------|----------|----------|----------|----------|----------|
| DF | r_p | 1 | 0.220* | 0.176 | -0.024 | 0.030 | 0.024 | -0.052 | 0.032 | -0.222* | 0.026 | -0.355** | 0.187 | 0.206 | -0.217* | -0.040 | -0.105 | -0.057 |
| | r_g | 1 | 0.540** | 0.369** | -0.016 | -0.065 | 0.243* | -0.032 | 0.088 | -0.386** | 0.039 | -0.534** | 0.373** | 0.355** | -0.428** | -0.090 | -0.149 | -0.010 |
| DM | r_p | | 1 | 0.138 | -0.015 | 0.043 | -0.124 | 0.021 | 0.115 | -0.098 | -0.072 | -0.218* | 0.084 | -0.064 | -0.054 | 0.079 | -0.068 | -0.173 |
| | r_g | | 1 | 0.237* | 0.128 | 0.141 | -0.316** | 0.036 | 0.257* | 0.067 | -0.270* | -0.133 | 0.004 | -0.419** | -0.198 | 0.075 | -0.326** | -0.404** |
| PH(cm) | r_p | | | 1 | 0.098 | 0.237* | 0.112 | 0.243* | -0.220* | -0.350** | 0.165 | -0.357** | -0.018 | -0.031 | -0.085 | 0.192 | -0.085 | 0.104 |
| | r_g | | | 1 | 0.158 | 0.285** | 0.150 | 0.297** | -0.277** | -0.456** | 0.194 | -0.523** | -0.090 | -0.016 | -0.149 | 0.243* | -0.073 | 0.146 |
| PB | r_p | | | | 1 | 0.398** | 0.273** | 0.373** | -0.201 | 0.153 | 0.154 | 0.064 | -0.371** | -0.091 | 0.304** | 0.077 | 0.135 | 0.245* |
| | r_g | | | | 1 | 0.519** | 0.682** | 0.499** | -0.290** | 0.334** | 0.217* | 0.059 | -0.434** | -0.144 | 0.480** | 0.138 | 0.233* | 0.434** |
| CP | r_p | | | | | 1 | 0.249* | 0.856** | -0.477** | -0.039 | 0.115 | 0.012 | -0.199 | 0.138 | 0.132 | -0.055 | 0.009 | 0.147 |
| | r_g | | | | | 1 | 0.518** | 0.945** | -0.539** | -0.029 | 0.122 | 0.027 | -0.235* | 0.220* | 0.116 | -0.028 | 0.016 | 0.168 |
| PC | r_p | | | | | | 1 | 0.459** | -0.122 | -0.085 | 0.395** | -0.084 | -0.069 | 0.006 | 0.014 | 0.069 | -0.088 | 0.074 |
| | r_g | | | | | | 1 | 0.834** | -0.294** | -0.515** | 0.953** | -0.245* | -0.171 | -0.114 | -0.082 | 0.272** | 0.043 | 0.357** |
| PP | r_p | | | | | | | 1 | -0.407** | -0.120 | 0.252* | 0.025 | -0.169 | 0.078 | 0.056 | -0.014 | -0.036 | 0.230* |
| | r_g | | | | | | | 1 | -0.476** | -0.113 | 0.292** | 0.043 | -0.226* | 0.107 | 0.065 | -0.005 | -0.053 | 0.261* |
| PL(cm) | r_p | | | | | | | | 1 | 0.070 | -0.052 | 0.017 | 0.027 | -0.092 | 0.105 | -0.076 | -0.375** | -0.036 |
| | r_g | | | | | | | | 1 | 0.029 | -0.056 | -0.036 | 0.075 | -0.136 | 0.157 | -0.033 | -0.487** | -0.091 |
| SP | r_p | | | | | | | | | 1 | -0.221* | 0.281** | -0.073 | -0.022 | 0.268* | 0.190 | 0.191 | 0.094 |
| | r_g | | | | | | | | | 1 | -0.350** | 0.441** | -0.071 | -0.094 | 0.412** | 0.305** | 0.385** | 0.134 |
| 100SW(g) | r_p | | | | | | | | | | 1 | -0.210* | 0.075 | -0.065 | -0.230* | -0.049 | -0.055 | -0.004 |
| | r_g | | | | | | | | | | 1 | -0.292** | 0.085 | -0.080 | -0.270* | -0.066 | -0.071 | -0.038 |
| HI(%) | r_p | | | | | | | | | | | 1 | -0.172 | -0.042 | 0.124 | -0.287** | 0.070 | 0.445** |
| | r_g | | | | | | | | | | | 1 | -0.223* | -0.058 | 0.228* | -0.372** | 0.110 | 0.542** |
| SCMRat35DAS | r_p | | | | | | | | | | | | 1 | 0.264* | -0.526** | -0.043 | -0.015 | -0.289** |
| | r_g | | | | | | | | | | | | 1 | 0.420** | -0.743** | -0.116 | 0.031 | -0.327** |
| SCMRat50DAS | r_p | | | | | | | | | | | | | 1 | -0.114 | 0.034 | -0.074 | 0.017 |
| | r_g | | | | | | | | | | | | | 1 | -0.139 | 0.019 | -0.220* | -0.061 |
| SLAat35DAS (cm ² g ⁻¹) | r_p | | | | | | | | | | | | | | 1 | 0.154 | 0.108 | 0.113 |
| | r_g | | | | | | | | | | | | | | 1 | 0.248* | 0.194 | 0.142 |
| SLAat50DAS (cm ² g ⁻¹) | r_p | | | | | | | | | | | | | | | 1 | -0.108 | -0.210* |
| | r_g | | | | | | | | | | | | | | | 1 | -0.189 | -0.256* |
| RWC(%) | r_p | | | | | | | | | | | | | | | | 1 | -0.041 |
| | r_g | | | | | | | | | | | | | | | | 1 | -0.184 |
| SYP(g) | r_p | | | | | | | | | | | | | | | | | 1 |
| | r_g | | | | | | | | | | | | | | | | | 1 |

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

DF: Days to 50% flowering; DM: Days to maturity; PH: Plant height (cm); PB: Primary branches per plant; CP: Clusters per plant; PC: Pods per cluster; PP: Pods per plant; PL: Pod length (cm); SP: Seeds per pod; 100 SW: 100 seed weight (g); HI: Harvest index (%); SCMR 35: SPAD chlorophyll meter reading at 35 DAS; SCMR 50: SPAD chlorophyll meter reading at 50 DAS; SLA 35: Specific leaf area at 35 DAS; SLA 50: Specific leaf area at 50 DAS; RWC: Relative water content (%); SYP: Seed yield per plant(g).

Table 2: Phenotypic path coefficient analysis for yield, yield components and water use efficiency traits in blackgram under organic fertilizer management

| | No. of primary branches per plant | No. of pods per plant | Harvest index (%) | SPAD chlorophyll reading at 35 DAS | Specific leaf area at 50 DAS (cm ² g ⁻¹) | Seed yield per plant (g) |
|--|-----------------------------------|-----------------------|-------------------|------------------------------------|---|--------------------------|
| No. of primary branches per plant | 0.1144 | 0.0554 | 0.0239 | 0.0604 | -0.009 | 0.245* |
| No. of pods per plant | 0.0427 | 0.1483 | 0.0095 | 0.0274 | 0.0016 | 0.230* |
| Harvest index (%) | 0.0074 | 0.0038 | 0.3716 | 0.0281 | 0.0337 | 0.445** |
| SPAD chlorophyll reading at 35 DAS | -0.0424 | -0.0250 | 0.0641 | -0.1627 | 0.0051 | -0.289** |
| Specific leaf area at 50 DAS(cm ² g ⁻¹) | 0.0088 | -0.002 | 0.1065 | 0.0070 | -0.1176 | -0.210* |

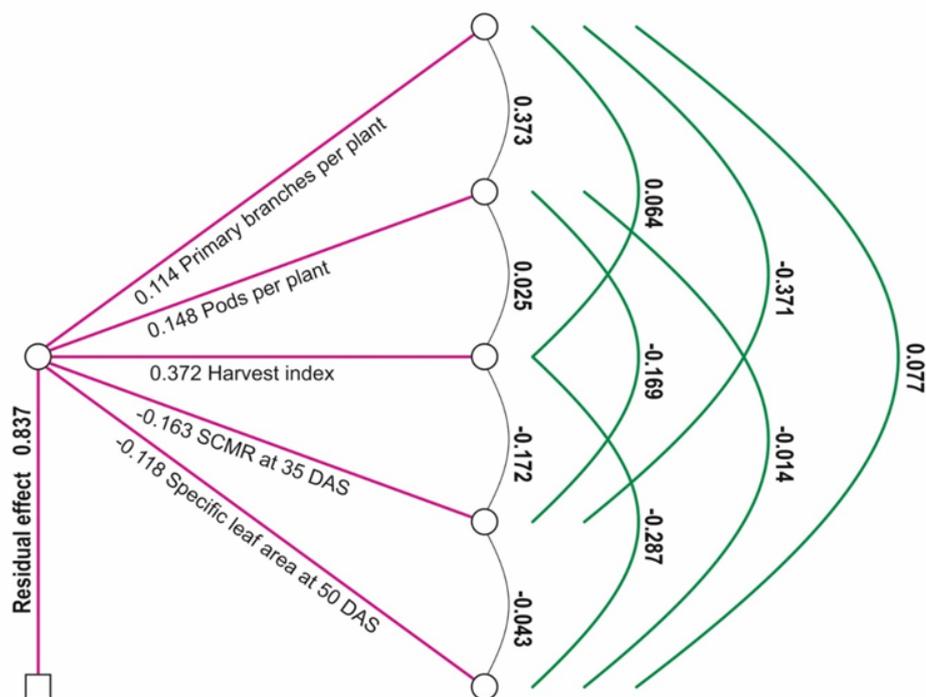


Figure 1. Phenotypic path diagram for yield, yield components and water use efficiency traits under organic fertilizer management

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