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# ASSOCIATION ANALYSIS FOR YIELD AND ITS COMPONENTS IN URD BEAN (*VIGNA MUNGO* L.) GENOTYPES

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**ABSTRACT**
An experiment was conducted during summer and rainy seasons of 2011 and 2012 to estimate the association among yield and its components in urdbean. Correlation coefficient analysis revealed that seed yield per plant exhibited positive and significant association with number of branches per plant (P 0.23, G 0.34 & E 0.16), number of pods per plant (P 0.27, & E 0.36), biological yield per plant (P 0.74, G 0.76 & E 0.72), 100 seed weight (P 0.23, G 0.30 and E 0.20) and harvest index (G 0.40 & E 0.20). Negative association of seed yield per plant was observed with days to maturity and plant height. The characters like number of branches per plant, number of pods per plant, 100 seed weight and harvest index are also positively associated among them indicating the simultaneous improvement of these characters by selection. The study revealed that five characters *viz*. number of branches per plant, number of pods per plant, biological yield per plant, 100 seed weight and harvest index significantly influence seed yield. Selection of these traits is expected to lead positive results in improvement of seed yield in blackgram.

## INTRODUCTION

Black gram (*Vigna mungo* L.) is an important short duration pulse crop grown in India. It is considered to have been domesticated in India from its wild ancestral form *Vigna mungo* var. *silvestris*. Center of genetic diversity is found in India (Zeven and de Wet. 1982). It belongs to the family fabaceae. It is predominantly a self pollinated crop with a little amount of out crossing. The productivity of urdbean is very low as compared to other pulses. In India it is grown in an area about 3.06 m ha with a total production of 1.7 m t with an average productivity of 555 kg/ha (2013-14 source www.iipr.res.in). Hence efforts should be concentrated in increasing the yield potential by developing high yielding stable varieties having resistance to diseases and pests. Yield is a complex character under the control of several genes and highly influenced by environmental factors. The effective improvement in yield can be brought about by means of selecting yield contributing characters.

Various biometrical and taxonomic techniques have been successfully used to classify and measure the pattern of genetic diversity in legumes (Ghafoor *et al*., 2000). Correlations are frequent features in selection of breeding programmes as they decide the selection criteria to be practiced for genetic improvement in targeted direction. The experiment carried out in single environment does not give the realistic results which may vary from one environment to the other. Therefore, to get more reliable results the experiment should be conducted over a wide range of environmental conditions. In the present study an attempt was made to determine the nature and magnitude of relation of seed yield and its component characters in four environments. The correlation coefficient at phenotypic, genotypic and environmental level was computed.

## MATERIALS AND METHODS

The experimental material used in present investigation comprised of thirty five genotypes of urd bean obtained from the genetic stock maintained at Department of Genetics and Plant Breeding, JNKVV, Jabalpur. The experiment was conducted in Randomized Complete Block Design with three replications in four environments namely *summer* 2011, *kharif* 2011, *summer* 2012 and *kharif* 2012 with row to row distance 30 cm. and plant to plant distance 15 cm. The full package of practices, recommended for urd cultivation in Madhya Pradesh was strictly adopted for optimum crop growth. The agronomical operations were timely carried out. Observations were recorded for the ten characters *viz*. days to 50 % flowering, number of branches per plant, number of pods per plant, YMV incidence, days to maturity, plant height, biological yield per plant, 100 seed weight, harvest index and seed yield per plant. The genotypic, phenotypic and environmental correlation coefficients were calculated as per method developed by Johanson *et al*. (1955).

## RESULTS AND DISCUSSION

Correlation coefficients for all possible combinations at

**Table 1: Phenotypic, genotypic and environmental correlation coefficient for seed yield /plant and its components during *Summer* 2011 and *Kharif* 2011**

| | | Days to 50 % Flowering | No. of branches /plant | No. of pods/ plant | YMV incidence | Days to maturity | Plant height | Biological yield/ plant | 100 seed weight | Harvest Index | Seed yield /plant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Days to 50 % Flowering | P | -0.13 | -0.06 | -0.07 | 0.01 | -0.06 | -0.02 | 0.02 | 0.13 | 0.12 |
| | G | -0.30** | -0.08 | 0.16 | 0.01 | -0.16 | -0.11 | 0.04 | 0.34 | 0.20* |
| | E | 0.05 | 0.01 | 0.09 | -0.03 | -0.04 | 0.23 | -0.01 | -0.29** | -0.07 |
| No. of branches / plant | 0.19 | P | 0.02 | -0.06 | 0.13 | 0.42*** | -0.17 | -0.07 | 0.10 | -0.11 |
| | 0.29** | G | -0.13 | -0.19* | 0.20* | 0.62*** | -0.30 | -0.08 | 0.33*** | -0.14 |
| | -0.04 | E | 0.35*** | 0.12 | 0.12 | 0.02 | 0.42*** | 0.02 | -0.07 | -0.18 |
| No. of pods/ plant | 0.12 | 0.31** | P | -0.09 | -0.24* | 0.28** | -0.03 | 0.23* | 0.23* | 0.22* |
| | 0.33*** | 0.48*** | G | -0.16 | -0.25* | 0.51*** | -0.03 | 0.37*** | 0.26** | 0.23** |
| | 0.04 | 0.29** | E | 0.19* | -0.11 | 0.43*** | -0.03 | -0.13 | 0.12 | 0.16 |
| YMV incidence | 0.14 | 0.09 | -0.05 | P | 0.14 | 0.16 | 0.07 | 0.21* | 0.09 | 0.17 |
| | 0.18 | 0.17 | 0.05 | G | 0.16 | 0.55*** | 0.08 | 0.25* | 0.17 | 0.18 |
| | -0.04 | -0.02 | -0.13 | E | 0.08 | 0.06 | 0.02 | 0.13 | -0.09 | 0.02 |
| Days to maturity | 0.25** | 0.28** | 0.13 | -0.05 | P | 0.04 | -0.11 | -0.05 | -0.05 | -0.13 |
| | 0.28** | 0.42*** | 0.63*** | -0.01 | G | 0.10 | -0.13 | -0.07 | -0.06 | -0.19* |
| | 0.03 | -0.05 | -0.29** | -0.22* | E | 0.05 | 0.02 | 0.01 | 0.05 | 0.16 |
| Plant Height | -0.03 | -0.16 | 0.13 | -0.07 | 0.04 | P | 0.15 | -0.05 | 0.17 | 0.31*** |
| | -0.04 | -0.18 | 0.11 | -0.24 | 0.11 | G | 0.15 | -0.13 | 0.38*** | 0.51*** |
| | -0.02 | -0.14 | 0.15 | 0.15 | -0.12 | E | 0.27** | -0.03 | 0.15 | 0.41*** |
| Biological yield/plant | 0.06 | 0.32*** | 0.31** | -0.15 | 0.16 | -0.01 | P | 0.03 | 0.03 | 0.26** |
| | 0.06 | 0.32*** | 0.18 | -0.15 | 0.22* | -0.09 | G | 0.06 | -0.47 | 0.71*** |
| | 0.04 | 0.34*** | 0.47*** | -0.15 | -0.04 | 0.09 | E | -0.03 | 0.01 | 0.50*** |
| 100 seed weight | -0.06 | -0.08 | -0.08 | 0.16 | -0.05 | 0.16 | -0.05 | P | 0.33*** | 0.25** |
| | -0.09 | -0.09 | 0.04 | 0.22 | -0.05 | 0.24* | -0.01 | G | 0.52*** | 0.43*** |
| | 0.12 | -0.07 | -0.17 | 0.00 | -0.03 | 0.06 | -0.18 | E | 0.01 | 0.09 |
| Harvest Index | -0.14 | -0.07 | 0.07 | 0.09 | 0.02 | -0.13 | -0.42*** | 0.09 | P | 0.32*** |
| | -0.22* | -0.24 | 0.18 | 0.18 | 0.00 | -0.15 | -0.62 | 0.26** | G | 0.25* |
| | -0.06 | 0.05 | 0.05 | -0.06 | 0.08 | -0.12 | -0.26** | -0.11 | E | 0.51*** |
| Seed yield/plant | -0.01 | 0.29** | 0.42*** | -0.04 | 0.22* | -0.10 | 0.72*** | 0.03 | 0.29** | P |
| | -0.04 | 0.15 | 0.36*** | 0.05 | 0.37*** | -0.20* | 0.85*** | 0.22* | 0.21 | G |
| | 0.02 | 0.27** | 0.46*** | -0.14 | 0.00 | -0.03 | 0.62*** | 0.27** | 0.56*** | E |

* Significant at 5 % level of probability, ** Significant at 1% level of probability, *** Significant at 0.1% level of probability; P = Phenotypic, G = Genotypic, E = Environmental. Upper and lower diagonals represent *summer* 2011 and *kharif* 2011 respectively.

genotypic, phenotypic and environmental levels were determined for individual environments as well as pooled analysis over the environments (Table no. 1 to 3) In general genotypic correlation was higher in magnitude then phenotypic correlation. However the direction of genotypic and phenotypic correlations was mostly same.

The result revealed that there was inherent association between various characters but their phenotypic expression was influenced by the climatic conditions of the four seasons under study. Hence the discussion of the present study is based on correlation coefficient over the environment. Genotypic correlations were higher in magnitude than their respective phenotypic correlations in general also reported by Reddy *et al*., in 2011. Environmental correlations are of least importance to the breeder but they give an idea about how to environmental conditions influence the phenotypic expression of various characters.

Seed yield per plant exhibited positive and significant correlation with biological yield per plant and harvest index during all the seasons as well as over the seasons similar findings were reported by Chuahan *et al*. (2007). 100 seed weight and seed yield per plant exhibited positive and significant correlation in pooled analysis while same trend was reported for genotypic correlation during summer 2011 and *kharif* 2011

Positive and significant genotypic correlation was observed between seed yield per plant and days to 50 % flowering during summer 2011 and summer 2012 these findings are in agreement with the work of Konda *et al.,* 2008 and Shivade *et al*., 2011.

Number of branches per plant exhibited positive and significant correlation with seed yield per plant over the environments and during *kharif* 2012 while same trend of genotypic and phenotypic correlation was observed during summer 2012. During *kharif* 2011 only phenotypic and environmental correlations were found positive and significant between these two traits.

Number of pods per plant showed positive and significant association with seed yield per plant during *kharif* 2011, summer 2012 and *kharif* 2012. Phenotypic and genotypic correlation between these two characters follow the same trend during summer 2011, while phenotypic and environmental correlation was found positive significant between these characters over the environments.

Negative and significant association between days to maturity and seed yield per plant was reported during summer 2011, summer 2012 and *kharif,* 2011 while environmental correlation between these two traits exhibited same trend over the seasons. During *kharif,* 2012 there is positive and

**Table 2: Phenotypic, genotypic, and environmental correlation coefficient for seed yield /plant and its components during *Summer* 2012 and *Kharif* 2012**

| | Days to 50 % Flowering | No. of branches /plant | No. of pods/ plant | YMV incidence | Days to maturity | Plant height | Biological yield /plant | 100 seed weight | Harvest Index | Seed yield/ plant |
|---|---|---|---|---|---|---|---|---|---|---|
| Days to 50 % | P | 0.11 | 0.19* | 0.16 | 0.21* | 0.20* | 0.22* | -0.17 | -0.18 | 0.16 |
| Flowering | G | 0.16 | 0.25* | 0.18 | 0.25* | 0.25* | 0.25 | -0.21* | -0.29*** | 0.19* |
| | E | 0.08 | 0.03 | 0.09 | -0.03 | 0.02 | 0.01 | -0.08 | 0.04 | 0.09 |
| No. of branches | 0.26*** | P | 0.45*** | 0.15 | -0.14 | 0.37*** | 0.44*** | 0.21* | -0.23* | 0.38*** |
| / plant | 0.29** | G | 0.69*** | 0.27** | -0.20* | 0.46*** | 0.64*** | 0.25* | -0.21* | 0.69*** |
| | 0.24** | E | 0.23* | 0.02 | -0.09 | 0.31*** | 0.27** | 0.20* | -0.25** | 0.06 |
| No. of pods/ plant | 0.12 | 0.31** | P | 0.08 | -0.14 | 0.54*** | 0.80*** | 0.29** | -0.33*** | 0.74*** |
| | 0.21* | 0.23* | G | 0.11 | -0.04 | 0.60*** | 0.90*** | 0.47*** | -0.55*** | 0.84*** |
| | 0.01 | 0.40*** | E | 0.04 | -0.06 | 0.42*** | 0.57** | -0.02 | -0.01 | 0.52*** |
| YMV incidence | -0.14 | 0.08 | -0.27*** | P | -0.01 | 0.00 | 0.11 | 0.10 | -0.18 | 0.02 |
| | -0.18 | 0.03 | -0.70*** | G | 0.04 | -0.06 | 0.18 | 0.04 | -0.28** | 0.07 |
| | 0.01 | 0.18 | 0.19* | E | -0.16 | 0.13 | -0.10 | 0.23* | -0.03 | -0.08 |
| Days to maturity | 0.32*** | 0.11 | 0.04 | -0.18 | P | -0.20* | -0.03 | 0.44*** | -0.15 | -0.23* |
| | 0.36*** | 0.20* | 0.06 | -0.23* | G | -0.21* | -0.02 | -0.55*** | -0.31 | -0.32* |
| | 0.04 | -0.19 | 0.00 | 0.01 | E | -0.18 | -0.07 | -0.18 | 0.22* | 0.08 |
| Plant Height | 0.02 | -0.43*** | 0.19 | -0.13 | -0.29** | P | 0.51*** | 0.33*** | -0.14 | 0.48*** |
| | 0.01 | -0.63*** | 0.09 | -0.22* | -0.34** | G | 0.64*** | 0.46*** | -0.39*** | 0.57*** |
| | 0.04 | 0.01 | 0.36*** | 0.11 | -0.02 | E | 0.11 | 0.10 | 0.18 | 0.29** |
| Biological yield/plant | 0.08 | -0.01 | 0.42*** | 0.03 | -0.16 | 0.52*** | P | 0.32*** | -0.53*** | 0.77*** |
| | 0.08 | -0.22* | 0.24* | -0.05 | -0.17 | 0.59*** | G | 0.44*** | -0.65*** | 0.85*** |
| | 0.10 | 0.18 | 0.65*** | 0.22* | -0.16 | 0.33*** | E | 0.03 | -0.37*** | 0.55*** |
| 100 seed weight | 0.14 | -0.41*** | -0.02 | -0.03 | -0.29*** | 0.35*** | 0.24* | P | -0.04 | 0.40*** |
| | -0.25** | -0.67*** | 0.12 | -0.04 | -0.39*** | 0.49*** | 0.40*** | G | -0.03 | 0.67*** |
| | 0.20* | 0.01 | -0.01 | 0.01 | 0.01 | 0.03 | 0.03 | E | -0.05 | -0.08 |
| Harvest Index | -0.09 | 0.36*** | -0.16 | 0.02 | 0.03 | -0.61*** | -0.60*** | -0.41*** | P | 0.06 |
| | -0.14 | 0.53*** | -0.15 | 0.06 | -0.01 | -0.74*** | -0.64*** | -0.57*** | G | 0.21* |
| | 0.08 | 0.00 | -0.19* | -0.08 | 0.23* | -0.16 | -0.47*** | -0.08 | E | 0.48*** |
| Seed yield/plant | -0.02 | 0.41*** | 0.35*** | 0.06 | -0.19* | -0.07 | 0.46*** | 0.14 | 0.35*** | P |
| | -0.06 | 0.37*** | 0.21* | 0.03 | -0.24* | -0.15 | 0.40*** | 0.12 | 0.39*** | G |
| | 0.11 | 0.46*** | 0.54*** | 0.14 | -0.07 | 0.14 | 0.59*** | 0.16 | 0.28** | E |

* Significant at 5% level of probability, ** Significant at 1% level of probability, *** Significant at 0.1% level of probability; P = Phenotypic, G = Genotypic, E = Environmental. Upper and lower diagonals represent *summer* 2012 and *kharif* 2012 respectively

**Table 3: Phenotypic, genotypic and environmental correlation coefficient for seed yield /plant and its components during over the environments**

| | | No. of branches /plant | No. of pods/ plant | YMV incidence | Days to maturity | Plant Height | Biological yield/ plant | 100 seed weight | Harvest Index | Seed yield/ plant |
|---|---|---|---|---|---|---|---|---|---|---|
| Days to 50 % Flowering | P | 0.07 | 0.11* | 0.01 | 0.21*** | -0.02 | 0.03 | -0.08 | -0.05 | 0.06 |
| | G | 0.05 | 0.03 | 0.12* | 0.11* | -0.08 | 0.08 | -0.31 | -0.02 | 0.08 |
| | E | 0.12* | 0.15** | 0.01 | 0.28*** | 0.00 | 0.00 | -0.02 | -0.06 | 0.06 |
| No. of branches / plant | P | | 0.39*** | 0.03 | 0.01 | -0.47*** | -0.03 | 0.24*** | 0.41*** | 0.23*** |
| | G | | 0.61*** | -0.05 | 0.00 | -0.63*** | -0.11* | 0.49*** | 0.64*** | 0.34*** |
| | E | | 0.30*** | 0.10* | 0.12* | -0.09 | 0.08 | 0.01 | 0.03 | 0.16*** |
| No. of pods/ plant | P | | | -0.06 | -0.04 | 0.00 | 0.03 | 0.17*** | 0.12* | 0.27*** |
| | G | | | -0.18*** | 0.00 | -0.26*** | -0.38*** | 0.62*** | 0.57*** | 0.08 |
| | E | | | -0.04 | -0.05 | 0.21*** | 0.25*** | 0.00 | -0.13** | 0.36*** |
| YMV incidence | P | | | | -0.04 | -0.02 | 0.03 | - 0.12* | -0.01 | 0.09 |
| | G | | | | -0.36*** | 0.04 | 0.03 | 0.05 | - 0.13** | - 0.18*** |
| | E | | | | 0.02 | -0.06 | 0.04 | - 0.14** | -0.05 | 0.06 |
| Days to maturity | P | | | | | -0.09 | -0.03 | -0.19*** | -0.04 | -0.07 |
| | G | | | | | -0.06 | -0.01 | -0.27*** | 0.14** | 0.04 |
| | E | | | | | -0.12* | -0.04 | -0.17*** | -0.13** | -0.11* |
| Plant Height | P | | | | | | -0.15** | -0.00 | -0.26*** | -0.23*** |
| | G | | | | | | -0.34*** | -0.07 | -0.36*** | -0.55*** |
| | E | | | | | | 0.08 | 0.06 | -0.13** | 0.04 |
| Biological yield/plant | P | | | | | | | 0.10* | -0.48*** | 0.74*** |
| | G | | | | | | | 0.09 | -0.65*** | 0.76*** |
| | E | | | | | | | 0.10* | -0.33*** | 0.72*** |
| 100 seed weight | P | | | | | | | | 0.05 | 0.23*** |

**Table 3: Cont....**

| | No. of branches /plant | No. of pods/ plant | YMV incidence | Days to maturity | Plant Height | Biological yield/ plant | 100 seed weight | Harvest Index | Seed yield/ plant |
|---|---|---|---|---|---|---|---|---|---|
| | G | | | | | | | -0.01 | 0.30*** |
| | E | | | | | | | 0.08 | 0.20*** |
| Harvest Index | P | | | | | | | | 0.06 |
| | G | | | | | | | | 0.14** |
| | E | | | | | | | | 020*** |

* Significant at 5% level of probability, ** Significant at1% level of probability, *** Significant at 0.1% level of probability; P = Phenotypic, G = Genotypic, E = Environmental

significant genotypic and phenotypic correlation was reported between these two characters. It is clear from the above results that seed yield per plant exhibited positive and significant correlation with number of branches per plant, number of pods per plant, biological yield per plant, 100 seed weight and harvest index. These results are in agreement with the findings of Ghafoor *et al*. (1999), Santha and Veluswamy (1998) and Patil and Narkhede (1987)

Seed yield per plant was observed to be negatively associated with days to maturity and plant height. The characters like number of branches per plant, number of pods per plant, 100 seed weight and harvest index are also positively associated among themselves indicating the simultaneous improvement of these characters by selection.

It can be concluded from the study that characters like number of branches per plant, number of pods per plant, biological yield per plant, 100 seed weight and harvest index contribute directly for yield per plant. Hence direct selection for these traits will be rewarding for selection of high yielding genotypes.

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