



(RESEARCH PAPER IN AGRONOMY)

Abstract

The present investigation was undertaken with the objective to study correlation between various yield and yield attributing traits among the 188 RIL population developed from the cross between ICPL 20097 and ICP 8863 (maruti). Field experiments to study 14 important agronomic traits were carried out at two locations ARS, Tandur and College farm, PJTSAU during Kharif 2012 and 2013 at Tandur and Kharif 2013 at PJTSAU, respectively. Pooled analysis of data from all the locations showed a total of 91 pair wise combinations among the fourteen traits studied, of which 31 combinations were found to be significantly correlated. Yield per plant showed positive significant correlation with pods per plant at across the environments and within all the individual environment and positive correlation with pod weight, plant height and secondary branches at across the environments. Thus, improvement of yield per plant can be achieved by direct selection through these significantly positively associated characters.

Key Words Correlation, Pooled analysis, Direct effects, RILs.

Introduction

Pigeonpea is one of the major grain legume crops of the tropics and subtropics. It is an often cross pollinated, diploid ($2n=22$) crop species with genome size of 833.07 Mbp. Besides its main use as dhal (dry, dehulled, split seed used for cooking), its tender, green seeds are used as a vegetable, crushed dry seeds as animal feed, green leaves as fodder, stem as fuel wood and to make huts, baskets, etc. Evidence suggests that peninsular India as the place of its origin. Pigeonpea is often called as "biological plough" as its root system improves soil structure. Pigeonpea crop has wider adaptability, and is drought tolerant, prevents soil and water erosion and fixes atmospheric nitrogen. Yield is complex character and contributed by many component characters. Hence the information on the correlation between yield and its component characters is a prerequisite for crop improvement. Keeping in this view present study was undertaken to know the nature of relationship existing between the 188 RILs and their parents for 14 quantitative characters.

Materials and Methods

188 RIL population along with their parents (ICPL 20097 and ICP 8863) were sown at two locations i.e., College farm, Rajendranagar, PJTSAU and Research farm, Agricultural Research Station, Tandur in randomized block design (RBD) with two replications using 4 meter long rows, spaced 75 cm apart during the cropping season of 2012-13 and 2013-14. The plant to plant spacing was maintained at 30 cm in both the experiments (Figure 1). All the recommended package of practices was followed. The observations on three randomly selected plants at the middle of the row from each RIL (to avoid border effect) and parents were recorded for the following morphological parameters i.e. plant height, number of primary branches, number of secondary branches, base height, leaf area, pod weight, number of seeds per pod, pod length, seed weight, pod width, days to 50% flowering, days to 75% pod maturity, pods per plant, and yield per plant. The correlation coefficients were worked out to determine the degree of association of a character with yield and also among the yield components. Phenotypic correlations were computed by using the formula as given by Weber and Moorti (1952).

Results and Discussion

Knowledge of the association between various agronomic characters is essential to conceptualize, identify, and develop ideal plant types through effective planning of recombination, and deployment of selection indices. The correlation matrix helps to select accessions with a desired combination of trait from the collection. Pooled analysis of data from all the locations showed a total of 91 pair wise combinations among the fourteen traits studied, of which 16 combinations were found to be significant at 1% level and 15 combinations were significant at 5% level correlated (Table 1).

Plant height showed consistently positive correlation with base height at across the environments and within individual environment. The plant height exhibited positive and significant association with primary branches at three locations which are PJTSAU 2013, Tandur 2013 and Tandur 2012. It also has positive correlation with secondary branches at location PJTSAU 2013, Tandur 2013. However; the plant height had positive and significant correlation with yield at across the environments and two individual environments i.e. PJTSAU 2013 and Tandur 2013. It showed positive correlation with pod width at overall environment, PJTSAU 2013 and Tandur 2012. Plant height was found positively associated with pods per plant and seed weight at across the environment and Tandur 2013, whereas at locations, PJTSAU 2013 and Tandur 2013, plant height showed positive correlation with pod weight and pod length, respectively (Table 3). The plant height was positively correlated with yield per plant which was supported by Rahman *et al.*, (1995), Spanner *et al.*, (1996), Kumar and Kumar (1997) and Gautam *et al.*, (1999) results.

Primary branches showed maximum positive significant association with secondary branches at overall locations correlation (0.260) (Table 2). Primary branches was found positively associated with days to 75% pod maturity (0.192), days to 50% flowering (0.156) during overall correlation. However, at all three individual locations, PJTSAU 2013, Tandur 2013 and Tandur 2012 primary branches showed positive correlation with plant height. Primary branches also exhibited positive significant correlation with pods per plant and yield at Tandur 2013. These results were in agreement with the results reported by Sidhu, *et al.* (1985). Secondary Branches showed positive significant correlation with plant height (0.434) and primary branches (0.260) at across the environments and within the individual environment except at Tandur 2012 (Table 2). It also exhibited positive significant correlation with base height at across the environments and within individual environment except at Tandur 2013. Secondary branches had positive significant correlation with days to 50% flowering at across the environment and Tandur 2013. It was found positively associated with yield, leaf area, pod length and pod width at across the environment (Table 3).

Base height exhibited significant positive association with plant height at across the environments and within individual environment. It was found positively correlated with secondary branches at across the environments and within individual environment except at Tandur 2013. Base height exhibited positive significant association with pod weight and pod width at the overall environments & PJTSAU 2013 and at Tandur 2013, base height showed positive significant association with seeds per pod, yield and seed weight whereas, at Tandur 2012 base height showed negative significant association with seeds per pod and days to 50% flowering (Table 3). Leaf area showed maximum positive significant association (0.194) with secondary branches in

pooled location and at Tandur 2013. Leaf area exhibited significant positive association with pod width at across the environments & PJTSAU 2013 and also showed positive correlation with days to 75% pod maturity at individual location i.e. Tandur 2013. However, the Leaf area had negative correlation with days to 75% pod maturity at Tandur 2012. Leaf area showed positive significant association with seed weight at Tandur 2013 and Tandur 2012. At location Tandur 2012, leaf area showed positive correlation with pod length and yield (Table 3).

Days to 50% flowering showed maximum positive correlation with days to 75% pod maturity (0.957-max.) at across the environments and within individual environment (Table 2). It was also exhibited significant positive correlation with primary branches and secondary branches at across the environments and at location Tandur 2013 with secondary branches and leaf area. However, days to 50% flowering showed positive correlation with seed weight and negative significant correlation with base height at Tandur 2012 (Table 3). The days to 50% flowering had significant and strongly positive association with secondary branch per plant and days to 75 per cent maturity. Similar trend was reported by Sodavadiya *et al.* (2009) and Linge *et al.* (2010) and Prasad *et al.* (2013). Days to 75% pod maturity showed significant positive correlation with days to 50% flowering at across the environments and within individual environment. It was also exhibited significant positive association with primary branches and length of pods at across the environment and at location Tandur 2013, showed significant positive association with secondary branches and leaf area. At Tandur 2012, days to 75% pod maturity showed negative significant association with leaf area and positive association with seed weight. Days to 75 per cent pod maturity exhibited highly significant correlation with days to 50% flowering and secondary branches (Table 3). This was in accordance with results obtained by Sinha *et al.* (1987). Seeds per pod showed positive significant association with yield at all the individual environments. It exhibited significant positive association with pod width with pooled environment data. It showed positive correlation with base height but negative and significant correlation with leaf area at Tandur 2013. It showed negative and significant correlation with base height at Tandur 2012 (Table 3). Pod weight showed positive significant correlation with pod length and seed weight at across the environments and within the individual environment except at PJTSAU 2013. However at location, PJTSAU 2013, it exhibited positive significant association with plant height and base height. Pod weight showed positive correlation with leaf area at all the individual environments except at PJTSAU 2013 and it was also observed that pod weight had positive correlation with pod width and secondary branches at across the environments & at Tandur 2013 (Table 3). Pod length was found positively associated with pod weight at across the environments and within the individual environment except at PJTSAU 2013. Pod length exhibited positive significant correlation with pod width at across the environments and Tandur 2013. It showed positive significant correlation with seed weight, secondary branches & days to 50% flowering at across the environments and pods per plant, plant height Pod length was found positively associated with pod weight at Tandur 2013 and at Tandur 2012 locations (Table 3). Pod width showed significant positive association with plant height at across the environments and within the individual environment. Pod width was found positively associated with leaf area, pods per plant at across the environments and PJTSAU 2013. It was also found positively associated with pod weight, seed weight, yield and pod length at overall correlation and Tandur 2013. It was observed that, at across the environments pod width had positive significant correlation with base height, seeds per pod and secondary branches (Table 3). Seed weight showed significant positive association with pod weight at across the environment and within the individual environment except PJTSAU 2013. Seed weight exhibited significant positive association with plant height & Pod width at across

the environment & Tandur 2013. At Tandur 2013 & Tandur 2012, seed weight showed significant positive correlation with yield. It was also showed positive correlation with leaf area & pod length at across the environment, pods per plant & base height at Tandur 2013 and pod length, days to 50% flowering and days to 75 per cent pod maturity at Tandur 2012 (Table 3).

Pods per plant showed significant positive association with yield at across the environments and within all the individual environments. It exhibited significant positive association with plant height, pod weight at across the environments and pod width at PJTSAU 2013. It showed positive association with secondary branches, seed weight, pod length, primary branches and plant height at Tandur 2013 (Table 3). This corroborates the findings of Sodavadiya *et al.* (2009). Number of pods per plant exhibited positive and significant correlation with plant height and seed yield per plant in both the generations. Sinha *et al.* (1987) also reported the same. Yield showed positive significant correlation with pods per plant at across the environments and within all the individual environments. Yield also has positive correlation with pod weight, plant height and secondary branches at across the environments (Table 1). It has positive significant correlation with seeds per pod and plant height at PJTSAU 2013 and at Tandur 2013 it showed positive correlation with seeds per pod, plant height and secondary branches. Leaf area and seed weight also showed positive correlation with yield at Tandur 2012 (Table 3). Positive interrelationship between yield and these attributes have earlier been reported in pigeonpea by Bhadru (2010). Therefore, improvement of these characters can simultaneously improve yield per plant in pigeonpea.

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Figure 1. Photographs depicting the view of RIL population during Kharif 2013 at ARS, Tandur

Table 1. Estimation of phenotypic correlation coefficients between yield and yield attributing traits for pooled environments performance

| Traits | PH | PB | SB | BH | LA | FLW | PM | SP | PW | PL | PWD | SW | PP | YD |
|--------|--------|--------|--------|--------|--------|--------|--------|-------|--------|--------|--------|--------|--------|--------|
| PH | 1 | .064 | .434** | .336** | .129 | .057 | .049 | .041 | .115 | .107 | .199** | .158* | .146* | .248** |
| PB | .064 | 1 | .260** | .027 | .051 | .156* | .192** | -.056 | .052 | .024 | .001 | .118 | .048 | .024 |
| SB | .434** | .260** | 1 | .196** | .194** | .159* | .142 | -.111 | .063 | .178* | .182* | .128 | .113 | .206** |
| BH | .336** | .027 | .196** | 1 | .022 | .032 | .026 | .055 | .155* | .008 | .165* | .101 | .087 | .106 |
| LA | .129 | .051 | .194** | .022 | 1 | .122 | .111 | -.012 | .099 | .142 | .271** | .180* | .090 | .131 |
| FLW | .057 | .156* | .159* | .032 | .122 | 1 | .957** | .015 | .082 | .145* | .038 | .017 | .069 | .043 |
| PM | .049 | .192** | .142 | .026 | .111 | .957** | 1 | .001 | .092 | .109 | .028 | .017 | .083 | .064 |
| SP | .041 | -.056 | -.111 | .055 | -.012 | .015 | .001 | 1 | .023 | .013 | .177* | .047 | -.045 | .053 |
| PW | .115 | .052 | .063 | .155* | .099 | .082 | .092 | .023 | 1 | .155* | .372** | .145* | .105 | .114 |
| PL | .107 | .024 | .178* | .008 | .142 | .145* | .109 | .013 | .155* | 1 | .204** | .189** | .022 | -.006 |
| PWD | .199** | .001 | .182* | .165* | .271** | .038 | .028 | .177* | .372** | .204** | 1 | .180* | .186* | .218** |
| SW | .158* | .118 | .128 | .101 | .180* | .017 | .017 | .047 | .145* | .189** | .180* | 1 | .067 | .115 |
| PP | .146* | .048 | .113 | .087 | .090 | .069 | .083 | -.045 | .105 | .022 | .186* | .067 | 1 | .582** |
| YD | .248** | .024 | .206** | .106 | .131 | .043 | .064 | .053 | .114 | -.006 | .218** | .115 | .582** | 1 |

**Correlation is significant at the 1% level

* Correlation is significant at the 5% level

Table 2. Correlations values of the significant yield and yield related traits in ICPL 20097 X ICP 8863 RIL population across the environments

| Traits | Positive significant correlation | r value |
|--------------|----------------------------------|--------------|
| Plant Height | Secondary branches ** | 0.434 (max.) |
| | Base height** | 0.336 |
| | Pod width ** | 0.199 |

| Traits | Positive significant correlation | r value |
|--------------------------|----------------------------------|--------------|
| | Yield** | 0.248 |
| | Seed weight* | 0.158 |
| | Pods per plant* | 0.146 |
| Primary branches | Secondary branches** | 0.260 (max.) |
| | Days to 75% pod maturity** | 0.192 |
| | Days to 50% flowering* | 0.156 |
| Secondary Branches | Plant height** | 0.434 (max.) |
| | Primary branches** | 0.260 |
| | Base height** | 0.196 |
| | Leaf area** | 0.194 |
| | Yield** | 0.206 |
| | Days to 50% flowering* | 0.159 |
| | Pod length* | 0.178 |
| | Pod width* | 0.182 |
| Base Height | Plant height** | 0.336 (max.) |
| | Secondary branches** | 0.196 |
| | Pod weight* | 0.155 |
| | Pod width* | 0.165 |
| Leaf area | Secondary branches** | 0.194 (max.) |
| | Pod width** | 0.271 |
| | Seed weight* | 0.180 |
| Days to 50% flowering | Days to 75% pod maturity** | 0.957 (max.) |
| | Primary branches* | 0.156 |
| | Secondary branches* | 0.159 |
| | Length of pods* | 0.145 |
| Days to 75% pod maturity | Primary branches* | 0.192 |
| | Days to 50% flowering* | 0.957 (max.) |
| Seeds per pod | Pod width* | 0.177 |
| Pod weight | Pod width** | 0.372 (max.) |
| | Base height* | 0.155 |
| | Pod length* | 0.155 |
| | Seed weight* | 0.145 |
| Pod length | Pod width** | 0.204 (max.) |
| | Seed weight* | 0.189 |
| | Secondary branches* | 0.178 |
| | Days to 50% flowering* | 0.145 |
| | Pod weight* | 0.155 |
| Pod width | Plant height** | 0.199 (max.) |
| | Leaf Area** | 0.271 |
| | Pod weight** | .0372 |
| | Pod length** | 0.204 |
| | Yield** | 0.218 |
| | Secondary branches* | 0.182 |
| | Base height* | 0.165 |
| | Seeds per pod* | 0.177 |
| | Seed weight* | 0.180 |
| | Pods per plant* | 0.186 |

| Traits | Positive significant correlation | r value |
|----------------|----------------------------------|-------------|
| Seed weight | Pod length ** | 0.189(max.) |
| | Plant height * | 0.158 |
| | Leaf Area * | 0.180 |
| | Pod width * | 0.180 |
| | Pod weight * | 0.145 |
| Pods per plant | Yield** | 0.582(max.) |
| | Plant height * | 0.146 |
| | Pod weight * | 0.186 |
| Yield | Plant height** | 0.248 |
| | Secondary branches** | 0.206 |
| | Pod weight ** | 0.218 |
| | Pods per plant** | 0.582(max.) |

**Correlation is significant at the 1% level

*Correlation is significant at the 5% level

Table 3 Correlations of the yield and yield related traits in ICPL 20097 X ICP 8863 RIL population at overall and different environments

| Traits | Significant correlation | | | |
|--------------------------|----------------------------|----------------------------|----------------------------|------------------------------|
| | Overall correlation | PJTSAU 2013 | TANDUR 2013 | TANDUR 2012 |
| Plant Height | Base height** | Base height** | Base height** | Base height* |
| | - | Primary branches* | Primary branches** | Primary branches* |
| | Secondary branches** | Secondary branches** | Secondary branches** | - |
| | Yield** | Yield** | Yield** | - |
| | Pod width ** | Pod width* | Pod length* | - Pod width* |
| | Pods per plant* | Pod weight** | Pods per plant** | - |
| | Seed weight* | - | Seed weight* | - |
| Primary branches | Days to 50% flowering* | Plant height* | Plant height** | Plant height* |
| | Secondary branches** | Secondary branches* | Secondary branches** | - |
| | Days to 75% pod maturity** | - | Pods per plant** | - |
| | - | - | Yield* | - |
| Secondary Branches | Plant height** | Plant height** | Plant height** | - |
| | Base height** | Base height** | - | Base height*(-) |
| | Primary branches** | Primary branches* | Primary branches** | - |
| | Days to 50% flowering* | - | Days to 50% flowering** | - |
| | Yield** | - | - | - |
| | Leaf area** | - | - | - |
| | Pod length* | - | - | - |
| | Pod width * | - | - | - |
| Base Height | Plant height** | Plant height** | Plant height** | Plant height* |
| | Secondary branches** | Secondary branches** | Yield* | Secondary branches*(-) |
| | Pod weight * | Pod weight** | Seeds per pod* | Seeds per pod*(-) |
| | Pod width * | - | Seed weight** | Days to 50% flowering*(-) |
| Leaf area | Pod width ** | Pod width* | Days to 75% pod maturity** | Days to 75% pod maturity*(-) |
| | Secondary branches** | - | Secondary branches* | - |
| | Seed weight* | - | Pod weight* | Pod weight** |
| | - | - | Plant height* | Pod length* |
| | - | - | Seeds per pod*(-) | Yield** |
| | - | - | Days to 50% flowering** | - |
| Days to 50% flowering | Days to 75% pod maturity** | Days to 75% pod maturity** | Days to 75% pod maturity** | Days to 75% pod maturity** |
| | Secondary branches* | - | Secondary branches** | Base height*(-) |
| | Primary branches* | - | Leaf area** | Seed weight** |
| Days to 75% pod maturity | Days to 50% flowering* | Days to 50% flowering** | Days to 50% flowering** | Days to 50% flowering** |
| | Length of pods* | - | Leaf area** | Leaf area*(-) |
| | Primary branches* | - | Secondary branches** | Seed weight* |

| | | | | |
|----------------|------------------------|-----------------|----------------------|---------------------------|
| Seeds per pod | Pod width * | Yield* | Yield* | Yield* |
| | - | - | Base Height* | Base height*(-) |
| | - | - | Leaf area*(-) | - |
| Pod weight | Pod length * | Plant height** | Pod length** | Pod length** |
| | Seed weight* | - | Seed weight** | Seed weight* |
| | Base height* | Base height** | Leaf area* | Leaf area** |
| | Pod width ** | - | Pod width** | - |
| | - | - | Secondary branches* | - |
| Pod length | Pod weight * | - | Pod weight** | Pod weight** |
| | Pod width ** | - | Pod width** | Leaf area* |
| | Seed weight* | - | Pods per plant** | Seed weight** |
| | Secondary branches* | - | Plant height* | - |
| | Days to 50% flowering* | - | - | - |
| Pod width | Plant height** | Plant height* | Plant height** | Plant height* |
| | Leaf Area** | Leaf Area* | - | - |
| | Pod weight ** | - | Pod weight** | - |
| | Seed weight* | - | Seed weight* | - |
| | Yield** | - | Yield* | - |
| | Pod length ** | - | Pod length** | - |
| | Pods per plant* | Pods per plant* | - | - |
| | Base height* | - | - | - |
| | Seeds per pod* | - | - | - |
| | Secondary branches* | - | - | - |
| Seed weight | Pod weight * | - | Pod weight** | Pod weight* |
| | Leaf Area* | - | Yield* | Yield** |
| | Plant height* | - | Plant height* | Pod length** |
| | Pod width* | - | Pod width* | Days to 50% flowering** |
| | Pod length ** | - | Pods per plant** | Days to 75% pod maturity* |
| | - | - | Base height** | - |
| Pods per plant | Yield** | Yield* | Yield** | Yield** |
| | Plant height* | Pod width* | Secondary branches** | - |
| | Pod weight * | - | Seed weight** | - |
| | - | - | Pod length** | - |
| | - | - | Primary branches** | - |
| | - | - | Plant height** | - |
| Yield | Pods per plant** | Pods per plant* | Pods per plant** | Pods per plant** |
| | Pod weight ** | Seeds per pod* | Seeds per pod* | Seeds per pod* |
| | Plant height** | Plant height** | Plant height** | Leaf area** |
| | Secondary branches** | - | Secondary branches** | Seed weight** |
| | - | - | Seed weight* | - |
| | - | - | Pod width* | - |
| | - | - | Base height* | - |
| | - | - | Primary branches* | - |

**Correlation is significant at the 0.01 level

* Correlation is significant at the 0.05 level