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# CORRELATION BETWEEN YIELD AND YIELD RELATED TRAITS IN PEARL MILLET GERMPLASM LINES

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## SUMMARY

Pearl millet is one of the most important dual-purpose crops which is mainly grown for grain and fodder. Pearl millet contains enormous phenotypic diversity, that's why it is an ideal crop to study diversity. A field experiment was conducted using 60 genotypes of pearl millet during *Kharif,* 2017 (in one environment) and *Kharif*, 2018 (in two environments, irrigated and unirrigated) to find out the correlation between yield related traits and yield in different environments. The traits, *i.e.* panicle length, panicle girth, number of productive tillers/plant, 1000 grain weight, dry fodder yield were found to be significantly correlated with grain yield/plant in all environments. These traits can be considered as an important yield determining traits can be given due attention during population and hybrid development.

**Key words :** pearl millet, correlation, yield, yield contributing traits

Pearl millet (*Pennisetum glaucum*) is the most widely grown type of millet. Because of its tolerance to difficult growing conditions such as drought, low soil fertility and high temperature, it can be grown in areas where other cereal crops, such as maize (*Zea mays*) or wheat (*Triticum aestivum*), would not survive (Basavaraj et al. 2010). Pearl millet is an ideal crop species for basic and applied research due to low chromosome number, short life cycle, easy selfing and crossing, plasticity for tillering, high number of seeds per panicle, good transplanting success and a low seed rate (Khairwal *et al.,* 1999). Genetic variability plays a key role in the improvement of target traits since it offers natural and artificial selection to tailor genotypes to better suit diverse agro-ecological conditions. Therefore, knowledge of the existing genetic variability/diversity is required for the development of new high yielding varieties of pearl millet and also the extent of association among the yield contributing characters. Direct selection for yield is not so much easy as grain yield is a complex character. So, it is necessary to have the knowledge of inter-relationship among the yield components and especially with yield, which therefore will be useful to the plant breeder for designing an effective selection programme. Therefore, the simple way to improve grain yield is through improvement in contributing characters such as number of tillers/plant, panicle length, panicle girth, number of grains/panicle, 1000-grain weight, etc. along with yield (Arya *et al.,* 2009). Therefore, knowledge of nature and magnitude of variability existing in available breeding material, the association of component characters with yield and their exact contribution through direct and indirect effect are very important in order to have appropriate choice of characters for selection of desirable genotypes under planned breeding programme for yield enhancement.

Keeping these in view, the present investigation was carried out to know the correlation between yield and yield related traits.

## MATERIALS AND METHODS

The present investigation was carried out by taking 60 genotypes of pearl millet including hybrids, composites, maintainer lines, white grain lines and high iron and zinc lines. All the lines were made available from Bajra Section. The first year field experiment was carried out in the *Kharif*, 2017 at the Bajra Research Area of Department of Genetics and Plant Breeding, Chaudhary Charan Singh Haryana Agricultural University, Hisar. In second year during *Kharif*, 2018, two trials were laid out, one at the Bajra Research Area of Department of Genetics and Plant Breeding (Irrigated) and another at research area of Dryland Section, Department of Agronomy (Rainfed), Chaudhary Charan Singh Haryana Agricultural

University, Hisar. The experiment was laid out in Randomized Block Design (RBD) with two replications. Trials were irrigated with life saving irrigations except the rain-fed trial in unirrigated environment. All recommended package of practices were adopted to raise a good crop of pearl millet. Data were collected on important morphological traits and then pooled analysis was done.

## RESULTS AND DISCUSSION

### Analysis of variance (ANOVA)

For pooled analysis (E4), mean sum of square was significant for all the characters. It means that further statistical analysis can be done with yield and yield related traits (Table 1).

Mean, Range, Phenotypic coefficient of variation (PCV), Genotypic coefficient of variation (GCV), Heritability and Genetic advance as per cent of mean for pooled analysis

This was observed that magnitude of PCV was higher than GCV which indicated that there was influence of environment on all the traits in all three environments and in pooled also. The mean, range, PCV, GCV, heritability and genetic advance as per cent of mean of different germplasm lines for different traits have been presented in Table 2. In case of pooled analysis, only the trait *i.e.* dry fodder yield/plant had high GCV, PCV, heritability and genetic advance as per cent of mean which means there was presence of additive gene action and these traits can be easily exploited through simple selection procedures. The characters which showed large variation includes days to 50% flowering (41-54 days), panicle length (14.6-31.9 cm), panicle diameter (13.3-29.6 mm), number of productive tillers/plant (1.8-3.7), plant height (62.5-255.8 cm), 1000 seed weight (8.6-11.6 g), dry fodder yield/plant (65.8-215.7 g) and grain yield/plant (21.6-111.5 g) for pooled analysis in present study (Table 5).

Similar results for morphological traits also showed by Satyavathi *et al.* (2009); Bashir *et al.* (2014); Sharma and Bhatnagar (1996). Shah *et al.* (2012) found that mean values of days to 50% flowering, number of productive tillers per plant, plant height and spike length showed a large variation. Similarly, Sharma *et al.* (2003) observed genetic variation among 115 germplasm lines of pearl millet for the trait, days to heading. Naeem *et al.* (2002)

TABLE 1
Analysis of Variance (ANOVA) for morphological and yield characters for pooled data

| Source of variation (SV) | Mean sum of squares | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Degree of freedom (df) | Days to 50% flowering | Panicle length | Panicle diameter | Productive tillers/ plant | Plant height | 1000-grain weight | Dry fodder yield/plant | Grain yield/ plant |
| Replication | 1 | 143.1 | 62.6 | 1.9 | 15.9 | 1223.1 | 48.7 | 23.4 | 0.2 |
| Treatment | 59 | 21.5** | 28.8** | 32.7* | 0.6** | 3794.5** | 3.5** | 7209.6** | 2405.2** |
| Error | 59 | 5.3 | 10.0 | 10.1 | 3.5 | 94.9 | 4.8 | 138.3 | 51.3 |

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

TABLE 2
Grand mean ±S.E. (m), range, PCV, GCV, heritability and genetic advance as per cent of mean for quantitative characters for Pooled

| Characters | Mean ±S.E(m) | Range | PCV (%) | GCV (%) | Heritability ($h^2$) (%) | Genetic advance as % of mean |
|---|---|---|---|---|---|---|
| Days to 50% flowering (Days) | 48±0.9 | 41-54 | 6.9 | 6.0 | 66.5 | 10.8 |
| Panicle Length (cm) | 20.4±1.3 | 14.6-31.9 | 19.4 | 15.9 | 87.3 | 26.9 |
| Panicle Diameter (mm) | 19.8±0.9 | 13.3-29.6 | 18.8 | 16.9 | 81.5 | 31.5 |
| Productive tillers per plant (number/plant) | 2.9±0.2 | 1.8-3.7 | 19.7 | 13.9 | 60.0 | 70.3 |
| Plant Height (cm) | 150.9±17.2 | 62.5-255.8 | 27.9 | 19.8 | 50.3 | 58.9 |
| 1000 seed weight (g) | 10.2±0.4 | 8.6-11.6 | 12.6 | 11.2 | 78.8 | 10.5 |
| Dry Fodder Yield/plant (g) | 126.5±16.9 | 65.8-215.7 | 32.5 | 27.2 | 70.4 | 57.1 |
| Grain yield/plant (g) | 52.3±1.6 | 21.6-111.5 | 47.5 | 47.3 | 49.3 | 57.1 |

evaluated nine varieties of pearl millet and reported significant differences for plant height.

High GCV, PCV, heritability and genetic advance as percent of mean were observed for dry fodder yield/ plant which indicated that variation of these characters contributed directly to the total variability. Further, it has been noted that there was narrow range of difference in the values of GCV and PCV indicated that if there is any selection pressure operates on these characters, it may be helpful in improvement at early generation. High GCV and PCV values were reported for grain yield per plant by Vinodhana *et al.* (2013); Lakshmana *et al.* (2003); Subi and Idris (2013).

**Correlation coefficient analysis**

The main breeding objective of any selection programme is improvement of yield character. But as we know that yield is a complex quantitative character which is highly influenced by the environment, so direct selection for yield is not effective. So, correlation studies are done. The prime aim of correlation studies is indirect selection for traits which contribute in increasing the yield either directly or indirectly and to know the suitability of various characters for indirect selection because selection for any particular trait brings about undesirable changes in other associated characters. So, it is important to know the correlation between yield and its component traits and also to know correlation of traits among themselves in selection programmes. This has been observed that the magnitude of correlation coefficients at genotypic level was higher than corresponding correlation coefficients at phenotypic level. This showed that there was a strong inherent association between different attributes.

In case of pooled analysis (Table 3), the traits *i.e.* panicle length, panicle diameter, number of productive tillers/plant, 1000 grain weight, dry fodder yield/plant showed positive and significant association with grain yield/plant at both genotypic and phenotypic level while significant negative correlation was shown by days to 50% flowering. Along with these traits, plant height showed positive significant correlation with grain yield/plant at phenotypic level.

Similarly, Govindaraj *et al.* (2009); Depke *et al.* (2014) found that there was a positive and significant association of spike length, number of productive tillers per plant and 1000 grain weight with grain yield.

In present study, the correlation between productive tillers per plant and grain yield is in agreement with the previous work of Balakrishnan and Das (1995); Harrer and Karad (1998); Arya *et al.* (2009). They also have reported that productive tillers per plant was principal component of grain yield in pearl millet. Positive association of plant height with grain yield also reported by Poongodi and Palannisamy (1995); Harrer and Karad (1998). Previous findings of Kulkarni *et al.* (2000) and Arya *et al.* (2009) also found significant and positive association between 1000 grain weight and grain yield. Positive and significant correlation of fodder yield with grain yield was also reported by Harrer and Karad (1998); Kulkarni *et al.* (2000); Arya *et al.* (2009) working with pearl millet. Panicle length and girth showed positive and significant association with grain yield

TABLE 3

Estimates for Genotypic (above diagonal) and Phenotypic (below diagonal) Correlation Coefficient of pearl millet germplasm lines for quantitative characters (Pooled)

| Characters | Days to 50% flowering (days) | Panicle length (cm) | Panicle diameter (mm) | Productive tillers/plant (no./plant) | Plant height (cm) | 1000-seed weight (g) | Dry Fodder yield/plant (g) | Grain yield/ plant (g) |
|---|---|---|---|---|---|---|---|---|
| Days to 50% flowering (Days) | 1 | -0.58** | -0.78** | -0.49** | -0.55** | -0.78** | -0.58** | -0.63** |
| Panicle Length (cm) | -0.63** | 1 | 0.85** | 0.43** | 0.22 | 0.73** | 0.73** | 0.79** |
| Panicle Diameter (mm) | -0.84** | 0.77** | 1 | 0.62** | 0.56** | 0.87** | 0.75** | 0.82** |
| Productive tillers per plant (number/plant) | -0.53** | 0.43** | 0.47** | 1 | 0.31** | 0.57** | 0.58** | 0.52** |
| Plant Height (cm) | -0.65** | 0.20 | 0.36** | 0.30** | 1 | 0.61** | 0.52** | 0.20 |
| 1000 seed weight (g) | -0.80** | 0.64** | 0.77** | 0.37** | 0.33** | 1 | 0.93** | 0.74** |
| Dry Fodder Yield/plant (g) | -0.71** | 0.59** | 0.77** | 0.51** | 0.31** | 0.82** | 1 | 0.78** |
| Grain yield/plant (g) | -0.64** | 0.79** | 0.63** | 0.46** | 0.34** | 0.62** | 0.64** | 1 |

* *Significant at p= 0.01, * Significant at p= 0.05.

which means that these are also important yield determining characters.

Days to 50% flowering showed significant but negative correlation with grain yield/ plant which is also reported by Bashir et al. (2014).

## CONCLUSION

The study revealed that there is substantial genetic variability in pearl millet germplasm lines and there is a scope for improvement of yield via improving the traits, panicle length, panicle diameter, number of productive tillers, plant height, 1000 seed weight and dry fodder yield/plant traits through selection. These characters were important yield determining traits as indicated by results of correlation studies during 2017 and 2018. So, it can be said that these traits should be given importance and due attention during the course of development of populations and inbred lines.

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