Genetic Variability Studies for Yield and Related Attributes in Finger millet (*Eleusinecoracana*) Genotypes

Abstract

The fifty-finger millet (Eleusinecoracana) genotypes used in the current experiment were examined in four different environments: E1 and E2 at the Student Research Farm at the C.S.A.U.A.&T. Kanpur, and E3 and E4 seeded at the Research Farm in Daleep Nagar, Kanpur. The genotypes were assessed using a randomised block design with three replications to determine genetic variability for the following traits: days to 50% flowering, days to maturity, plant height (cm), number of productive tillers per plant, number of fingers per ear, length of finger (cm), finger width (cm), ear head width (cm), ear head length (cm), ear head weight (g), ear head weight (g), straw yield per plant (g), harvest index (%), 1000 grain weight (g), protein content (%) and grain yield per plant (g). This experiment revealed low GCV and PCV for days to 50% flowering, days to maturity, ear head width across all conditions, and protein content across all environments with the exception of E2. High levels of GCV and PCV were found in the ear head weight, straw yield per plant, 1000 grain weight, and grain yield per plant. In every context, the magnitude of GCV was often lower than the corresponding PCV. Plant height, finger width, ear head weight, straw yield per plant, harvest index, 1000 grain weight, and grain yield per plant all showed strong heritability along with high genetic progress. As a result of the cumulative impact of its component features, the yield has a complicated and highly variable character. It is the outcome of the combined influence of its constituent features, therefore straight selection for yield might not be very effective.

Introduction

Because finger millet is a valuable food grain and has a wide range of adaptability to different geographical regions in India, it is mostly farmed as a rainfed crop. It is recognised for having more nutrients than many cereals, including calcium (344 mg/100 g), protein (7–10%), iron, and other minerals. In India, finger millet is grown on a total of 10.04 lakh hectares, with a productivity of 1747 kg/ha and a yield of roughly 17.55 lakh tonnes (India stat, 2019- 2020). The United States National Academies consider finger millet to be one of the most nutrient-dense primary cereals, making it a possible "super cereal". An annual plant called millet is cultivated extensively as a significant grain crop, mostly in arid and semi-arid regionsof Africa and Asia. Other common names for it are mandua, nagli, kapai, and thaidalu. According to legend, finger millet originated in Africa, with India serving as a secondary origin region (Chandra et al., 2016). Epidemiological research has shown that regular consumption of whole grains and their products can reduce the risk of heart disease, type II diabetes, obesity, gastrointestinal cancer, anti-tumor and atherosclerogenic effects, antioxidant and antimicrobial properties, and a variety of other diseases (Mckeown, 2002). In addition to its nutritional benefits, finger is highly environmentally sustainable. It has a relatively short growing season, little soil fertility, and can easily endure extreme climatic conditions. Soil salinity is one of the abiotic factors limiting the growth of finger millet. This destructive environmental stressor has a significant detrimental effect on crop quality and growth (Hema et al., 2014). Given its benefits, this crop requires significant attention in terms of crop improvement programmes to increase yield. Finding and developing superior genotypes with broader environmental adaptability with knowledge of variability, inheritance, direction, and magnitude of association between various variables is one way to increase its production and productivity. The degree and kind of genetic variability of every crop is genetically controlled, environmentally influenced, and determines the success in plant breeding for yield and yield-contributing traits (Wright, 1921 and Fisher, 1936).

Material and Methods

The current study was carried out in the College of Agriculture's Student Research Farm at Chandra Shekhar Azad University of Agriculture and Technology in Kanpur, as well as the Research Farm in Daleep Nagar Kanpur (Table 1). In order to raise a superior crop, appropriate crop management techniques were used. Evaluation of fifty distinct finger millet genotypes that were sown in Kharif 2021 using a Randomized Block Design with three replications and four different surroundings, with seven rows and a spacing of 30 cm by 10 cm for each plot. The following biometric measurements were made on five randomly selected plants from each genotype in three replications: days to 50% flowering, days to maturity, plant height, number of fingers/ear, finger length, finger width, ear head, weight, thousand seed weight, yield of grains and straw per plant, harvest index and protein content. To raise a successful crop, all the suggested set of procedures were performed, along with the mandatory preventative plant protection measures. Data was statistically analysed once observations were gathered. the variability was estimated in accordance with the procedure for analysis of variance recommended by Panse and Sukhame (1985), PCV and GCV were calculated by the formula by Burton (1952), heritability in broad sense (h2) by Burton and De Vane (1953) and genetic advance i.e., the expected genetic gain were calculated by using the procedure given by Johnson et al. (1955).

Result and Discussion

Analysis of variance imparted for fifteen characters studied was significant mean sum of square as shown in Table 2, these indicates there is a sufficient variability present in the genotypes taken for the study. This indicated that, the choice of the germplasm line was appropriate they were quite distinct in relation to the characters studied and hence, suitable for genetical studies. The highest mean value was recorded in E_1 and lowest found in the E_4 for all the characters except for harvest index. In harvest index, the lowest mean value was recorded for E_2. All the genotypes showed early flowering and early maturity in E_2 and E_4 environment as compared to pooled mean. The highest grain yield per plant as per mean values was recorded in E_1 followed by E_2, E_3 and E_4 as shown in Table 3.For days to 50% flowering, days to maturity, ear head diameter for all environments, and protein content for all environments with the exception of E2, the genotypic and phenotypic coefficients of variation were low. The characteristics, including finger length, finger width, and ear head length, displayed moderate GCV and PCV values for all settings, harvest index for all environments with the exception of E4, and plant height for environments E1, E3, and pooled. High levels of GCV and PCV were found in the ear head weight, straw yield per plant, 1000 grain weight, and grain yield per plant. For every context, the genotypic coefficient of variance was typically smaller than the corresponding phenotypic coefficient of variation. The estimates of heritability in broad sense ranged from 10.70 to 95.30 percent in E_1, 18.80 to 97.5 in E_2, 2.40 to 96.10 in E_3 and 27.90 to 96.00 in E_4 and in pooled analysis, it varied from 15.20 to 92.80. The genetic advance as percent of mean varied from 4.12 to 48.81 in E_1, 9.64 to 53.19 in E_2, 1.05 to 57.28 in E_3 and 9.14 to 74.17 in E_4 and in pooled analysis, it varied from 5.41 to 55.17. High heritability coupled with high genetic advance was recorded for plant height, finger width, ear head weight, straw yield per plant, harvest index, 1000 grain weight and grain yield per plant for all the environment while, high heritability coupled with low genetic advance was observed in days to 50 % flowering for E_1. The yield is a complex and highly variable character and is a result of cumulative effect of its components characters and therefore, direct selection for yield may not be very effective. Thus, to bring chances in yield and other characters to a desire direction, proper understanding of association among the yield and yield contributing characters is must.

Conclusion

Based on present investigation experimental material consisting of 50 genotypes were studied to estimate the genetic variability for 15 characters. Genetic variability existence was confirmed by significant differences for different characters through ANOVA for all the environments as well as genotypic coefficient of variation. Hence, material has considerable genetic variability for selection program. Plant height, finger width, ear head weight, straw production per plant, harvest index, 1000 grain weight, and grain yield per plant all showed significant heritability along with high genetic progress for all the environments and pooled making these characters available for selection using appropriate direct selection parameters.