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Correlation analysis of yield and yield-contributing traits in pearl millet (*Pennisetum glaucum* L.) germplasm

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Abstract
An experiment entitled “Genetic diversity studies in pearl millet [Pennisetum glaucum (L.) R. Br.]”. was carried out during Kharif 2024 at the Research Farm of National Agriculture Research Project, Chhatrapati Sambhajinagar. The experiment was laid out in Randomized Block Design (RBD) with 42 genotypes and two replications to estimate the extent of genetic variability, heritability, genetic advance, correlation coefficient and path coefficient analysis among all the genotypes.
The characters, including the number of productive tillers per plant, panicle girth, 1000 Grain Wt. (g), and Fodder yield per plot, demonstrated a positive and significant correlation with grain yield per plant. In contrast, traits such as panicle length, days of maturity, Harvest Index, plant height showed a positive yet non-significant effect. This indicates the substantial role and importance of these characters in the development of superior genotypes with high yield potential.

Keywords: Pearl millet, genetic divergence, correlation and path analysis

Introduction
Pearl millet (*Pennisetum glaucum* L. R. Br.) is an annual, diploid (2n = 14), highly cross-pollinated cereal crop belonging to the family Poaceae, subfamily Panicoideae. Believed to have originated in West Africa (Vavilov, 1950), it is now extensively cultivated in arid and semi-arid regions owing to its exceptional drought tolerance, short growth cycle, and high photosynthetic efficiency. In India, it is primarily grown during the kharif season, with Rajasthan, Maharashtra, Uttar Pradesh, Gujarat, and Haryana accounting for the majority of production.
The crop thrives under 400-600 mm of annual rainfall and temperatures between 15 °C and 40 °C, with optimum growth occurring at 30-35 °C. It performs well in sandy loam to clay loam soils, tolerates marginal conditions, and is well adapted to low-input farming systems. Nutritionally, pearl millet surpasses many staple cereals, providing high protein, dietary fiber, essential minerals such as iron and zinc, and health-promoting polyunsaturated fatty acids (Singh *et al.*, 2021) [8]. Its low glycemic index and high resistant starch content make it particularly beneficial for managing lifestyle-related disorders (Anuradha *et al.*, 2021).
Genetic improvement in pearl millet relies on understanding variability, heritability, and genetic advance for key traits, alongside correlation and path coefficient analyses to identify traits exerting the greatest influence on yield. Assessing genetic diversity within germplasm helps identify superior and genetically divergent parents for hybridization, thereby accelerating the development of high-yielding, climate-resilient, and nutrient-dense cultivars (Singh *et al.*, 2021) [8].

Materials and Methods
The present study, entitled “Genetic Diversity Studies in Pearl Millet Germplasm [*Pennisetum glaucum* (L.) R. Br.]”, was conducted during *Kharif* 2024-2025. The experimental material, selected from the germplasm maintained at the National Agricultural Research Project, Chhatrapati Sambhajinagar, was evaluated in a Randomized Block Design (RBD) with two replications.
A total of 42 genotypes, comprising 40 inbred lines and two checks (ABPC 4-3 and AIMP 92901), were used.

The genotypes were sown in two rows of 4 m length each, with a spacing of 45 cm between rows and 15 cm between plants. Standard agronomic practices, including timely weeding, irrigation, and other intercultural operations, were carried out as per the crop's growth stage and requirements. Fertilizer was applied at the recommended dose, and all crop management activities were performed according to standard guidelines.
The experimental material was selected to represent wider diversity for various morphological and yield-related traits, ensuring comprehensive assessment of genetic variability.

Table 1: List of Genotypes

Sr. No	Entry	Sr. No	Entry
1	AUBI-15333R	21	AUBI-15280R
2	AUBI-15452R	22	AUBI-15287R
3	AUBI-15313R	23	AUBI-15050R
4	AUBI-15448R	24	AUBI-15309R
5	AUBI-15352R	25	AUBI-15221R
6	AUBI-15387R	26	AUBI-15346R
7	AUBI-15262R	27	AUBI-15286R
8	AUBI-15260R	28	AUBI-15052R
9	AUBI-15279R	29	AUBI-18097R
10	AUBI-15241R	30	AUBI-15022R
11	AUBI-15348R	31	AUBI-15071R
12	AUBI-15245R	32	AUBI-15024R
13	AUBI-15233R	33	AUBI-15415R
14	AUBI-15265R	34	AUBI-16287R
15	AUBI-15385R	35	AUBI-15374R
16	AUBI-15358R	36	AUBI-15184R
17	AUBI-15453R	37	AUBI-15137R
18	AUBI-15468R	38	AUBI-16630R
19	AUBI-15230R	39	AUBI-15043R
20	AUBI-1549R	40	AUBI-18801R
Checks I	ABPC 4-3	Checks II	AIMP-92901

Results and Discussion

Correlation Studies

Tables 4.8 and 4.9, present the genotypic and phenotypic correlation coefficients for grain yield and its component traits. Only statistically significant positive or negative associations are discussed in detail. In general, phenotypic correlation coefficients were observed to be higher than their corresponding genotypic coefficients.

Association of Grain Yield with Its Components

Grain yield per plant exhibited a significant positive association with days to maturity (P = 0.2054; G = 0.1400), plant height (P = 0.1611; G = 0.2050), number of productive tillers per plant (P = 0.4140; G = 0.5736), panicle girth (P = 0.2285; G = 0.3194), 1000-grain weight (P = 0.2326; G = 0.2854), fodder yield per plot (P = 0.3538; G = 0.5615), and harvest index (P = 0.0672; G = 0.1244) at both phenotypic and genotypic levels.

Days to 50% Flowering with Other Characters

Days to 50% flowering showed a significant positive correlation with days to maturity (G = 0.3319; P = 0.2631) at both levels. Non-significant positive correlations were observed with harvest index (G = 0.0669; P = 0.0593) and plant height (G = 0.0426; P = 0.0375). Significant negative correlations were recorded with number of productive tillers per plant (G = -0.2890; P = -0.2647) and fodder yield per plot (G = -0.4907; P = -0.4141). Non-significant negative associations were observed with panicle girth (G = -0.0414; P = -0.0337) and 1000-grain weight (G = -0.1668; P = -0.1709). Grain yield per plant had a significant negative correlation with days to 50% flowering (G = -0.3627; P = -0.2476).

Days to Maturity with Other Characters

Days to maturity had non-significant negative correlations with number of productive tillers per plant (G = -0.1959; P = -0.1924) and panicle length (G = -0.0760; P = -0.0670). It showed a non-significant positive association with 1000-grain weight (G = 0.0980; P = 0.0619), panicle girth (G = 0.1974; P = 0.1895), and harvest index (G = 0.1415; P = 0.0801). A significant positive correlation was recorded with fodder yield per plot (G = 0.4692; P = 0.2710). Association with plant height was positive but non-significant at the genotypic level (G = 0.0207) and negative non-significant at the phenotypic level (P = -0.0165). Grain yield per plant showed a non-significant positive correlation with days to maturity (G = 0.1400; P = 0.2054).

Plant Height with Other Characters

Plant height showed a significant positive correlation with panicle girth (G = 0.8060; P = 0.7310) and harvest index (G = 0.6440; P = 0.6150). Non-significant positive correlations were recorded with number of productive tillers per plant (G = 0.1195; P = 0.1138), fodder yield per plot (G = 0.0462; P = 0.0405), and grain yield per plant (G = 0.1195; P = 0.1138). Non-significant negative associations were observed with panicle length (G = -0.2126; P = -0.1333) and 1000-grain weight (G = -0.0403; P = -0.0434).

Number of Productive Tillers per Plant with Other Characters

Number of productive tillers per plant had a significant positive correlation with 1000-grain weight (G = 0.2536; P = 0.2343), fodder yield per plot (G = 0.3528; P = 0.2586), and grain yield per plant (G = 0.5736; P = 0.4140). Non-significant positive associations were observed with panicle length (G = 0.1832; P = 0.1528), panicle girth (G = 0.1152; P = 0.1076), and harvest index (G = 0.1002; P = 0.1071).

Panicle Length with Other Characters

Panicle length had non-significant positive correlations with 1000-grain weight (G = 0.2536; P = 0.2343), panicle girth (G = 0.1152; P = 0.1076), fodder yield per plot (G = 0.3528; P = 0.2586), and harvest index (G = 0.1002; P = 0.1071). Grain yield per plant showed a non-significant positive association with panicle length at the genotypic level (G = 0.0159) and a non-significant negative association at the phenotypic level (P = -0.0011).

Panicle Girth with Other Characters

Panicle girth had significant positive correlations with fodder yield per plot (G = 0.3721; P = 0.2729), harvest index (G = 0.6535; P = 0.5950), 1000-grain weight (G = 0.4171; P = 0.3992), and grain yield per plant (G = 0.3194; P = 0.2285).

1000-Grain Weight with Other Characters

1000-grain weight exhibited significant positive correlations with fodder yield per plot (G = 0.4599; P = 0.3387) and grain yield per plant (G = 0.2854; P = 0.2326). Non-significant positive correlations were observed with harvest index (G = 0.0064; P = 0.0030).

Fodder Yield per Plot with Other Characters

Fodder yield per plot showed a significant positive correlation with grain yield per plant (G = 0.5615; P = 0.3538). It also had a non-significant positive correlation at the genotypic level (G = 0.0429) and a non-significant negative correlation at the phenotypic level (P = -0.0323).

Harvest Index with Other Characters

Harvest index showed a non-significant positive association with grain yield per plant (G = 0.1244; P = 0.0672) at both levels.

Table 4.8: Estimation of phenotypic correlation coefficient in Bajra.

Characters	Days to 50% Flowering	Days to Maturity	Plant Height (cm)	No. of Tillers/Plant	Panicle Length (cm)	Panicle Girth (cm)	1000-Grain Wt.(g)	Fodder Yield/plant (g)	Harvest Index (%)	Grain Yield/plant (g)
Days to 50% flowering	1.0000	0.2631*	0.0375	-0.2647*	-0.0305	-0.0337	-0.1709	-0.4141***	0.0593	-0.2476
Days To Maturity		1.0000	-0.0165	-0.1924	-0.0670	0.1895	-0.0689	0.2710*	0.0801	0.2054
Plant height (cm)			1.0000	0.1138	-0.1333	-0.2318*	-0.0434	0.0405	-0.2765*	0.1611
Number of tillers per plant				1.0000	0.1528	0.1076	0.2343*	0.2586*	0.1071	0.4140
Panicle length(cm)					1.0000	0.0655	0.0950	0.0365	0.1155	-0.0011
Panicle girth (cm)						1.0000	0.3992***	0.2729*	0.5950***	0.2285
1000-Grain Wt.(g)							1.0000	0.3387**	0.0030	0.2326
Fodder Yield/plot(kg)								1.0000	-0.0323	0.3538
Harvest Index (%)									1.0000	0.0672

*, ** indicate significance at the 5% and 1% probability levels, respectively.

Table 4.9: Estimation of genotypic correlation coefficient in Bajra.

Characters	Days to 50% Flowering	Days to Maturity	Plant Height (cm)	No. of Tillers/Plant	Panicle Length (cm)	Panicle Girth (cm)	1000-Grain Wt.(g)	Fodder Yield/plant (g)	Harvest Index (%)	Grain Yield/plant (g)
Days to 50% flowering	1.0000	0.3319***	0.0426	-0.2890**	-0.0340	-0.0414	-0.1668	-0.4907***	0.0669	-0.3627
Days to maturity		1.0000	0.0207	-0.1959	-0.0760	0.1974	-0.0894	0.4692***	0.1415	0.1400
Plant height (cm)			1.0000	0.1195	-0.2126	-0.2494*	-0.0403	0.0462	-0.3613	0.2050
Number of tillers per plant				1.0000	0.1832	0.1152	0.2536*	0.3528***	0.1002	0.5736
panicle length(cm)					1.0000	0.0754	0.0917	0.0558	0.0694	0.0159
panicle girth (cm)						1.0000	0.4171**	0.3721***	0.6435***	0.3194
1000-Grain Wt.(g)							1.0000	0.4599***	0.0064	0.2854
Fodder Yield/plot(kg)								1.0000	0.0429	0.5615
Harvest Index (%)									1.0000	0.1244

*, ** indicate significance at the 5% and 1% probability levels, respectively.

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