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Correlation and path analysis in *rabi* sorghum [*Sorghum bicolor* (L.) Moench]

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Abstract

The present investigation was carried out to study the correlation and path analysis in *rabi* sorghum (*Sorghum bicolor* (L.) Moench) with the set of fifty genotypes of sorghum grown in Randomized Block Design with two replications. Correlation study indicated that plant height, leaf length, ear head length, ear head width and harvest index had significant positive association with grain yield per plant at both genotypic and phenotypic levels. The path analysis indicated that ear head length, ear head width exerted high direct positive effect on grain yield per plant.

Keywords: Correlation, path, grain yield, sorghum

Introduction

Sorghum [*Sorghum bicolor* (L.) Moench] is an important crop, used for food (as grain) and forage. It belongs to family Poaceae and genus Sorghum. Besides the traditional use of grain and fodder, several alternative products such as starch, syrup, jaggery, alcohol, sugar, wine, vinegar, silage, pulp in paper industry use, sweetener and natural pigments can be obtained. Use of ethanol extracted from sweet sorghum in automobiles holds a great promise for reducing air pollution from CO₂ and SO₂.

In the present investigation, phenotypic and genotypic correlation coefficients between yield and other related component characters and among themselves were estimated. Correlation studies indicate the magnitude of association between pairs of characters and are useful for selecting genotypes with desirable combination of characters which aids the plant breeder in improving crop yield. Path analysis is an important tool for partitioning the correlation coefficients into direct and indirect effects and indirect effects of an independent variable on the dependent variable. Thus, correlation in combination with path analysis could provide a better insight into the cause and effect relationship between different pairs of characters.

Material and Methods

Fifty germplasm lines were evaluated to study the genetic parameters, correlation and path analysis during *rabi* 2016-2017 at Agricultural College Farm, Bapatla. The experiment was laid out in Randomized Block Design (RBD) with two replications. Spacing between row to row and plant to plant was kept 45 cm and 15cm respectively. Recommended package of practices were followed for raising a normal crop. In each genotype, ten plants were selected randomly and used for collecting data on days to 50% flowering, plant height (cm), total no of leaves, leaf length (cm), leaf width (cm), ear head length (cm), ear head width (cm), grain yield per plant, 100 grain weight and harvest index (%).

Results and Discussions

Correlation analysis

Direct selection for yield and quality traits is not effective as they are complex quantitative traits and highly influenced by environment. High genotype and environment interaction will restrict the improvement, if selection is based on yield per se. The effective improvement in yield may be brought about through selection of yield component characters.

In the present study traits like plant height (0.5817** and 0.5413**), leaf length (0.3029** and 0.2344**), ear head length (0.8377** and 0.7653**), ear head width (0.6418** and 0.5932**) and harvest index (0.3032** and 0.2714**) showed significant positive association with grain

yield per plant both at genotypic and phenotypic levels. Other characters like days to 50% flowering (0.1525 and 0.1351), 100 grain weight (0.1197 and 0.1089) revealed non significant positive association at both genotypic and phenotypic levels and total number of leaves exhibited non significant negative genotypic association with grain yield (-0.0591) and positive non significant phenotypic association with grain yield (0.0022).

From the above results, it can be summarized that five out of ten characters included in the study recorded significant positive association with dependent variable *i.e* grain yield

per plant both at genotypic and phenotypic levels. The associations was strongest with ear head length, similar results were observed by (Aml *et al.* 2012) [1] followed by ear head width, plant height by (Manonmani *et al.* 2002) [6] and harvest index by (Patil *et al.* 2003 and Kassahun *et al.* 2015) [7, 4] and for leaf length by (Manonmani *et al.* 2002 and M Prabhakar *et al.* 2007) [6, 3]. This indicates that the alone characters are having important role in the process of selection for the improvement of the grain yield per plant. (Table 1 and Table 2).

Table 1: Estimates of Phenotypic correlation coefficients among yield and yield components in Sorghum [*Sorghum bicolor* (L.) Moench]

Character	Days to 50% flowering	Plant height (cm)	Total No. of leaves per plant	Leaf length (cm)	Leaf width (cm)	Ear head length (cm)	Ear head width (cm)	100 Grain weight (g)	Harvest index (%)	Grain yield per pant (g)
Days to 50% flowering	1.0000	0.0233	0.0342	0.2825 **	0.3336 **	0.2916 **	0.1156	-0.1761*	0.1676	0.1351
Plant height (cm)		1.0000	-0.0739	0.1830*	-0.1025	0.5365 **	0.2733 **	0.0453	0.2386 **	0.5413**
Total No.of leaves per plant			1.0000	-0.0557	-0.0274	-0.0701	-0.0477	-0.0645	-0.1013	0.0022
Leaf length (cm)				1.0000	0.2446 **	0.2993 **	0.0476	-0.0721	0.2172 **	0.2344**
Leaf width (cm)					1.0000	0.0865	0.0150	-0.2265 **	-0.1082	-0.0576
Ear head length (cm)						1.0000	0.4550 **	0.1041	0.3003 **	0.7653**
Ear head width (cm)							1.0000	0.0728	-0.0072	0.5932**
100 Grain weight (g)								1.0000	-0.0129	0.1089
Harvest Index (%)									1.0000	0.2714**
Grain yield per plant (g)										1.0000

*significant at 5% level, ** significant at 1% level

Table 2: Estimates of Genotypic correlation coefficients among yield and yield components in Sorghum [*Sorghum bicolor* (L.) Moench]

Character	Days to 50% Flowerin (g)	Plant height (cm)	Total No. of leaves per plant	Leaf length (cm)	Leaf width (cm)	Ear head length (cm)	Ear head width (cm)	100 Grain weight (g)	Harvest index (%)	Grain yield per pant(g)
Days to 50% flowering	1.0000	0.0140	0.0514	0.3412**	0.3624**	0.3047**	0.1300	-0.1893*	0.1783*	0.1525
Plant height (cm)		1.0000	-0.0880	0.2038*	-0.1333	0.5689**	0.2849**	0.0471	0.2446**	0.5817**
Total No.of leaves per plant			1.0000	0.1846*	0.1346	-0.1376	0.0134	-0.0697	-0.1120	-0.0591
Leaf length (cm)				1.0000	0.2002*	0.4055**	0.0470	-0.0986	0.1965*	0.3029**
Leaf width (cm)					1.0000	0.1336	-0.0093	-0.2580**	-0.1469	-0.0373
Ear head length (cm)						1.0000	0.5071**	0.1178	0.3353**	0.8377**
Ear head width (cm)							1.0000	0.0718	-0.0091	0.6418**
100 Grain weight (g)								1.0000	-0.0184	0.1197
Harvest Index (%)									1.0000	0.3032**
Grain yield per plant (g)										1.0000

Path analysis

The path analysis indicated that ear head length (0.5357 and 0.6306), ear head width (0.2992 and 0.3225) exerted high direct positive effect on grain yield per plant. These results are in accordance with (Umakanth *et al.* 2004, Arunkumar

2013 and Mahajan *et al.* 2011) [8, 2, 5]. As direct effects of these parameters are high direct selection through these characters for improvement in grain yield per plant should be rewarding. (Table 3 and Table 4).

Table 3: Direct and indirect effects (phenotypic) of yield components on yield among Sorghum [*Sorghum bicolor* (L.) Moench]

Character	Days to 50% Flowering	Plant Height (cm)	Leaves/ Plant	Leaf Length (cm)	Leaf Width (cm)	Ear Head Length (cm)	Ear Head Width (cm)	100 grain Weight (g)	Harvest Index (g)
Days to 50% Flowering	-0.0683	-0.0016	-0.0023	-0.0193	-0.0228	-0.0199	-0.0079	0.0120	-0.0114
Plant Height (cm)	0.0032	0.1356	-0.0100	0.0248	-0.0139	0.0727	0.0371	0.0061	0.0324
Leaves/ Plant	0.0026	-0.0057	0.0770	-0.0043	-0.0021	-0.0054	-0.0037	-0.0050	-0.0078
Leaf Length (cm)	0.0167	0.0108	-0.0033	0.0590	0.0144	0.0177	0.0028	-0.0043	0.0128
Leaf Width (cm)	-0.0249	0.0077	0.0020	-0.0183	-0.0747	-0.0065	-0.0011	0.0169	0.0081
Ear Head Length (cm)	0.1562	0.2874	-0.0376	0.1603	0.0463	0.5357	0.2438	0.0557	0.1608
Ear Head Width (cm)	0.0373	0.0881	-0.0154	0.0154	0.0049	0.1468	0.3225	0.0235	-0.0023
100 grain Weight (g)	-0.0009	0.0002	-0.0003	-0.0004	-0.0011	0.0005	0.0004	0.0049	-0.0001
Harvest Index (%)	0.0132	0.0188	-0.0080	0.0171	-0.0085	0.0237	-0.0006	-0.0010	0.0790
Grain Yeild Per Plant (g)	0.1351	0.5413**	0.0022	0.2344**	-0.0576	0.7653**	0.5932**	0.1089	0.2714**
Partial R ²	-0.0092	0.0734	0.0002	0.0138	0.0043	0.4099	0.1913	0.0005	0.0214

R SQUARE = 0.7057 RESIDUAL EFFECT = 0.54

Table 4: Direct and indirect effects (genotypic) of yield components on yield among Sorghum [*Sorghum bicolor* (L.) Moench]

Character	Days to 50% Flowering	Plant Height (cm)	Leaves/Plant	Leaf Length (cm)	Leaf Width (cm)	Ear Head Length (cm)	Ear Head Width (cm)	100 grain Weight (g)	Harvest Index (%)
Days to 50% Flowering	-0.0776	-0.0011	-0.0040	-0.0265	-0.0281	-0.0236	-0.0101	0.0147	-0.0138
Plant Height (cm)	0.0015	0.1098	-0.0097	0.0224	-0.0146	0.0625	0.0313	0.0052	0.0268
Leaves/Plant	0.0026	-0.0044	0.0498	0.0092	0.0067	-0.0069	0.0007	-0.0035	-0.0056
Leaf Length (cm)	0.0102	0.0061	0.0055	0.0298	0.0060	0.0121	0.0014	-0.0029	0.0058
Leaf Width (cm)	-0.0293	0.0108	-0.0109	-0.0162	-0.0809	-0.0108	0.0007	0.0209	0.0119
Ear Head Length (cm)	0.1921	0.3588	-0.0868	0.2557	0.0842	0.6306	0.3198	0.0743	0.2115
Ear Head Width (cm)	0.0389	0.0853	0.0040	0.0141	-0.0028	0.1517	0.2992	0.0215	-0.0027
100 grain Weight (g)	0.0017	-0.0004	0.0006	0.0009	0.0024	-0.0011	-0.0007	-0.0092	0.0002
Harvest Index (%)	0.0123	0.0169	-0.0077	0.0136	-0.0101	0.0232	-0.0006	-0.0013	0.0691
Grain Yield Per Plant (g)	0.1525	0.5817**	-0.0591	0.3029**	-0.0373	0.8377**	0.6418**	0.1197	0.3032**
Partial R ²	-0.0118	0.0639	-0.0029	0.0090	0.0030	0.5283	0.1920	-0.0011	0.0209

R SQUARE = 0.8013 RESIDUAL EFFECT = 0.4458

Conclusion

Correlation study indicated that plant height, leaf length, ear head length, ear head width and harvest index had significant positive association with grain yield per plant at both genotypic and phenotypic levels and simultaneous improvement of these traits along with grain yield per plant is possible. The path analysis indicated that ear head length, ear head width exerted high direct positive effect on grain yield per plant. As direct effects of these parameters are high, direct selection through these characters for improvement in grain yield per plant should be rewarding. Thus, the present study revealed that the major emphasis should be laid on selection process by direct selection for improvement through component yield traits such as plant height, leaf length, ear head length, ear head width and harvest index directly contributed for increased realization.

(*Sorghum bicolor* (L.) Moench). National Journal of Plant improvement. 2004; 6(2):104-107.

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