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# Identification of Promising Parents for Grain Yield and Early Maturity in Kharif Sorghum (*Sorghum bicolor* (L.) Moench)

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**A B S T R A C T**

Field experiment was carried out at experimental field of Sorghum Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth (PDKV), Akola to identify the promising early lines and testers along with desirable grain yield in sorghum. Newly developed six cytoplasmic male sterile lines (CGMS) lines and eleven testers were crossed in line x tester fashion and the resultant 66 hybrids were evaluated along with the checks (CSH 35 for grain yield and CSH 14 for earliness) and parents for days to 50% flowering, days to maturity and grain yield per plant under combining ability analysis during *Kharif* 2015. The results of general combining ability analysis revealed that among the lines, two promising lines AKMS 89A and AKMS 103-8-1A found early on the basis of general combining effects (gca) for days to 50% flowering (-2.34** and -1.40** respectively), days to maturity (-0.96** and -0.57** respectively) and with desirable grain yield per plant (4.10** and 5.19** respectively). Similarly, among the testers, the tester AKR 524 and AKR 528 were found to be the good general combiners for grain yield (3.04*, 2.64*) along with earliness like early days to 50% flowering (-0.85*, -1.19* resp.) . Three testers, AKR 492, AKR 492-1 and AKR 526 found promising for earliness like days to 50% flowering (-0.52, -0.74, -1.52** respectively) and days to maturity (-2.07**, -0.96**, -0.51 respectively). These lines and testers need to be extensively used in crossing programme for development of high yielding and early maturing *kharif* sorghum hybrids.

## Introduction

Sorghum (*Sorghum bicolor* L. Moench) is one of the most important staple food and fodder crops in parts of the semi-arid tropics of the world and cultivated in areas considered to be too dry and hot for other cereals, because of its tolerance to drought and heat stress. It is mostly grown on the conserved soil moisture that too receding soil moisture. The sorghum is mostly exposed to the terminal moisture stress in which the crop at flowering and post flowering stage suffers from the soil moisture deficit. This moisture stress during flowering and grain filling stage results in drastic reduction in the productivity level of the sorghum. There is need to develop the high yielding and early maturing hybrid in sorghum. For this identification of the suitable parental lines having potential for earliness and high grain yield needs to be identified.

Knowledge of combining ability is necessary in selection of appropriate parents for hybridization. Since it gives an idea whether a particular parent combines well in a cross and

also denotes specific performance of a cross combination against the expectations from the general combining ability of parents. The information on the nature and magnitude of gene action is important in understanding the genetic potential of a population. It is useful to decide the breeding procedure. Sorghum has good potential for grain yield. Development of the varieties/hybrids of grain Sorghum, making them popular among the cultivators will therefore, be definitely helpful for increasing and improving the grain production. Line x tester analysis is a precise method for obtaining such information when a large number of parents are to be tested. Keeping this in view, present study was undertaken for line x tester analysis in *kharif* sorghum to develop suitable hybrid parents. In the present investigation the promising parental lines for high grain yield and earliness were sorted out based on mean performance and their general combining ability effects.

## Materials and Methods

The experimental material comprised of six cytoplasmic male sterile lines viz., AKMS 89 A, AKMS 90 A, ICS 279 A, AKMS 103-8 1A, ICS 751 A and ICS 733 A and eleven testers viz., AKR 523, AKR 524, AKR 525, AKR 492, AKR 492-1, AKR 526, AKR 527, AKR 528, AKR 529, AKR 530, and AKR 531. These seventeen genotypes (lines and testers) were crossed in line x tester fashion at Sorghum Research Farm, Dr. Panjabrao Deshmukh Krishi Vidyapeeth (PDKV), Akola during rabi 2014-15. Seventeen parents and their resulting 66 hybrids along with standard checks CSH-14 (For earliness) and CSH-35(For grain yield) were planted at Sorghum Research Unit, Dr. P.D.K.V. Akola, during *kharif* 2015-16 in randomized block design with three replications. The observations were recorded on five randomly selected plants per plot per replication for grain yield per plant (g). For days to 50% flowering and days to maturity, observations were recorded on plot basis. The data on all the above characters was subjected to combining ability analysis by following Kempthorne (1957) method to estimate the general combining effects of these lines and testers for earliness and grain yield.

## Results and Discussion

Analysis of variance for combining ability is presented in the Table 1. The total variance due to hybrids was partitioned into portions attributable to lines (females), testers (males), their interaction (lines x testers) and error sources. The components of variances attributable to lines and testers were used as a measure of general combining ability. The lines (females) recorded significant variation for days to 50% flowering. The estimates of general combining ability effects of the lines and testers are presented in Table 2 and Table 3 respectively. In sorghum, positive gca effects is desirable for grain yield per plant while for days to 50% flowering and days to maturity negative gca effects are desirable.

Among the six lines, the line AKMS 89A recorded significant and desirable gca effects for grain yield per plant (4.10**) as well as for days to 50% flowering (-2.34**) and days to maturity (-0.96**) along with better mean performance at 66.33 days, 108.67 days and 43.94 g respectively. Line AKMS 103-8-1A also showed significant and desirable gca effects along with greater mean performance for grain yield per plant (5.19** and 39.13 g) as well as for days to 50% flowering (-1.40** and 63.33 days) and days to maturity (-0.57* and 108.67 days). Thus the lines AKMS 89A and AKMS 103-8-1A were found to be suitable for developing high yielding and early maturing hybrids in *kharif* sorghum due to its positive significant gca effects for grain yield along with negative significant gca effects for days to 50% flowering and days to maturity.

Premalatha *et al.*, (2006) also reported that negative gca effects for days to 50% flowering might be useful in breeding programme for earliness. Prabhakar *et al.*, (2013) also identified one line SL-39B with positive significant gca for grain yield and negative significant gca for days to flowering and reported the use of this line in developing high yielding early maturing hybrids in *rabi* sorghum.

**Table.1** Analysis of variance for combining ability for flowering, maturity and grain yield in Kharif Sorghum

| Source of variation | d.f. | Mean Sum of Squares | | |
|---|---|---|---|---|
| | | Days to 50% Flowering | Days to Maturity | Grain Yield/ Plant (g) |
| **Replications** | 2 | 2.68 | 7.15* | 15.38 |
| **Crosses** | 65 | 21.67** | 15.63** | 245.45** |
| **Lines** | 5 | 83.48** | 20.02 | 585.11* |
| **Testers** | 10 | 27.96 | 23.72 | 245.71 |
| **Line x Tester** | 50 | 14.23** | 13.57** | 211.43** |
| **Error** | 130 | 3.45 | 1.72 | 28.82 |

**Note -** * - significant at 5% level of significance ** - significant at 1% level of significance

**Table.2** Estimates of general combining ability (gca) effects of lines for flowering, maturity and grain yield in Kharif Sorghum

| Parents | Days to 50% Flowering | Days to Maturity | Grain Yield/ Plant (g) |
|---|---|---|---|
| **Lines (Females)** | | | |
| AKMS 89 A | -2.34 ** | -0.96 ** | 4.10 ** |
| AKMS 90 A | 0.51 | 0.71 ** | -5.55 ** |
| ICS 279 A | 0.21 | -0.54 * | -3.38 ** |
| AKMS103-8 1A | -1.40 ** | -0.57 * | 5.19 ** |
| ICS 751 A | 1.09 ** | 0.89 ** | -1.32 |
| ICS 733 A | 1.93 ** | 0.465 * | 0.96 |
| SE (gi) ± | 0.90 | 0.61 | 0.87 |
| CD at 5 % | 0.34 | 0.23 | 1.71 |
| CD at 1 % | 0.68 | 0.46 | 2.26 |

* - significant at 5% level of significance,
** - significant at 1% level of significance

**Table.3** Estimates of general combining ability effects of testers in Kharif Sorghum

| Parents | Days to 50% Flowering | Days to Maturity | Grain Yield/ Plant (g) |
|---|---|---|---|
| **Testers** | | | |
| AKR 523 | 0.09 | 1.66 ** | -4.74 ** |
| AKR 524 | -0.85* | -0.90 ** | 3.04 * |
| AKR 525 | 2.76 ** | 1.49 ** | 4.68 ** |
| AKR 492 | -0.52 | -2.07 ** | -6.12 ** |
| AKR 492-1 | -0.74 | -0.96 ** | -0.86 |
| AKR 526 | -1.52 ** | -0.51 | -3.85 ** |
| AKR 527 | -0.08 | 1.10 ** | -1.10 |
| AKR 528 | -1.19 * | 0.04 | 2.64 * |
| AKR 529 | 0.15 | 0.66 * | 2.33 * |
| AKR 530 | 1.59 ** | -0.57* | 3.97 ** |
| AKR 531 | 0.31 | 0.04 | 0.09 |
| SE (gi) ± | 1.22 | 0.82 | 1.17 |
| CD at 5 % | 0.47 | 0.31 | 2.32 |
| CD at 1 % | 0.92 | 0.62 | 3.06 |

* - significant at 5% level of significance, ** - significant at 1% level of significance

**Table.4** Mean performance of lines and testers for characters under studies

| Genotypes | Days to 50 % flowering | Days to maturity | Grain yield per plant (g) |
|---|---|---|---|
| **Lines (Females)** | | | |
| AKMS 89 A | 66.33 | 108.67 | 43.94 |
| AKMS 90 A | 70.33 | 108 | 43.46 |
| ICS 279 A | 73 | 110.67 | 51.5 |
| AKMS 103-8-1A | 63.33 | 108.67 | 39.13 |
| ICS 751 A | 73.33 | 111.33 | 40.58 |
| ICS 733 A | 70.33 | 108.33 | 45.84 |
| **Testers (Males)** | | | |
| AKR 523 | 68 | 109.67 | 50.6 |
| AKR 524 | 67 | 108.33 | 48.84 |
| AKR 525 | 73 | 111.67 | 49.06 |
| AKR 492 | 69 | 109.33 | 49.24 |
| AKR 492-1 | 70 | 113.67 | 50.26 |
| AKR 526 | 67.33 | 110 | 53.06 |
| AKR 527 | 68 | 113.67 | 36.24 |
| AKR 528 | 69.66 | 112.67 | 48.68 |
| AKR 529 | 75 | 111.33 | 44.49 |
| AKR 530 | 70.66 | 114.33 | 52.75 |
| AKR 531 | 70.66 | 112.33 | 49.58 |

Among the testers, the tester AKR 524 exhibited positive significant gca effects for grain yield per plant (3.04*) along with negative gca effects for days to maturity (-0.90**). Further, the grain yield per plant of tester AKR 524 was 48.84 g. Similarly, another tester AKR 528 also showed significant gca effects for grain yield per plant (2.64*) along with negative gca effects for days to 50% flowering (-1.19**). Likewise, AKR 528 recorded good grain yield per plant (48.68 g). This tester appeared to be promising for development of early maturing and high yielding *kharif* sorghum hybrids. Prabhakar *et al*., (2013) also reported the tester SLR-66 with significant desirable gca effects for grain yield per plant along with days to 50% flowering and reported the usefulness of this tester in developing high yielding and early maturing hybrids in sorghum. Thus it was concluded from the present study that there is need to extensively

use the lines AKMS 89A, AKMS 103-8-1A and the testers AKR 524, AKR 528 in the hybridization programme to develop high yielding and early maturing *kharif* sorghum hybrids.

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