Sorghum Physiology (Kharif, 2013)

SS Rao, N Nimbkar, BC Nandeshwar, MM Patil, CS Khore, HV Kalpande, Ambika More, JS Mishra

Executive summary

Phenotyping forty promising kharif sorghum germplasm for mid-season drought adaptation in dryland condition indicated that entries SSRK13-1, SSRK13-24, SSRK13-26 and SSRK13-30 were found to be the earliest for phenology. Higher total plant leaf area and leaf area index at flowering were recorded by SSRK13-2, SSRK13-13, SSRK13-14, SSRK13-16, SSRK13-18, SSRK13-19, SSRK13-27, and SSRK13-35 (range:4102 to 5471 cm^2 $plant^{-1}$) than check CSV23 (2474 cm^2 $plant^{-1}$). Significantly higher dry biomass was recorded by SSRK13-2, SSRK13-8, SSRK13-16, SSRK13-21, SSRK13-30 (Range: 853 -1299 g m^{-2}) than check CSV23 (595 g m^{-2}). Eleven test entries showed very high stalk brix (16.2 to 20.0%) than check CSV23 (4.7%) which include SSRK13-5, SSRK13-7, SSRK13-8, SSRK13-22, SSRK13-24, SSRK13-29, SSRK13-34, SSRK13-35, SSRK13-36, SSRK13-37, and SSRK13-38. SSRK13-29, and SSRK13-2 recorded more grain yields (448 and 342 g m^{-2}, respectively) than check CSV23 (330 g m^{-2}).

Detailed report

The primary objectives of kharif physiology evaluation program include:

i) To evaluate new germplasm sources for variability in climate change (drought and temperature stresses) and staygreen in kharif production system.

ii) To assess the performance and stability of genotypes across a range of environments (latitudes) and soil types (especially alfisols) and identify superior genotypes.

iii) To characterize plant traits contributing higher biomass accumulation combining mid-season drought and heat stress tolerance.

This trials was organized during Kharif 2013 at Parbhani (19^0 08' N; 76^0 50'E), Phaltan (18^0 47' N; 74^0 32'E), Akola and Hyderabad (17^0 27' N; 78^0 28' E).

Trial 1K. Phenotyping kharif sorghum germplasm for mid-season drought adaptation

Forty promising sorghum germplasm (representing caudatum, durra, and guinea land races) were planned for evaluation at four test locations i.e., Parbhani, Akola, Phaltan, and Hyderabad during kharif 2013. The check used in this study was CSV 23 which is the dual-purpose one released for kharif. The genotypes were selected based on their performance in the initial evaluation in rabi 2012-2013 and based on seed availability. The test materials represent the all biological races of sorghum namely durra, caudatum, kafir, bicolor and guinea. Each genotype was planted in one row of 3m length (plot size: 3.0 * 0.45m =1.35 m2) in a randomized complete block design (RCBD) adopting spacing of 45 cm between the rows and 15 cm within the row. The data from Akola, Parbhani were not received as the crop was affected due to severe rains in the vegetative stage as reported from the centres. Hence only data from Phaltan and Hyderabad are considered.

The details of environmental conditions were presented in Fig 1 to Fig. 6. Recommended dose of fertilizer was applied (@ 60:30:0 kg N: P2O5: K2O ha^{-1} in the form of urea, single super phosphate, muriate of potash, respectively) with half N and complete P and K as basal, and balance N was side-dressed at 35 DAE. Furadan 3G (@ 20 kg ha^{-1}) was applied in furrows at planting to control the shoot fly (*Atherigona soccata* R). Need based minimal plant protection measures were followed to control the major insect pests of sorghum. The data were collected as per standard procedures and are presented in tables 1K1.1 to 1.3. Variation was observed for phenology, components of biomass, quality and grain yield components.

Plant population: Plant population at final thinning and physiological maturity were presented in Table 1K 1.1. The average plant population recorded at physiological maturity was about 6 $m^{-2.}$ Some entries such as SSRK13-3 & SSRK13-18 were severely affected by shootfly & stem borer at both locations.

C*rop phenology and plant height:* Mean days to flowering across the locations varied from 68 to 126 d. Entries SSRK13-1, SSRK13-24, SSRK13-26 and SSRK13-30 were found to be the earliest ones than check (Table 1K1.1). Days to physiological maturity followed the similar trend those of flowering at all locations. Plant height ranged from 119 to 307 cm with a mean of 229 cm. Entries which grew very tall (~3.0m) include SSRK13-8, SSRK13-13, SSRK13-19, and SSRK13-34 than check CSV23 (2.1 m) .

Leaf area at soft dough stage: Considerable variation was observed in total plant leaf area and leaf area index at flowering. The ranges observed were for leaf area; 659-5471 cm^2 plant $^{-1}$ and leaf area index; 0.58-3.64. Interestingly, very high leaf area development occurred in entries such as SSRK13-2, SSRK13-13, SSRK13-14, SSRK13-16, SSRK13-18, SSRK13-19, SSRK13-27, and SSRK13-35 (range: 4102 to 5471 cm^2 $plant^{-1}$) than check CSV 23 (2474 cm^2 $plant^{-1}$). Similar trend was observed in LAI too (Table 1K1.1).

Stover yield and biomass accumulation: Dry stover yield and total biomass at maturity varied from 46 to 1410 g m^{-2} and 302 to 1290 g m^{-2}, respectively. The average biomass production was 600 g m^{-2} . Significantly higher dry biomass was recorded by SSRK13-2, SSRK13-8, SSRK13-16, SSRK13-21, SSRK13-30 (Range:853 -1299 gm^{-2}) than check CSV23 (595 g m^{-2}). Similar trend was observed in case of dry stover yields and total fresh biomass at maturity (Table 1K1.3).

Stalk quality traits: Stalk brix at physiological maturity varied between 4.5 and 19.9% with a mean of 10.0%. The check which is the dual-purpose grain sorghum showed very low brix (4.7%). Eleven test entries showed very high stalk brix (16.2 to 20.0%) than check include SSRK13-5, SSRK13-7, SSRK13-8, SSRK13-22, SSRK13-24, SSRK13-29, SSRK13-34, SSRK13-35, SSRK13-36, SSRK13-37, and SSRK13-38. Some of these entries were biomass types and late in maturity.

Grain yield components: Grain yields ranged from 29 to 448 g m^{-2} with a mean of 123 g m^{-2}, while grain # per panicle ranged between 1008 and 3146 with mean of 1134. Among the test entries, SSRK13-29, and SSRK13-2 recorded more (448 and 342 g m^{-2}, respectively) grain yields than check CSV23 (330 g m^{-2}). In SSRK13-29, higher yield realization was mainly due to higher grain number per panicle. While, SSRK13-1, and SSRK13-11 too recorded higher grain # (3146; and 2492) than check (2292).