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**RESEARCH ARTICLE :**

# Optimization of production factors in *Rabi* grain sorghum under resource constraints

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**SUMMARY :** A field experiment was conducted during *Kharif* season 2016-17 at Sorghum Research Station , V.N.M.K.V., Parbhani . The objective of the experiment was to find out per cent loss of yield when one of the Priority inputs miss due to whatever reasons then know how much per cent reduction in yield found . The results clearly indicated that test weight, grain yield, fodder yield kg ha$^{-1}$, harvest index (%), GMR, NMR Rsha$^{-1}$ and B:C ratio were significantly influenced by application of all priority inputs. Treatment $T_2$ Full package of practices (FPP) to *Rabi* sorghum recorded highest test weight, panicles / m$^{-2}$, grain yield, fodder yield kg ha$^{-1}$, harvest index (%), GMR, NMR Rs.ha$^{-1}$ and B:C ratio and was found significantly superior over rest of the all treatments, however it was found at par with treatment $T_7$ FPP minus seed treatment with PSB and Azospirillum. Among different *Rabi* sorghum priority inputs adaptation of only improved variety without any input treatments recorded significantly lowest test weight, grain yield, fodder yield kg ha$^{-1}$, harvest index (%), GMR, NMR Rs.ha$^{-1}$ and B : C ratio over all priority inputs treatments.

**KEY WORDS :**
Full package of practices, Priority inputs, Sorghum, GMR, NMR

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## BACKGROUND AND OBJECTIVES

Sorghum is one of the major cereal crops consumed in India after rice and wheat (DES, 2007). Almost entire production of sorghum (95%) in the country comes from the Maharashtra and Southern states of Karnataka and Telangana (2007) (Directorate of Economics and Statistics, Development of Agriculture and Cooperation, 2012).At present Maharashtra is largest producer of sorghum in India accounting for 50 per cent of the total area *i.e.* 50.10 lakh hectares with a production of 28.90 lakh tones and productivity was about 657 kg ha$^{-1}$ as reported by Awaghad *et al.* (2010). High yielding varieties and hybrids coupled with use of organic and inorganic manures under irrigated conditions can substantially increase the productivity of *Rabi* sorghum (Khade *et al.*,1989). Sorghum cultivars are known to vary in their response to fertilizers. Productivity of sorghum is limited by soil fertility. Kumar *et al.* (2010) reported that the increase in productivity of sorghum could be brought out both by genetic improvement as well as associated nutrient management intervention in a rainfed

environment.

*Rabi* sorghum is an important dry land crop of Maharashtra and is the major source of food and fodder. Several production technologies have been recommended by the research stations but in most cases farmers have either not adopted or only partially adopted these. Hence, it seems clear that technologies have to be evaluated by taking into account the farmers' environment, and with farmers' active participation. Priority inputs include in filed for crop production depends on frames economies conditions, crop / environment conditions.

**Objective :**

To find out the contribution of different production factors (Priority inputs) in *Rabi* sorghum production.

## RESOURCES AND METHODS

An experiment on Priority inputs in *Rabi* grain sorghum was conducted during *Rabi* 2016-17 at Experimental Farm of Sorghum Research Station. V.N.M.K.V., Parbhani, . The experimental design consist of Randomized Block Design with replicated thrice with nine treatments. Treatments comprises are $T_1$ : Control (only improved variety without any input) $T_2$: Full package of practices (FPP (Protective irrigation+ fertilizer (RDF) + Weed control (Herbicides and Hand Weeding)+Plant protection (application of insecticide and fungicides seed treatments with fungicides)+ seed treatment with PSB and Azospirillum + Thinning + Improved variety)) $T_3$: FPP minus irrigation, $T_4$: FPP minus fertilizer, $T_5$:- FPP minus weed control, $T_6$: FPP minus plant protection, $T_7$: FPP minus seed treatment with PSB and Azospirillum, $T_8$ : FPP minus thinning, and $T_9$: FPP minus improved hybrid (local cultivar Dagdi). The gross and net plot sizes were 4.5 m x 5.0 m and 3.6 m x 4.40 m, respectively. The sowing was done by dibbling two seeds at each plot spaced at 45 x 15 $cm^2$ apart and seed were covered with soil. CSV 22R variety of *Rabi* sorghum selected. The soil type of experimental filed was Vertisol, medium deep, clayey in texture and slightly alkaline in reaction. It contained about 5.20 g organic carbon $kg^{-1}$ of soil, and 260 kg N, 12.3 kg P and 345 kg available K $ha^{-1}$. The recommended plant protection schedule was followed. The recommended dose of fertilizer was given at the time of sowing *i.e.* half dose of N and full dose of $P_2O_5$ and $K_2O$ as a basal dose and remaining half dose of N was applied 30 days after sowing.

The collected data were subjected to combine the analysis of variance (ANOVA) using the Statistical Analysis System (SAS) software version 9.1 programme (SAS Institute, 2004). Means were separated using Fisher's Least significant difference (LSD) test at 5% level of probability as stated in Gomez and Gomez (1984).

## OBSERVATIONS AND ANALYSIS

The results clearly indicated that test weight, grain yield, fodder yield kg $ha^{-1}$, harvest index (%), GMR, NMR Rs.$ha^{-1}$ and B:C ratio were significantly influenced by application of all priority inputs (Table 1). Treatment $T_2$ *i.e.* Full package of practices (FPP) to *Rabi* sorghum recorded highest test weight, grain yield, fodder yield kg $ha^{-1}$, harvest index (%), GMR, NMR Rs.$ha^{-1}$ and B:C ratio and was found significantly superior over rest of the all treatments, excvept it was found at par with treatment $T_7$ FPP minus seed treatment with PSB and Azospirillum. This implicated that all the inputs or production factors are essential to *Rabi* sorghum except bio fertilizers. This might be the cumulative effect of all production factors. The next important factor was irrigation; it reduced the yield by 36% over FPP.

Increase in yield may be due to adoption high yielding varieties, optimum plant population, sufficient fertilizer availability, weed free crop for crop production. Which may leads into well plant stand , competition free nutrient and moisture availability result into vigorous growth leads to increases in yield contributing characters result into higher yield. Similar results were also reported by Bangar (1991); Sumeriya and Singh (2008); Mishra *et al.* (2009); Ahmed *et al.* (2010) and Sagarka *et al.* (2013)

Among different *Rabi* sorghum priority inputs factors adaptation of only improved variety without any input treatments ($T_1$) recorded significantly lowest test weight, grain yield , fodder yield kg $ha^{-1}$, harvest index (%), GMR, NMR Rs.$ha^{-1}$ and B:C ratio over all priority inputs treatments. The tune of decrease was upto 42% as compared to $T_2$ (FPP).

**Conclusion :**

For better *Rabi* sorghum productions one should go with all Priority inputs FPP *i.e.* Protective irrigation+ fertilizer (RDF)+Weed control(Herbicides and Hand Weeding) + Plant protection (application of insecticide and fungicides seed treatments with fungicides)+ seed treatment with PSB and Azospirillum + Thinning

**Table 1: Effect of priority inputs 100 seed weight and Grain and fodder yield, harvesting index, gross monetary returns, net monetary returns and benefit : cost ratio, and decreased grain yield as compared to FPP as influenced by various treatment**

| Treatments | 100 seed wt (g) | Grain yield (kg $ha^{-1}$) | Fodder yield (kgha$^{-1}$) | Harvest Index (%) | GMR (Rs./ha) | NMR (Rs./ha) | B:C ratio | Decreased grain yield as compared to FPP (%) |
|---|---|---|---|---|---|---|---|---|
| $T_1$: Control : only improved hybrid without any input | 3.59 | 1761 | 4271 | 28.79 | 49528 | 30388 | 2.59 | 42 |
| $T_2$: Full package of practice (FPP) | 3.39 | 3055 | 7646 | 28.37 | 87105 | 55755 | 2.78 | ---- |
| $T_3$: FPP minus Irrigation | 3.35 | 1944 | 4630 | 29.20 | 54262 | 27112 | 2.00 | 36 |
| $T_4$: FPP minus Fertilizer | 3.34 | 2245 | 5574 | 28.41 | 63799 | 35249 | 2.23 | 26 |
| $T_5$: FPP minus Weed control | 3.28 | 2184 | 5292 | 28.87 | 61412 | 32472 | 2.12 | 28 |
| $T_6$: FPP minus Plant Protection | 3.16 | 2496 | 6381 | 27.85 | 71839 | 41609 | 2.38 | 18 |
| $T_7$: FPP minus Seed treatment with PSB and Azospirillum | 3.06 | 2782 | 7016 | 28.16 | 79591 | 48321 | 2.55 | 9 |
| $T_8$: FPP minus Thinning | 2.99 | 2253 | 5427 | 29.03 | 63185 | 34055 | 2.17 | 26 |
| $T_9$: FPP minus Improved hybrid (use local variety of the region) | 2.97 | 2090 | 5003 | 29.15 | 58448 | 27848 | 1.91 | 32 |
| S.E. $\pm$ | 0.14 | 109.41 | 289.89 | 0.21 | 318.32 | 318.32 | -- | -- |
| C.D . (P=0.05) | 4.26 | 327.51 | 867.75 | 6.27 | 952.87 | 952.87 | -- | -- |
| C.V . | 7.61 | 8.19 | 8.82 | 9.26 | 8.42 | 14.91 | -- | -- |
| G.M. | 3.24 | 2312 | 5693 | 28.65 | 65463 | 36979 | 2.30 | -- |

FPP: Protective irrigation +Fertilizer (RDF) + Weed control (herbicide and hand weeding) + Plant protection (application of insecticides and fungicides including seed treatment with fungicides) + Seed treatment with PSB and Azospirillum + Thinning + Improved variety

+Improved variety.

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