

## **Impact of Biofertilizer on yield and Economics of *Rabi sorghum (Sorghum bicolor L.)* under rainfed condition.**

**Abstract:** A field experiment was conducted at All India Coordinated Research Project on sorghum, Main Agricultural Research Station, University of Agricultural Sciences, Dharwad-580050, Karnataka for two consecutive *rabi* season (2018 and 2019) to study the impact of biofertilizers on growth, yield and Economics of *Rabi sorghum (Sorghum bicolor L.)* under rainfed condition in northern transition tract of Karnataka. The pooled results of the experiment indicated that, application of RDF (50:25:0 kg N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O/ha) + seed treatment with *Azospirillum* @4ml + PSB @ 4 ml kg<sup>-1</sup> seeds recorded significantly higher grain (2.3 q/ha) and fodder yield (8.4 t/ha) of *rabi* sorghum compared to rest of the treatments. The higher grain yield was due to significantly higher values of yield components viz., grain yield/g plant (40.0) and 1000-grain weight (33.3g). Further, significantly higher gross returns (Rs.102133/ha), net returns (Rs.68232/ha) and BC ratio (3.0) were recorded due to application of RDF (50:25:0 kg N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O/ha) + seed treatment with *Azospirillum* @4ml + PSB @ 4ml kg<sup>-1</sup> seeds compared to rest of the treatments.

Key words: Biofertilizers, seed treatment, *rabi* sorghum, Economics.

### **Introduction**

**Sorghum** (*Sorghum bicolor* L. Moench) is one of the most important cereal crop in the world, popularly known as king of millets and great millet as an account of its large grain size among millet and vast area under it. It is grown in tropics and subtropics climates. Sorghum is called as camel crop because of drought, water logging and saline-alkaline tolerance. It is one of the most efficient C<sub>4</sub> plant in terms of photosynthesis. It is gaining importance as healthy food now days because of its higher dietary fibre (2.56%). Apart from grains it also provides valuable fodder which is one of the principle roughage feed in India.

**Bio-fertilizer:** The need of the hour in agriculture at present times, there is a growing concern about environmental hazards and threats to sustainable agriculture. In view of the above stated facts, the long term use of bio-fertilizers proves to be economical, ecofriendly, more efficient, productive and accessible to marginal and small farmers over chemical fertilizers. Biofertilizers have an advantage over chemical fertilizers, as they provide nutrients in addition to plant growth promoting substances like hormones, vitamins, amino acids etc. (Shivankar *et al.*, 2000). The primary goal of soil phosphorus management is to maximize crop output while minimizing phosphorus loss from the soil. (Bashan *et al.*, 2013)

## Material and methods

Field experiment was conducted at All India Coordinated Research Project on sorghum, Main Agricultural Research Station, University of Agricultural Sciences, Dharwad-580005, Karnataka, for two consecutive *rabi* season (2018 and 2019) to study the impact of Biofertilizers on growth, yield and Economics of *Rabi* sorghum (*Sorghum bicolor* L.) under rainfed condition in northern transition tract of Karnataka. The soil of the experimental site was clayey soils. The experiment consisted of six treatments *viz.*, T<sub>1</sub>: Recommended dose of fertilizer (50:25:0 kg NPK/ha) (Control), T<sub>2</sub>: RDF + Seed treatment with *Azospirillum*@ 50g+PSB @ 50g kg<sup>-1</sup>seed, T<sub>3</sub>: RDF + Seed treatment with *Azospirillum* @ 2ml+PSB @ 2ml kg<sup>-1</sup>seed, T<sub>4</sub>: RDF + Seed treatment with *Azospirillum* @ 2ml+PSB @ 4ml kg<sup>-1</sup>seed, T<sub>5</sub>: RDF + Seed treatment with *Azospirillum* @ 4ml+PSB @ 2ml kg<sup>-1</sup>seed and T<sub>6</sub>: RDF + Seed treatment with *Azospirillum* @ 4ml+PSB @ 4ml kg<sup>-1</sup> seed. The treatments were evaluated in Randomized Block Design (RBD) with four replications. The seeds of *rabi* sorghum (variety CSV-29R) was sown with a row spacing of 45 cm x 15 cm and recommended dose of fertilizers was applied to soil in each treatment and seeds were treated with both powder and liquid form of biofertilizers (*Azospirillum* and PSB) at the time of sowing.

**Methodology followed for seed treatment:** *Azospirillum* @ 50g+ Phosphate-solubilizing bacteria (PSB) @ 50g /kg seeds (T<sub>2</sub>) .Similarly, *Azospirillum* @ 2-4 ml+ PSB @ 2-4ml/kg seed (T<sub>3</sub>-T<sub>6</sub> ) and shade dried for 2 hours before sowing. Species used for *Azospirillum* and Phosphate Solubilizing Bacteria (PSB) in the research study were *Azospirillum brasilense* and *Pseudomonas striata*. Sorghum yield attributes, grain and stover yields were recorded and economics were worked. The data obtained on *rabi* sorghum was subjected to statistical analysis by using MSTAT-programme according to Gomez and Gomez (1984).

## Results and discussion

The data on grain yield (g/plant), 1000-grain weight (g), grain yield (q/ha) and stover yield (tha<sup>-1</sup>) of *rabi* sorghum were differed significantly due to various treatment .The results of pooled data indicated that, significantly higher grain yield (40 g/plant) , 1000-grain weight (33.3g), grain yield (42.3q/ha), stover yield (8.4 t/ha) were recorded in seed treatment with *Azospirillum*@ 4ml +PSB @ 4ml /kg seeds along with RDF (50:25:0 kg N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O/ha) (T<sub>6</sub>) as compared to control and powder form of bio-fertilizers. However, lower levels of liquid form of biofertilizers were on par with each other but significantly superior over control and powder form of biofertilizers. The results are in accordance with findings of

Mokula Md Rafia and Charyulu (2016) The per cent increase in grain yield of *rabi* sorghum with liquid form of biofertilizers over powder form of biofertilizers was an extent of 3 to 11. Further, The per cent increase in grain yield of *rabi* sorghum was 5.3 and 16.4 with powder and liquid form of biofertilizers respectively over RDF alone. The use of biofertilizers may lead to higher availability of nitrogen and phosphorus that promoted growth and development and ultimately resulting in higher yields (Raja and Takankharb, 2017; Jatet *al.*, 2013).

Application of RDF (50:25:0 kg N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O ha<sup>-1</sup>) + seed treatment with *Azospirillum*@ 4ml +PSB @ 4ml /kg seeds recorded significantly higher gross returns (Rs.102123/ha), net returns (Rs.68232/ha) and BC ratio (3.01) compared to rest of the treatments followed by RDF (50:25:0 N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>Okg ha<sup>-1</sup>) +seed treatment with *Azospirillum* @ 4ml +PSB @ 2ml kg<sup>-1</sup>seeds. This might be due to higher grain and stover yields of sorghum with these treatments. These results were conformity with the findings ofPatel, 2015.

## Conclusion

Based on the experimental results it could be concluded that, all the yield and yield parameters of *rabi* sorghum were significantly superior with liquid form of bio-fertilizers over powder form of bio-fertilizers and gave higher gross and net returns.

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**Table1: Effect of powder vs. liquid form of bio-fertilizers on *rabi* sorghum (Pooled of 2018 and 2019).**

Treatments	Grain yield (g/panicle)	Test weight (1000-grain) (g)	Grain yield (q/ha)	Fodder yield (t/ha)	Cost of cultivation (Rs/ha)	Gross returns (Rs./ha)	Net returns (Rs/ha)	B:C ratio
T <sub>1</sub> : RDF(50:25:0 kg NPK/ha) alone	29.6	29.7	35.4	7.6	33900	86023	52123	2.53
T <sub>2</sub> :RDF+ seed treatment with <i>Azospirillum</i> @ 50g+ PSB @ 50g /kg seeds	33.8	29.4	37.4	8.1	33930	90913	56983	2.68
T <sub>3</sub> : RDF+ seed treatment with <i>Azospirillum</i> @ 2 ml+ PSB @ 2ml/kg seed	36.1	31.9	38.7	8.2	33881	93900	60019	2.78
T <sub>4</sub> :RDF+ seed treatment with <i>Azospirillum</i> @ 2 ml+ PSB @ 4 ml/kg seed	36.2	31.4	38.5	8.3	33385	93369	59984	2.80
T <sub>5</sub> : RDF+ seed treatment with <i>Azospirillum</i> @ 4 ml+ PSB @ 2 ml/kg seed	31.5	31.1	40.3	7.9	33887	96953	63066	2.90
T <sub>6</sub> : RDF+ seedtreatment with <i>Azospirillum</i> @ 4 ml+ PSB @ 4 ml/kg seed	40.0	33.3	42.3	8.4	33891	102123	68232	3.01
S.Em+/	1.57	0.86	0.35	0.13	!	746	739	0.02
CD at 5%	4.73	2.60	1.07	0.40	!	2248	2229	0.07