The Andhra Agric. J 67 (3): 148-151, 2020

Effect of Biofertilizer Consortium along with Recommended dose of Fertilizers on Growth and Yield of Rice Fallow Sorghum

K Sreenivasa Reddy, Ch Pulla Rao, M Martin Luther and P R K Prasad
Department of Agronomy, Agricultural College, Bapatla, A. P.

ABSTRACT

A field experiment entitled "Effect of manures in combination with biofertilizer consortium on yield and quality of rice fallow sorghum" was conducted on clay loam soil of Agricultural College Farm, Bapatla during *rabi*, 2018-19. The experiment was laid out in a Randomized Block Design (RBD) and replicated thrice with seven treatments. The results indicated that increased levels of fertilizer doses along with biofertilizer consortium had significantly increased the plant height, drymatter production at all growth stages of sorghum under rice fallows. Days to 50% earhead emergence and days to maturity were not significantly influenced by the treatments. Grain and straw yields of sorghum differed significantly with varying levels of inorganic fertilizers along with biofertilizer consortium.

Keywords: *Biofertilizer, Growth and Yield.*

Sorghum is traditionally grown for food in semi-arid tropics of India and occupies an area of 5.65 M ha with total production of 4.41 M t and a productivity of 780 kg ha^{-1} in Andhra Pradesh, sorghum occupies an area of 97,000 ha with an annual production and productivity of 1,98,000 tonnes and 2041 kg ha^{-1} respectively, in 2016-17 (Indiastat, 2016-17). However, the area under *kharif* sorghum cultivation is decreasing rapidly due to various reasons. Of late, *rabi* sorghum has also been successfully introduced in the rice fallows of coastal Andhra Pradesh (Patil *et al.,* 2012). In Krishna agroclimatic zone of Andhra Pradesh, it is emerging as a potential alternate feed, fodder and bio-energy crop. In recent times, in view of YMV threatening to blackgram and further, its tolerance to high temperature and drought makes it suitable under harsh climatic conditions. It is now grown in more than 14,000 ha area in rice-fallows of Guntur district alone in coastal Andhra Pradesh. It had the highest productivity of 6.9 t ha^{-1}. Of late, Sorghum cultivation is an emerging scenario in rice-fallows under zero tillage. However, there is a prospective situation especially in areas having frugal water resources in rice-fallows of this zone for taking up sorghum as an alternate crop to pulses especially blackgram. The yield and grain quality of sorghum in rice fallows may be improved by rational application of manures and bio-fertilizers consortium. Keeping these points in view, the present investigaton was undertaken to assess the impact of manures in combination with biofertilizer consortium on yield and quality of rice fallow sorghum.

MATERIAL AND METHODS

A field experiment entitled "Effect of manures in combination with biofertilizer consortium on yield and quality of rice fallow sorghum" was conducted on sandy clay loam soil of Agricultural College Farm, Bapatla during *rabi*, 2018-19. The seven treatments consisted of T_1: Control, T_2: 100% Recommended dose of fertilizers, T_3: 50% RDF+ Biofertilizer consortium, T_4: 75% RDF+ Biofertilizer consortium, T_5: 100% RDF+ Biofertilizer consortium, T_6: 125% RDF+ Biofertilizer consortium, T_7: Biofertilizer consortium. The experiment was laid out in a Randomized Block Design (RBD) and replicated thrice. The temperature was higher than optimum for crop as the experimental period from January to April. A total rainfall of 54 mm was received during the crop growth period. The soil was clay loam in texture, near neutral in reaction, low in organic carbon (0.4), low in available nitrogen (224.6 kg ha^{-1}) and medium in available phosphorus (38 kg ha^{-1}) and high potassium (482 kg ha^{-1}). Test variety was CSH-16 which was developed by Indian Institute of Millets Research, Hyderabad. It is a high yielding hybrid with a yield potential of 5 to 8 t ha^{-1} and matures in 110-120 days. It is tolerant to major sorghum pests like shoot fly and stemborer.

RESULTS AND DISCUSSIONS

Plant height

A perusal of the data (Table 1) on the plant height at different growth stages of sorghum *i.e.* 30, 60, 90 and at harvest revealed that plant height was significantly influenced by the different treatments at all the stages of the crop. At 30 DAS, significantly taller plants (44.7 cm) were recorded with T_6 treatment (125% RDF+ Biofertilizer consortium) which remained on par with 100% RDF+ Biofertilizer consortium, (T_5) treatment (39.5 cm) and T_2 treatment with 100% RDF (38.1 cm).

Table 1. Plant height (cm) at different stages of rice fallow-sorghum as influenced by inorganic fertilizers with biofertilizer consortium

Treatments	Plant height			
	30 DAS	60 DAS	90 DAS	Harvest
T_1 - Control	32.5	87.5	147.9	161
T_2 - 100% Recommended dose of fertilizers	38.1	110.1	189.6	206.3
T_3 - 50% Recommended dose of fertilizers + Bio-fertilizer consortium	35.9	96.9	174	183.5
T_4 - 75% Recommended dose of fertilizers + Bio-fertilizer consortium	37.1	103.4	184.1	195.7
T_5 - 100% Recommended dose of fertilizers + Bio- fertilizer consortium	39.5	113.4	191.4	209.6
T_6 - 125% Recommended dose of fertilizers + Bio-fertilizer consortium	44.7	121.6	207.8	216.1
T_7 - Bio-fertilizer consortium only	34.2	92.4	163	172.8
S.Em ±	1.8	5.5	10.8	11.2
CD (P=0.05)	5.5	16.8	32.6	33.9
CV(%)	8.3	9.2	10.4	12.3

Table 2. Drymatter production (kg ha^{-1}) at different stages of rice fallow-sorghum as influenced by inorganic fertilizers with biofertilizer consortium

Treatments	Drymatter production			
	30 DAS	60 DAS	90 DAS	Harvest
T_1 - Control	724	3628	6804	9189
T_2 - 100% Recommended dose of fertilizers	1004	4605	8638	11745
T_3 - 50% Recommended dose of fertilizers + Biofertilizer consortium	848	4288	7861	9391
T_4 - 75% Recommended dose of fertilizers + Biofertilizer consortium	903	4439	8053	10695
T_5 - 100% Recommended dose of fertilizers + Biofertilizer consortium	1029	4670	8783	11940
T_6 - 125% Recommended dose of fertilizers + Biofertilizer consortium	1361	5408	9655	12453
T_7 - Biofertilizer consortium only	737	3552	6616	9315
S.Em ±	50.75	294.3	502	791.2
CD (P=0.05)	156	907	1547	2438
CV(%)	9.3	11.6	10.8	12.8

Table 3. Days to 50 % flowering and maturity of rice fallow-sorghum as influenced by inorganic fertilizers with biofertilizer consortium

Treatments	Days to 50% flowering	Days to maturity
T_1 - Control	65	99
T_2 - 100% Recommended dose of fertilizers	64	102
T_3 - 50% Recommended dose of fertilizers + Biofertilizer consortium	64	100
T_4 - 75% Recommended dose of fertilizers + Biofertilizer consortium	64	100
T_5 - 100% Recommended dose of fertilizers + Biofertilizer consortium	63	101
T_6 - 125% Recommended dose of fertilizers + Biofertilizer consortium	62	102
T_7 - Biofertilizer consortium only	64	101
S.Em ±	1.54	2.21
CD (P=0.05)	NS	NS
CV(%)	4.1	3.7

Almost similar trend was continued for 60, 90 DAS and at harvest stages also. The maximum plant height at 60, 90 and harvest (121.6, 197.8, 216.1 cm) respectively was recorded with (T_6) treatment which was on par with T_5 (121.6, 191.4, 209.6 cm) and T_2 (110.1, 189.6, 206.3 cm) at 60, 90 and harvest treatments respectively. The minimum plant height at 60, 90 and harvest was recorded (87.5, 147.9, 161.0 cm) respectively with control (T_1). The increased plant height could also be attributed to soil enrichment with higher doses of nutrients owing to provide sufficient nutrients that are required for metabolic processes and resulting in the higher plant growth. These results are in accordance with the findings of Opera *et al.* (2017), Sujathamma *et al.* (2015) and Panwar *et al.* (2014)

Drymatter production

At 30 DAS, significantly highest drymatter was recorded with 125% RDF+ Biofertilizer consortium (T_6) treatment (1361 kg ha^{-1}) followed by (T_5) treatment 100% RDF +Biofertilizer consortium (1029 kg ha^{-1}). Similar trend was followed during harvest in which T_6 treatment recorded significantly higher drymatter production (12453 kg ha^{-1}) and was on par with T_5 (11940 kg ha^{-1}) and T_2 (11745 kg ha^{-1}) treatments. Lowest drymatter production (9189 kg ha^{-1}) was observed in the control.

The better availability of nutrients resulted in high rate of photosynthesis besides higher drymatter production of individual plants. This inturn, put forth adequate photosynthetic surface and efficiency, enhancing carbohydrate metabolism, contributing to drymatter production. These results are in confirmity with the findings of Opera *et al.* (2017) and Panwar *et al.* (2014)

Days to 50% flowering and Days to Maturity

Lowest number of days to 50 per cent flowering (62 days) was recorded by the treatment (T_6) i.e. 125% RDF+ Biofertilizer consortium followed by 100% RDF+ Biofertilizer consortium. Increase in the levels of recommended dose of fertilizers along with biofertilizer, time taken to 50 per cent flowering showed declining trend. Among treatments tested, control (T_1) treatment took less number of days (99) to reach maturity and T_6 treatment took maximum days (102) to attain marturity followed by T_2 (102) and T_5 (101) treatments.

Days to 50% flowering difference among the treatments may be due to availability of nutrients to the crop, which together enhances the photosynthetic rate, drymatter accumulation. The earliest maturity noticed in control, due to lack of application of sufficient nutrients might have resulted in early maturity. Number of days taken to reach maturity was not influenced by treatments, due to the fact that these were controlled by genetic characters. Similar results were obtained by Mishra *et al.* (2015) and Sujathamma *et al.* (2015).

Grain and Stover Yield (kg ha^{-1})

The maximum grain yield (4135 kg ha^{-1}) was recorded with the same treatment which proved its superiority *i.e.* T_6 treatment (125% RDF +Biofertilizers) but it remained on par with 100% RDF + Biofertilizers (T_5) treatment (3918 kg ha^{-1}) and 100% RDF (T_2) treatment (3854 kg ha^{-1}). The lowest grain yield (2880 kg ha^{-1}) was recorded with the control. The improvement in yield attributes with inorganic fertilizers and biofertilizer consortium consequently resulted in higher grain yield. The enhanced yield could be a result of good drymatter production for grain filling

Table 4. Grain yield, Straw yield of rice fallow-sorghum and Harvest index of sorghum as influenced by inorganic fertilizers with biofertilizer consortium

Treatments	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Harvest index (%)
T_1 - Control	2880	5529	34.2
T_2 - 100% Recommended dose of fertilizers	3854	7129	35.1
T_3 - 50% Recommended dose of fertilizers + Biofertilizer consortium	3184	6049	34.5
T_4 - 75% Recommended dose of fertilizers + Biofertilizer consortium	3460	6505	34.7
T_5 - 100% Recommended dose of fertilizers + Biofertilizer consortium	3918	7209	35.3
T_6 - 125% Recommended dose of fertilizers + Biofertilizer consortium	4135	7524	35.5
T_7 - Biofertilizer consortium only	3016	5706	34.6
S.Em ±	198.4	419.3	1.1
CD (P=0.05)	612	1292	NS
CV(%)	9.8	11.1	5.8

as a result of greater number of leaves and increased photosynthetic activity.

Highest stover yield (7524 kg ha^{-1}) was recorded with the T_6treatment supplied with (125% RDF+ Bio-fertilizer consortium). Lowest stover yield (5529 kg ha^{-1}) was recorded with control (T_1). The magnitude of increase in stover yield with T_6, T_5 and T_2 was 36.0, 30.3 and 28.9 percent increase respectively over control (T_1). Further, this could be ascribed to its positive influence on both vegetative and reproductive phases of the crop which lead to increase in stover yield. Increased photosynthetic rate might have also resulted in higher accumulation of drymatter and ultimately enhanced stover yield. Jat *et al.* (2018), Opera *et al.* (2017), Kishor *et al.* (2017), Panwar *et al.* (2014) and Yadav *et al.* (2013).

CONCLUSION

From the above findings, it can be concluded that, Significant increase in growth parameters, yield of sorghum was recorded with 125% RDF along with biofertilizers consortium which can be recommended for coastal region of A.P under rice fallow rabi sorghum in no till conditions.

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Received on 27.06.2019 and revised on 02.05.2020