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Productivity enhancement of rabi sorghum (*Sorghum bicolour* L.) through improved production technologies

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Abstract
Front line demonstrations were conducted at 200 farmers fields to demonstrate production potential of Rabi sorghum and economic benefits of improved technologies comprising high yielding Rabi Sorghum variety CSV 29 –R in Vikarabad district of southern Telangana region of Telangana during rabi 2014-2015, 2015-16, 2016-17 and 2017-18 in rainfed condition. The additional yield under improved technologies over local practice ranged from 2.25 to 3.20 q/ha with a mean yield of 2.6 q/ha. In comparison to local practice, there was an increase of 16%, 15%, 17% and 20%. The improved technologies also incurred higher benefit cost: ratio of 3.16 to 3.24 the ratio was 2.31 to 2.50 over the local check during the respective years of 2014-15 to 2017-18.

Keywords: Rabi sorghum, *Sorghum bicolour* L., improved production technologies

Introduction
Sorghum is an important crop of resource poor, small and marginal farmers in semi-arid regions. The rainy season (*kharif*) sorghum grain is used both for human consumption and livestock feed and post-rainy season (*rabi*) produce is used primarily for human consumption in our country. Thus, it is the key for the sustenance of human and livestock population. Rabi sorghum mostly is grown under rainfed conditions with some protective irrigation. Yield and quality of the sorghum crop often suffers due to presence of insufficient soil moisture during its growth period. Rabi sorghum fetches higher prices compared to kharif sorghum due of its special quality grains. Rabi sorghum is valued mainly for direct human food consumption and fodder for livestock.

Rabi sorghum is an important winter season crop grown in Telangana, Andhra Pradesh, Maharashtra and Karnataka. In telangana its cultivation is mainly confined to Ranga Reddy, Mahabubnagar, Adilabad, Nizamabad and khammam. The productivity of rabi sorghum is dependent on quantity of rains during pre-season monsoon and water holding capacity of soil, use of moisture conservation practices, use of high yielding cultivars on basis of soil types and available production technologies (Anuual report of DSR 2017). The yield of rabi sorghum can be increased by using drought resistant varieties with high yield in this area. Keeping this in view, on farm trials on rabi sorghum were conducted to demonstrate the production potential and economic benefits of improved technologies in farmers fields with the high yielding variety CSV- 29 R.

Materials and Methods
On farm trials were conducted in farmers fields of four mandals namely Peddemul, Gandeed, basheerabad and Vikarabad of Vikarabad district in southern Telangana zone of Telangana during rabi season of 2014-15, 2015-16, 2016-17 and 2017-18 under rainfed conditions in medium black soils with low to medium fertility status under sorghum sole cropping systems. Each demonstration was conducted in an area of 0.4 ha and adjacent to the farmers field in which the crop was cultivated with farmers practice/ variety. The package of practices includes were seed treatment, optimum plant population, residual soil moisture and high yielding variety CSV-29 R in the demonstration. The spacing followed was 45 cm x 20 cm. entire dose of N, P and K through Diammonium Phosphate, Urea and K through Murate of Potash @

40:20:0 kg/ha respectively was applied as basal before sowing. The seeds were treated with bavistin @3g/kg of seed. Hand weeding was done at 25 days after sowing. Intercultivation with bullock drawn guntaka was done at 15 days interval. The first intercultivation was done at 30 days after sowing prophylactic measure were taken to prevent shoot fly and bird scaring at the time of milky stage of grain. Harvesting was done with sickles when crop attained physiological maturity stage.

Results and Discussion

Effect of Weather

A total rainfall of 859.5 mm, 447.5.7 mm, 1156 mm, and 775.7 mm was received in 49, 35, 35 and 49 rainy days during 2014-15, 2015-16, 2016-17 and 2017-18 respectively (Annual report of Tandur). There was normal receipt of rain during the years, however a rainfall of 59 mm was deficit and distribution of rainfall was not normal during 2017-18. This caused unusual delay of sowing in some of the farmers fields during October thereby resulted in poor yields compared to the years of normal distribution of rainfall. Excessive rainfall increases the lodging of the sorghum crop. The crop is not fit for tracts of heavy rainfall. This crop grows well in areas having rainfall between 60-80 cm. waterlogging due to poor drainage or prolonged rains can cause substantial reduction in yield.

Yield

The productivity of Rabi Sorghum in vikarabad district under improved production technologies ranged from 21.3 to 24.6 q/ha with a mean yield of 18.75 q/ha. The productivity under the improved technologies varied from 15.2 to 23.6 q/ha, during 2014-15, 14.2 to 21.5 q/ha, during 2015-16, 14.6 to 21.3 q/ha during 2016-17 and 15.2 to 24.2 q/ha, during 2017-18 with the variety CSV 29 - R (Table 1) as against the yield range between 14.6 to 16.8 with a mean yield of 15.8 q/ha under farmers local practice of this variety. The additional yield under improved technologies over local practice ranged from 2.25 to 3.20 q/ha with a mean yield of 2.6 q/ha. In comparison to local practice, there was an increase of 16%, 15%, 17% and 20% in production of Rabi Sorghum under improved technologies in respective years with the variety CSV 29-R during the respective years 2014-15 to 2017-18. This increased grain yield with improved technologies was mainly because of inherent potential of the variety along with seed treatment and maintaining optimum plant population. Nazrulislam *et al.* (2004) [3] and Tomar *et al*. (2009) reported that adoption of improved variety increased the productivity by 35 to 59 percent than the local variety. Srilaxmi *et al*. (2012) [4] also reported that the yield increase under improved technologies with pigeonpea ranged from 36 to 60.7%. Satish *et al*. (2015) [5] reported that with improved variety of safflower the productivity increased by 23 to 34 per cent than the local varieties of safflower.

Table 1: Yield of rabi Sorghum as influenced by improved variety and local practices

Year	Variety	Area (ha)	Demo No.	Yield in q/ha				Additional yield over local check (q/ha)	% increase in yield over local check
				Max	Min	Average	Local		
2014-15	CSV-29-R	0.4	20	23.6	15.2	19.40	16.8	2.60	16
2015-16	CSV-29-R	0.4	20	21.5	14.2	17.85	15.6	2.25	15
2016-17	CSV-29-R	0.4	20	21.3	14.6	17.95	14.6	2.35	17
2017-18	CSV-29-R	0.4	20	24.2	15.2	19.70	16.5	3.20	20

Net return

The economics of improved technologies over the traditional farmers practice/varieties was calculated depending on the prevailing prices of inputs and output costs (table.2). It was found that cost of production of Rabi Sorghum under improved technologies varied from Rs13351 to 16154/ha as against Rs 111467 to 15301 /ha, over the local practice respectively during the years 2014-15 to 2017-18. The improved production technologies registered an additional cost of production ranging from Rs 711 to 1884/ha over the local check. The additional cost incurred in the improved technologies was mainly due to more costs involved in the improved seed cost only. Cultivation of Rabi sorghum under improved technologies accrued higher net returns of Rs 46191 to 52212 /ha, as compared to farmers practice /local check which recorded from Rs 33295 to 35310/ha, during the respective years. There was an additional net returns of Rs 13092 to 18036 /ha respectively during the years 2014-15 to 2017-18 over the local check under demonstration plots.

Table 2: cost of cultivation (Rs/ha), net returns (Rs/ha) and Benefit: Cost ratio of Rabi Sorghum as influenced by improved and local practice.

Year	Total cost of cultivation (Rs/ha)		Net returns (Rs/ha)		Benefit: Cost ratio		Additional cost of cultivation (Rs/ha)	Additional net returns (Rs/ha)
	Improved technology	Local check	Improved technology	Local practice	Improved technology	Local practice		
2014-15	14992	13308	47109	33205	3.16	2.50	1684	13904
2015-16	13351	11467	46191	31914	3.19	2.33	1884	14277
2016-17	16012	15301	48402	35310	3.20	2.31	711	13092
2017-18	16154	15080	52212	34176	3.24	2.27	1074	18036

The improved technologies also incurred higher benefit cost: ratio of 3.16 to 3.24 the ratio was 2.31 to 2.50 over the local check during the respective years of 2014-15 to 2017-18.

Conclusion

The results from the present study clearly brought out the potential of improved production technologies in enhancing the Rabi Sorghum production and economic gains in rainfed conditions of southern Telangana Zone of Telangana. The farmers were very much impressed by the performance of the variety than the local varieties. Non FLD farmers are coming forward to cultivate the crop with the improved variety CSV 29 R

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