

Original Research Article

<https://doi.org/10.20546/ijcmas.2018.703.222>

Yield and Economics of *Rabi Sorghum* [*Sorghum bicolor* (L.) Moench] as Influenced by Different Drip Irrigation Regimes and Fertigation Levels

B. Komuraiah*, K. Avil Kumar, M. Uma Devi, G. Prathibha and J. Harish

College of Agriculture, Professor Jayashankar Telangana State Agricultural University,
Rajendranagar, Hyderabad – 500030, India

*Corresponding author

ABSTRACT

The field experiment was conducted during *rabi* 2016-17 with CSH – 16 sorghum hybrid at Water Technology Centre, College farm, College of Agriculture, Rajendranagar, Professor Jayashankar Telangana State Agricultural University, Hyderabad. The trail was laid out in a split-plot design with three replications. The treatment combinations consisted of irrigation regimes and fertigation levels (I₂); Drip irrigation scheduled at estimated 0.8 ETc throughout the crop growth (I₁), drip irrigation at estimated 1.0 ETc throughout the crop growth (I₂), at estimated 0.8 ETc upto flowering and 1.0 ETc later on (I₃) and at estimated 0.8 ETc upto flowering and 1.2 ETc later on (I₄) as main-plot treatments and fertigation of 75% recommended dose of (RD) N and K₂O (F₁), 100% RD N and K₂O (F₂) and 125% RD N and K₂O (F₃) as sub-plot treatments. The RD of fertilizers generally is 100:60:40 kg NPK ha⁻¹ and fertigation was done with conventional fertilizers (N and K₂O in 10 equal splits with 7 days interval and entire P₂O₅ was applied basal soil application). The study indicated that the economics of *rabi* sorghum was influenced by different drip irrigation regimes and fertigation levels significantly. Gross returns, net returns and B:C ratio (₹ 1,17,650, ₹ 75,119 and 2.76, respectively) were significantly higher with 0.8 ETc upto flowering and 1.2 ETc later on compared to 0.8 ETc throughout the crop growth (₹ 1,02,047, ₹ 61,141 and 2.49, respectively) and on par with remaining treatments. Significantly higher B: C ratio (2.76) was with the fertigation of 100% RD N and K₂O than 125% RD N and K₂O (2.69) and 75% RD N and K₂O (2.63), respectively. Growing of *rabi* sorghum with drip irrigation at 0.8 ETc up to flowering and 1.2 ETc later on with 100% RD N & K₂O is economically benefit as net returns and B: C ratio were significantly higher.

Keywords

Rabi sorghum
(*Sorghum bicolor*
(L.) Moench)

Article Info

Accepted:
16 February 2018
Available Online:
10 March 2018

Introduction

Sorghum [*Sorghum bicolor* (L.) Moench], a C₄ plant is known as great millet, durra, jowari or milo and is cultivated widely in tropical and sub-tropical regions. Global sorghum area trends indicated that area increased from 45 million ha in 1970s to 51 million ha in 1980s.

Later there was fluctuation in area by 4 to 10 million ha and it declined to 42.12 million ha by 2012-13. Grain yields have increased from 1129 kg ha⁻¹ in 1970s to 1457 kg ha⁻¹ in 2012-13 (FAO, 2013) and the sorghum area occupied in 2016 globally was around 42 million hectares with the production and productivity of about 63.08 m tonnes and 1.60

tonnes ha⁻¹, respectively (USDA-2016-17). India contributes about 16 per cent of world's sorghum production with an area of 5.65 m ha (Agricultural statistics - 2015-16). Of which, 1.35 million hectares is cultivated during the rainy (*khari*) season with the productivity of 1170 kg ha⁻¹ and 4.3 million hectares in the post rainy (*rabi*) season with the productivity of 880 kg ha⁻¹. In Telangana sorghum is cultivated in 0.79 lakh hectares area annually with a production of 0.83 lakh tonnes, with an average productivity of 1054 kg ha⁻¹, respectively (DoES-2016-17). Sorghum is mainly grown in states of Andhra Pradesh, Karnataka, Maharashtra, Madhya Pradesh, Gujarat, Rajasthan and Telangana in India and it is an important crop of Telangana, mainly grown in Mahabubnagar, Medak, Ranga reddy, Khammam, Adilabad districts.

Judicious use of irrigation and fertilizer in scientific manner is essential for increasing the productivity. In India and Telangana sorghum is grown under rainfed conditions where as in *rabi* it is grown under irrigated conditions. The existing method of surface irrigation with canal water is inefficient because their application efficiencies are less compared to the modern pressurized irrigation systems. The drip irrigation system can save up water by 70 per cent (Dixit *et al.*, 2005).

Moreover, with drip fertigation system crop yield and grain quality is also be improved as the application of irrigation water and fertilizer quantity can controlled precisely. Adoption of micro-irrigation might help in increasing, productivity of crop, irrigated area and water use efficiency (Jyothirajan *et al.*, 2015).

Materials and Methods

The experiment was conducted during *rabi* 2016-17 with CSH-16 at Water Technology Centre, college farm, college of Agriculture,

Rajendranagar, Professor Jayashankar Telangana State Agriculture University, Hyderabad on a sandy clay loam soil, alkaline in reaction and non-saline, low in available nitrogen, high in available phosphorus and potassium, medium in organic carbon content with field capacity and permanent wilting point of 21.15 and 9.02 per cent, respectively having available soil moisture of 147.2 mm in 0-45 cm depth.

The recommended dose of fertilizer was 100-60-40 kg NPK ha⁻¹, entire dose of P₂O₅ was applied as basal before sowing and N & K₂O applied as fertigation in 10 splits of equal doses at 7days interval from 10 days after sowing (DAS). The experiment was conducted in a split-plot design with 12 treatments viz., Drip irrigation scheduled at estimated 0.8 ETc throughout the crop growth (I₁), Drip irrigation at estimated 1.0 ETc throughout the crop growth (I₂), at estimated 0.8 ETc up to flowering and 1.0 ETc later on (I₃) and at estimated 0.8 ETc up to flowering and 1.2 ETc later on (I₄) as main-plot treatments and 75% RD N and K₂ O (F₁), 100% RD N and K₂O (F₂) and 125% RD N and K₂O (F₃) as sub-plot treatments and replicated thrice. The data was analyzed statistically by following standard procedures. Sorghum was sown on 21 Oct 2016 by adopting a spacing of 0.40 m between rows and 0.15 m between plants to maintain population of 1,66,667 plants ha⁻¹. Irrigation was scheduled based on USWB Class A pan evaporation rates by estimating ETc with suitable pan coefficient depends upon crop stage as per FAO.

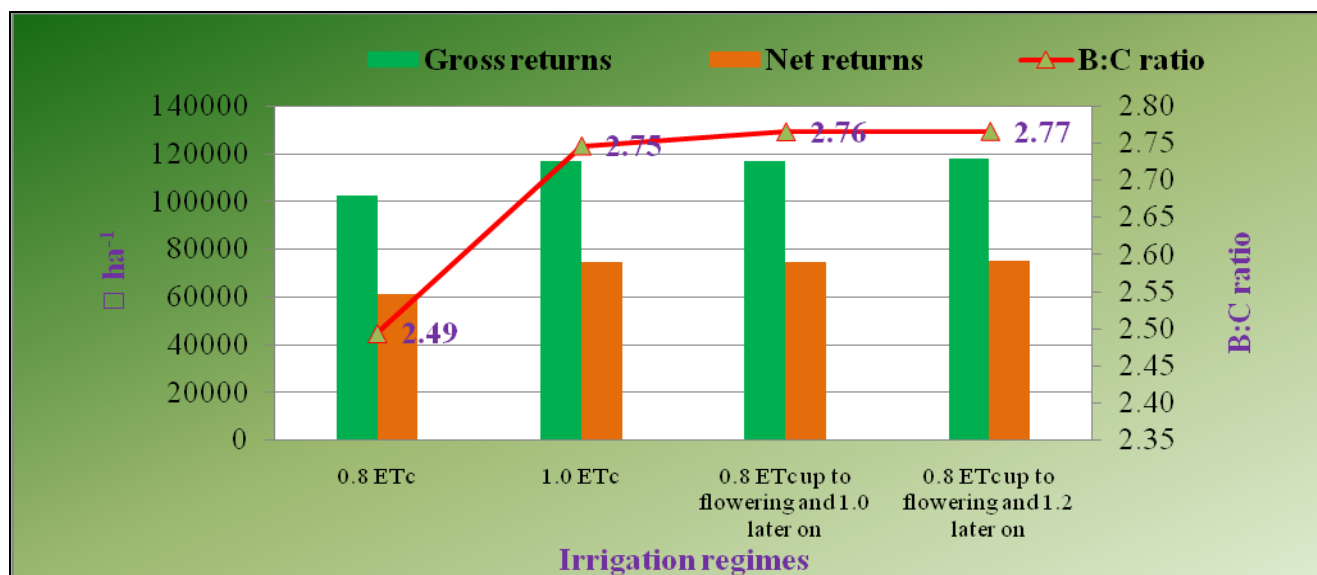
Results and Discussion

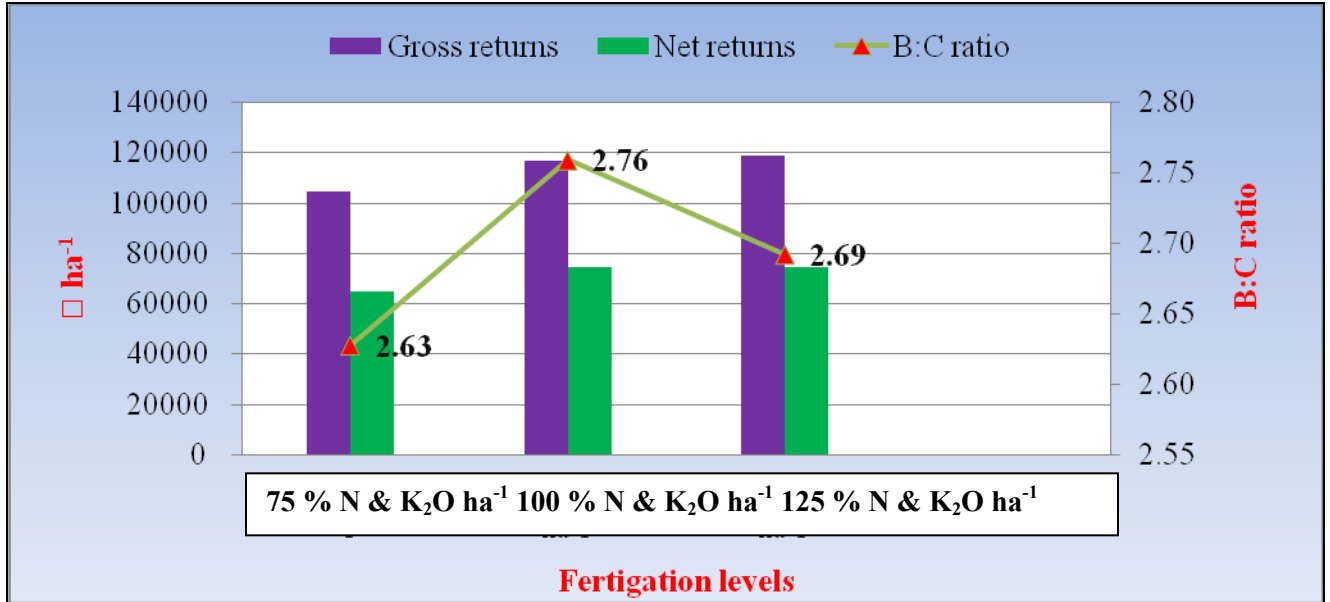
Cost of cultivation varied from ₹ 38,751 to ₹ 44,520 ha⁻¹ in different treatments of *rabi* sorghum. Main variation in cost of cultivation was due to cost of water, fertilizers and man power required for irrigation, fertigation and other operations among different treatments.

Table.1 Yield, cost of cultivation, gross, net returns (₹ ha⁻¹) and B: C ratio as influenced by different drip irrigation regimes and fertigation levels

Treatments	Grain yield (kg ha ⁻¹)	Gross returns (₹ ha ⁻¹)	Cost of cultivation (₹ ha ⁻¹)	Net returns (₹ ha ⁻¹)	B:C ratio
Main plot – (Irrigation regimes) :					
I ₁ : Drip irrigation at estimated 0.8 ETc throughout the crop growth.	5788	102047	40906	61141	2.49
I ₂ : Drip irrigation at estimated 1.0 ETc throughout the crop growth.	6595	116543	42404	74139	2.75
I ₃ : Drip irrigation at estimated 0.8 ETc up to flowering and 1.0 later on.	6625	116670	42184	74487	2.76
I ₄ : Drip irrigation at estimated 0.8 ETc up to flowering and 1.2 Etc later on.	6685	117650	42520	75119	2.77
SEm ±	36	556	-	556	0.01
C.D (P=0.05)	124	1924	-	1924	0.05
Sub plot – (Fertigation levels) :					
F ₁ – 75 % RD N & K ₂ O (75 N & 30 K ₂ O kg ha ⁻¹)	5903	104461	39741	64720	2.63
F ₂ – 100 % RD N & K ₂ O (100 N & 40 K ₂ O kg ha ⁻¹)	6638	116687	42256	74423	2.76
F ₃ – 125 % RD N & K ₂ O (125 N & 50 K ₂ O kg ha ⁻¹)	6730	118534	44014	74521	2.69
SEm ±	32	506	-	506	0.01
C.D (P=0.05)	95	1516	-	1516	0.04
Interaction :					
Fertigation levels at same level of irrigation regimes :					
SEm ±	63	1011	-	1011	0.02
C.D (P=0.05)	NS	NS	-	NS	NS
Irrigation regimes at same or different levels of fertigation :					
SEm ±	63	995	-	995	0.02
C.D (P=0.05)	NS	NS	-	NS	NS

Fig.1 Gross, net returns and B: C ratio of *rabi* sorghum influenced by different drip irrigation regimes and fertigation levels





Gross returns, net returns and B:C ratio from drip irrigated *rabi* sorghum varied among different irrigation regimes and significantly higher gross returns, net returns and B: C ratio (₹1,17,650, ₹75,119 ha⁻¹ and 2.77, respectively) were recorded with drip irrigation scheduled at estimated ET_c of 0.8 up to flowering and 1.2 ET_c later on compared to irrigation at estimated 0.8 ET_c throughout the crop growth (₹ 1,02,047, ₹ 61,141 ha⁻¹ and 2.49, respectively) and it was on par with drip irrigation at estimated 0.8 ET_c up to flowering and 1.0 ET_c later on (₹ 1,16,670, ₹ 74,487 ha⁻¹ and 2.76, respectively) and drip irrigation at estimated ET_c of 1.0 throughout the crop growth (₹ 1,16,543, ₹ 74,139 ha⁻¹ and 2.75, respectively), respectively (Table-1).

Significantly higher gross returns and net returns (₹ 1,18,534 ha⁻¹ and ₹ 74,521 ha⁻¹, respectively) were recorded with fertilization of 125% RD N and K₂O than 75% RD N & K₂O treatment (₹ 1,04,461 ha⁻¹ and ₹ 64,720 ha⁻¹, respectively). 100% RD N and K₂O recorded significantly lower gross returns than 125% RD N and K₂O and significantly higher gross returns than 75% RD N and K₂O, respectively, but in case of net returns it was

on par with 125% RD N and K₂O and significantly higher than 75% RD N and K₂O (Table 1). The variation in the gross returns, net returns were due to the variation in yields and cost of cultivation within the different treatments. Similar results were realised by the Satpal *et al.*, (2016), Kaushal Kishore (2017) in sorghum and Bisht *et al.*, (2012) in maize crops.

B: C ratio was significantly higher (2.76) with the fertilization of 100% RD N & K₂O than 125% RD N and K₂O (2.69) and 75% RD N & K₂O (2.63), respectively. Significantly lower B: C ratio was recorded with 75% RD N & K₂O.

B: C ratio of drip irrigated *rabi* sorghum was significantly higher (2.76) with drip irrigation at estimated ET_c of 0.8 up to flowering and 1.2 ET_c later on compared to irrigation at 0.8 ET_c throughout the crop growth (2.49) and it was on par with drip irrigation at estimated 0.8 ET_c up to flowering and 1.0 ET_c later on (2.76) and drip irrigation at estimated ET_c of 1.0 throughout the crop growth (2.75). Significantly higher B: C ratio (2.76) was with the fertilization of 100% RD N and K₂O than 125% RD N & K₂O (2.69) and 75% RD

N and K₂O (2.63), respectively. Growing of *rabi* sorghum with drip irrigation at 0.8 ETc up to flowering and 1.2 ETc later on with 100% RD N and K₂O is economically benefit as net returns and B: C ratio were significantly higher.

References

- Bisht, A.S., Bhatnagar, A., Pal, M.S and Singh, V. 2012. Growth dynamics, productivity and economics of quality protein maize (*Zea mays* L.) under varying plant density and nutrient management practices. *Madras Agricultural Journal*. 9 (1-3): 73 – 76.
- Dixit, A.K., Singh, O.P., Dileep Kachroo and Bali Amarjit, S. 2005. Response of promising rainy season sorghum (*Sorghum bicolor*) genotypes to nitrogen and phosphorus fertilization. *Indian Journal of Agronomy*. 50 (3): 206 - 209.
- DoES. 2017. Season and crop report of Telangana. Directorate of Economics and Statistics (DoES), Government of Telangana.
- Food and Agricultural Organization (FAO) 2013. In: FAO Statistical databases. <http://faostat.fao.org/>.
- Indian Agricultural Statistics 2015 - 16.
- Jyotiranjana Pradhan, Himangshu Das, Kundu, C.K and Pintoo Bandopadhyay. 2015. Response of fodder sorghum to irrigation scheduling and nitrogen levels. *International Journal of Farm Sciences*. 5 (2): 15 - 20.
- Kaushal Kishore, 2017. Production potential of sorghum (*Sorghum bicolor* L. Moench) genotypes under different fertility levels. *M.Sc. (Ag.) Thesis*. M.R.P.A.U, Udaipur, Rajasthan.
- Satpal, Duhan, B.S., Arya, S., Kumari, P and Devi, S. 2016. Performance of single cut forage sorghum genotypes to different fertility levels. *Forage Research*. 42 (3): 184 – 188.
- United States Department of Agricultural Statistics year book, 2016 – 17.

How to cite this article:

Komuraiah, B., K. Avil Kumar, M. Uma Devi, G. Prathibha and Harish, J. 2018. Yield and Economics of *Rabi* Sorghum [*Sorghum bicolor* (L.) Moench] as Influenced by Different Drip Irrigation Regimes and Fertigation Levels. *Int.J.Curr.Microbiol.App.Sci*. 7(03): 1874-1878. doi: <https://doi.org/10.20546/ijcmas.2018.703.222>