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Effect of cow dung on the growth, yield and agronomic use efficiency of sorghum

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Abstract

The research was conducted at the Livestock farm complex, Tamil Nadu Veterinary and Animal Sciences University, Chennai in sorghum with the objective to evaluate the application of cow dung along with irrigation water on the growth and yield. The experiment was laid out in a randomized complete block design. Treatments were three (application of cow dung twice, application of cow dung once and without application of cow dung) and replicated four times. Growth and yield data were subjected to analysis of variance. Significant means were compared with the least significant difference at 5%. The result showed a significant increase in growth, yield and agronomic use efficiency of sorghum with respect to application of cow dung twice along with irrigation water.

Keywords: Application, dung, agronomic

Introduction

Sorghum is one of the most important dryland crops grown in *kharif* and *rabi* seasons as a dual-purpose crop in Tamil Nadu. Cultivated area in Tamil Nadu is around 3.85 lakh hectares with an annual production of 4.30 lakh tonnes and grain productivity of 1117 kg/ha (2017-18). More than 80 per cent of the sorghum is cultivated as a rainfed crop by the marginal farmers to meet out the demand of grain for consumption and dry fodder as animal feed. CO 32, a variety of sorghum is a dual-purpose crop with an average grain yield of 3238 kg/ha and 11.6 tonnes/ha of dry fodder yield (approximately 40-45 t/ha of green fodder yield). Rational combinative supply of water and nutrients can increase efficiency of plants by way of increasing biomass with good interaction between soil nutrients and uptake by plants. The interaction of water and nutrient is time dependant, and its application at different stages of plant growth may produce different interaction effects (Lestari *et al.*, 2018) [7]. Application of organic manures, improves soil fertility, crop growth, development, and yield of the crops. Organic manures production requires cow dung as a base material and the conversion of dung to organic produces is laborious and time taking (Wang *et al.*, 2024) [8]. The fresh cow dung application as a foliar spray is found beneficial, however, application of cow dung to soil requires in depth analysis. Hence, the study on application of cow dung along with irrigation water was conducted to ascertain the growth and yield of annual sorghum.

Materials and Methods

The research was carried out at Livestock Farm Complex, TANUVAS in sandy soil, with pH – 7.12, Total organic carbon – 0.021%, Total nitrogen – 0.45%, available phosphorous - 0.016% and Exchangeable potassium – 0.015%. Study was conducted in Randomised block design and replicated five times. The treatments included were T₁: Application of cow dung water twice (25 DAS and 45 DAS), T₂: Application of cow dung water once (25 DAS) and T₃: without application of cow dung water replicated four times in randomized block design. Annual sorghum variety Co 32 was taken up sowing. Crop production techniques except the application of nutrients for sorghum were carried out as per the crop production guide, TNAU. Nutrients were provided through cow dung as per the treatment schedule. Nitrogen, phosphorous and potassium content of water was estimated as 4.85, 0.85 and 2.1% respectively. About 100 kg of cow dung was mixed along with irrigation water. Recorded plant growth parameters and yield at the time of harvest and statistically analysed to infer the results.

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Results and discussion

Growth parameters

The results pertaining to growth parameters are given in Table (1). The results showed that the application of cow dung water twice at 25 and 40 days after sowing of sorghum resulted in significantly higher plant height (190.3±6.52 cm), number of leaves per plant (12.4±0.81), leaf length (78.63±1.92 cm), leaf width (7.51±0.41 cm), leaf thickness (1.201±0.080 mm), and leaf stem ratio of 0.289±0.023. The root and shoot weight was found higher with the application of cow dung water twice at 25 and 45 DAS (Fig.1). However, the root shoot ratio was found higher with the application of cow dung water once. Stem girth and internode length was found higher with the application of cow dung water twice at 25 and 45 DAS (Fig.2). However, the inflorescence weight

was found higher with the application of cow dung water once. The increase in level of cow dung application enhanced both vegetative growth and fresh biomass of the plant. The mixture of semi solid phase of manure mixed with water becomes soluble and this offers a fastest way to improve the soil available nutrients by the plants. Also the soil available nutrients for uptake by plants is increased as visible from the increased root weight of the crops. Higher the volume of the roots, higher the shoot weight of the plants. The growth of a plant is limited by the total amount of nutrients available to the plants indicating that root and shoot parameters are interdependent. This is in line with the findings of Loh *et al.* (2003) [3]. The cow dung helps in holding higher water to facilitate the absorption of nutrients by the roots and reflects on the better growth of the plants (Samanhudi *et al.*, 2020) [6].

Table 1: Effect of cow dung water application on the growth parameters of annual sorghum

Treatments	Plant height (cm)	No. of leaves/plant	Leaf length (cm)	Leaf width (cm)	Leaf thickness (mm)	LS ratio
T ₁	190.3±6.52 a	12.4±0.81 a	78.63±1.92 a	7.51±0.41 a	1.201±0.080 a	0.289±0.023 a
T ₂	143.1±2.54 b	9.9±0.48 b	74.60±0.88 a	6.28±0.59 a	0.886±0.139 a	0.258±0.015 b
T ₃	106.7±3.49 b	8.4±0.37 b	63.81±4.36 b	4.59±0.64 b	0.302±0.087 b	0.230±0.028 b
CD (p=0.05)	12.68	1.61	8.25	1.645	0.324	0.03

Yield parameters

The effect of application of cow dung is presented in Table (2). The fresh yield obtained with application of cow dung twice at 25 and 45 DAS resulted in higher yield (40.80±12.14 t/ha) followed by the application of cow dung once at 25 DAS (32.49±3.49 t/ha). However, the treatment without application of cow dung resulted in significantly lesser yield. The agronomic use efficiency and water use efficiency of sorghum was found higher with the application of cow dung water twice (112.89 kg produce/kg N applied) and 5.70 kg/mm of water. Leaf stem ratio also influences the inflorescence and the biomass yield of the crop. Incremental application of cow dung led to increase in the proportion of leaf relative to the stem and hence the fresh biomass yield of sorghum has

improved. This is in line with the findings of Onyeonagu and Asiegbu, (2005) [4]. Cow dung has more organic matter and soluble nutrients than conventional ones, promoting nutrient use efficiency, soil sustainability and plant health (Gupta *et al.*, 2006) [2]. The nitrogen and phosphorous uptake of sorghum were considerably improved by the application of cow dung twice indicating increase in the agronomic efficiency of the crop as suggested by Rupa Matheus *et al.* (2024) [5]. The higher water use efficiency with increased quantity of cow dung application is related to the biomass yield of the crop. Ajeigbe *et al.* (2018) [1] reported similar results with the application of incremental nutrients over water use efficiency of the crop.

Table 2: Effect of cow dung water application on the yield and resource use efficiency of sorghum

Treatments	Green biomass yield (t/ha)	Agronomic use efficiency (kg produce/kg N applied)	Water use efficiency
T ₁	40.80±12.14 a	112.89	5.70
T ₂	32.49± 3.49 b	88.68	4.76
T ₃	25.6± 6.36 c	-	4.49
CD (p=0.05)	1.77	-	-

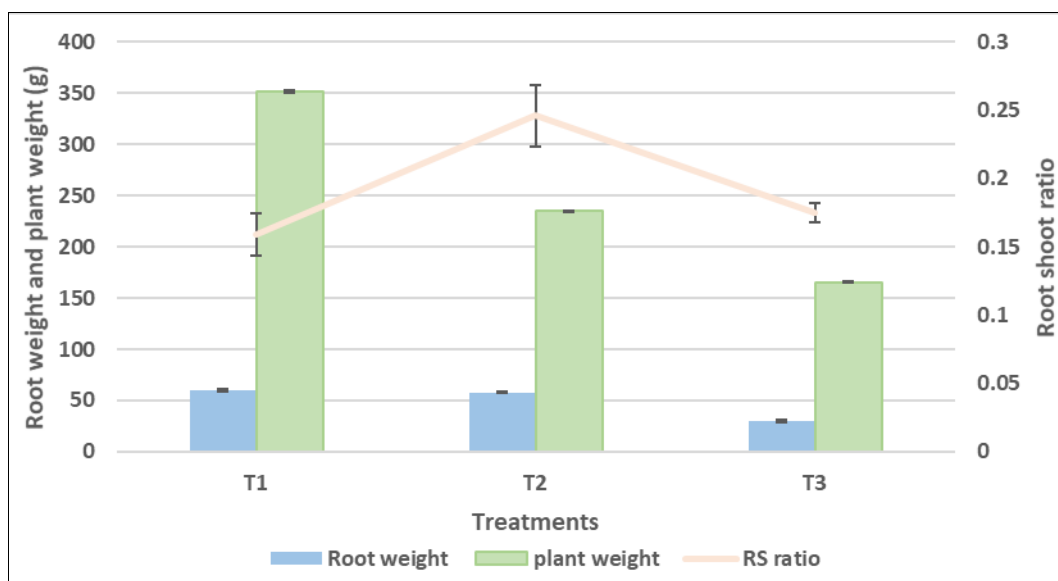


Fig 1: Interaction between root weight and plant weight to root shoot ratio

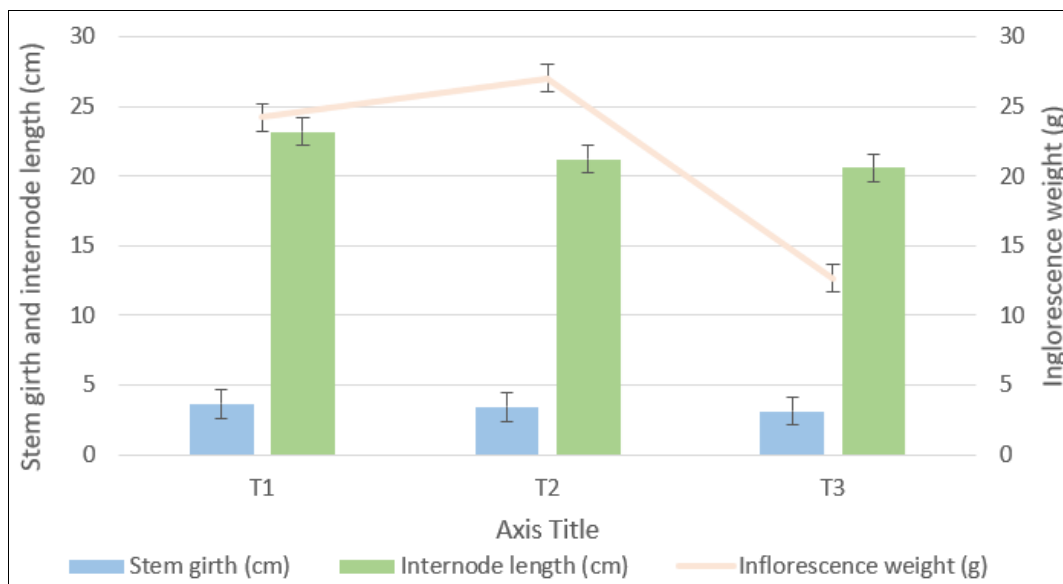


Fig 2: Effect of cow dung water application to sorghum on its stem parameters and inflorescence

Conclusion

The results show that the application of cow dung along with irrigation water is beneficial on the growth, yield and agronomic use efficiency of sorghum. However, application of nutrients along with water at the right stage is essential to improve the growth and yield of sorghum. Hence, it is concluded that the application of cow dung water twice at 25 and 45 days after sowing results in higher growth and yield parameters of sorghum

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