Interactive Effects of Plant Growth Regulators and Micronutrients on Growth, Yield and Quality of Sorghum Under Temperature Variability

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Abstract- A field experiment was conducted at Agricultural Dry land, Uthangarai taluk, and Krishnagiri district, to study the effect of Plant Growth Regulators and micronutrients on growth, yield and quality of sorghum. The objective of the study was to assess the effect of Plant Growth Regulators and micronutrients on herbage yield and quality in various treatments. The crop was raised with recommended package of practices. In treatments, where zinc was not a treatment, an amount of sulphur through gypsum equivalent to sulphate supplied with 5 kg ZnSO4 was applied to compensate. The crop was sown in 30.0 cm apart lines. The results indicated that all the treatments improved the green fodder yield over control. Among different treatments. It was significantly superior to other treatments. These treatments improved the green fodder yields by 35.0 % and 34.2 %, respectively, over control (spray of water). Similar trend was observed with respect to quality parameters (crude protein content and crude protein yield) of sorghum.

Keywords: Sorghum, Triacontanol, micronutrients.

I. INTRODUCTION

Sorghum (Sorghum bicolor L.) is a C4 short day plant with high photosynthetic efficiency. It is a principle dry land crop grown in India for food, feed, and fodder and ethanol production. Nowadays, it is gaining importance as an alternative for bio fuel production. Sorghum is a versatile crop grown for various purposes in temperate, tropical and subtropical environments. It has relatively low production costs, a particular ability to resist water stress as compared to other cereals and it produces a large residue biomass that improves the soil physico-chemical properties. It is resistant to drought, poor drainage and salinity. Sorghum is the fifth cereal in importance after wheat, maize, rice and barley, with a global production of around 50-60 million tonnes. The area under sorghum in India is 5.82 m ha with production and productivity of 5.39 million tonnes and 926 kg/ha, respectively. It is not possible to bring more area under cultivation due to population burden, industrialization and urbanization so to enhance the productivity, it is important to apply inputs judiciously especially nutrients. The balanced application of nutrients is important in overall development of the plant (growth, development and biological yield) as compared to single nutrient or in combination. Micro-nutrients play an important role in maintaining soil health and also the productivity of the crops. Adoption of High yielding varieties (HYVs) and intensive cropping has resulted in degradation of soil and removal of micronutrients from the soil. Due to increased removal of nutrients, there has been a shift towards high analysis of NPK fertilizers which resulted in decline of micro nutrients to below normal at which productivity of crops not be sustained. About 52% and 30% of Indian soils have been reported to be deficient in Zn and B status, respectively. Zinc is known to improve the metabolism of the plant and yield; and sink relationship. The role of zinc in crop growth is well known for its role in bio-synthesis of plant auxins, nitrogen metabolism, oxidation reduction reactions, which are considered to be essential for plant growth and development, chlorophyll formation, photosynthesis, important enzyme system and respiration in plants. Application of micronutrient fertilizers through soil application is the most efficient and economical method of getting these nutrients into the crops. Plant growth regulators increase the productivity of the crops under environmental stress. Plant growth regulators are chemical chemicals that can change the way plants grow and develop, resulting in higher yields, better grain quality, and easier harvesting. Triacontanol (PGR) has been found effective in inducing physiological efficiencies including photosynthetic efficiency which subsequently results in better growth and yield of crops without increase in cost of cultivation (Sumeriya et al., 2020). Plant growth regulators and micronutrients, in small amounts, play a critical role in plant growth and development.

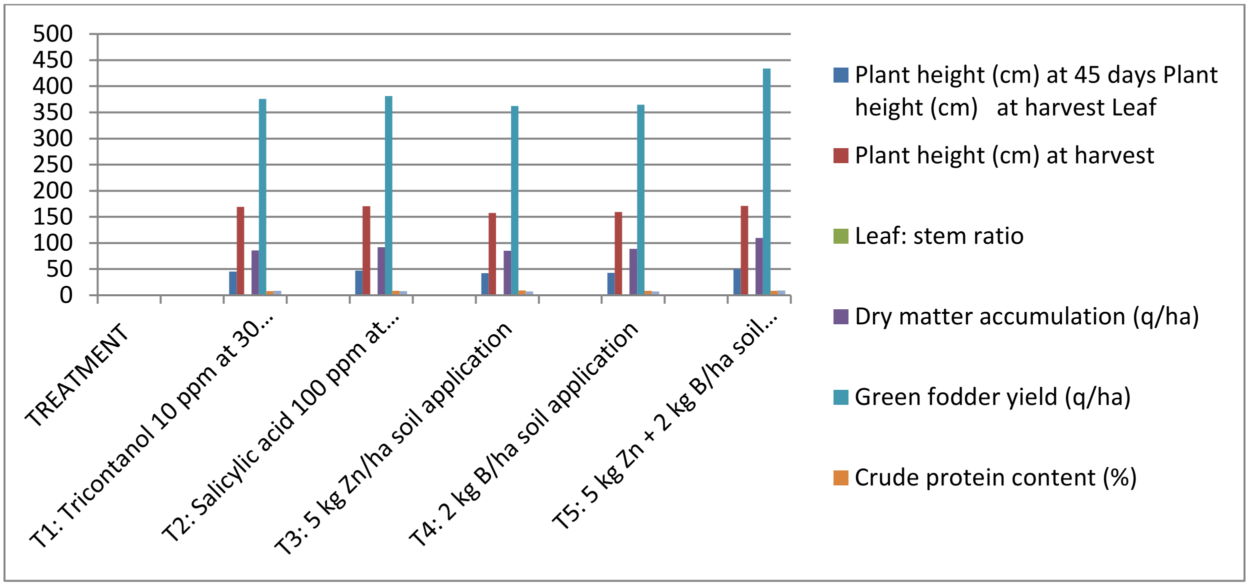
II.MATERIALS AND METHODS

The Physico-chemical properties of the soil are silty clay in texture with sand, clay and silt percentage of 9.5, 27.9 & 62.6, respectively. With respect to the chemical properties, the soil of the experimental site was having pH 7.2, electrical conductivity 0.15 dsm-1 and organic carbon 0.38%, medium in available nitrogen (480.2 kg/ha), phosphorus (9.5 kg/ha) and potash (202.4 kg/ha). The experiment consisted of twelve (12) treatment combinations viz; T1: Triacontanol 10 ppm at 30 DAS (foliar spray), T2: Salicylic acid 100 ppm at 30 DAS (foliar spray), T3: 5 kg Zn/ha (soil application), T4: 2 kg B/ha (soil application), T5: 5 kg Zn + 2 kg B/ha (soil application), Water spray at the time of plant growth regulator application and replicated thrice. The treatments were evaluated in a completely randomized block design. Micronutrients (Zn and B) were applied at the time of sowing whereas plant growth regulators were sprayed at 30 days after sowing as per treatment details. Recommended dose of NPK (80, 130 and 50 kg/ha, respectively) were applied in all the plots, half dose of N and full dose of P and K was applied as basal and remaining half dose of nitrogen was applied in two split doses, 1st at knee high stage and 2nd at flag leaf stage. Total amount of rainfall during the crop growth period was 158.4 mm. The mean maximum and minimum temperature for the entire crop growth period were 28.8oC and 13.0oC, respectively. The crop was sown by following all the agronomic practices. The crop was sown at the seed rate of 15 kg/ha with planting geometry of 40 cm x 10 cm and was irrigated twice i.e., at knee high stage and booting stage. In order to control the weeds, Atrazine @ 1 kg a.i/ha was applied at 1-3 days of sowing and the crop was harvested after flowering stage. Plant height was measured from the base of the plant to the tip of the longest leaf stretched from randomly labeled five plants in each net plot area and expressed in cm. For dry matter accumulation, five plants were randomly selected from penultimate rows of each plot. These plants were cut from ground level and sun dried for 2-3 days and was chopped into small pieces after sun drying, mixed homogenously and dried in hot air oven at 60 C temperature till constant weight. The plants from the net plot area, including the tagged plants were harvested to the ground level at 90 per cent moisture, cut in to bits of one meter length and the weight of the green fodder was recorded and expressed in q ha-1 for recording of green fodder yield. The green fodder was sun dried on the threshing floor for 7 days and later dry fodder yield was recorded at 15 per cent moisture and the weights were expressed as dry fodder yield in q ha-1. Yield (Green fodder and dry matter) was recorded by using standard procedure from five randomly selected plants from each plot. Crude Protein content of fodder was determined by multiplying respective nitrogen concentration with a factor 6.25 and the crude protein yield is determined by multiplying crude protein content with yield.

The Software package used for analysis of data was "OPstat," wherever the F-test" was found significant at 5 per cent probability; critical difference values were used to compare the treatment means.

TREATMENT	Plant height (cm) at 45 days Plant height (cm) at harvest Leaf	Plant height (cm) at harvest	Leaf: stem ratio	Dry matter accumulation (q/ha)	Green fodder yield (q/ha)	Crude protein content (%)	Crude protein yield (q/ha)
T1: Tricontanol 10 ppm at 30 DAYS	45.07	168.9	0.60	85.75	375.9	7.80	8.50
T2: Salicylic acid 100 ppm at 30 DAYS (foliar spray)	47.47	170.3	0.63	91.72	381.3	8.70	7.73

T3: 5 kg Zn/ha soil application	42.13	157.8	0.63	85.01	362.5	9.00	7.41
T4: 2 kg B/ha soil application	43.17	159.2	0.67	88.74	364.5	8.35	7.39
T5: 5 kg Zn + 2 kg B/ha soil application	50.07	171.2	0.69	110.01	434.1	8.80	9.34



III. RESULTS AND DISCUSSION

The observations pertaining to growth and yield of sorghum recorded during the course of investigation were statistically analyzed and significance of results tested. The results obtained from the experiment revealed that various growth and yield attributes were significantly influenced by plant growth regulators and micro-nutrients. Among growth parameters, plant height (cm) recorded at 45 DAYS and at harvest as influenced by plant growth regulators and micro-nutrients given in the table revealed that the highest plant height (53.23 cm and 205.5 cm) at 45 DAYS and at harvest was found with treatment T10 where 5 kg of zinc with 2 kg B and Triacontanol @ 10 ppm was applied which was found at par (51.73 cm and 199.8 cm) at 45 DAS and at harvest respectively with treatment T11. The improvement in growth parameters with these plant growth regulators and micronutrients might be due to their role in modifying various physiological and metabolic processes in the plant system. It increase in plant growth might also be due to higher quantity of chlorophyll synthesis in the leaf tissue and delayed senescence of plant leaves. The results indicated that all the treatments improved the green fodder yield over control. Among different treatments, T10: 5 kg Zn + 2 kg B/ha soil application + Triacontanol 10 ppm at 30 DAYS foliar spray and T11: 5 kg Zn + 2 kg B/ha soil application + salicylic acid 100 ppm at 30 DAYS foliar spray produced maximum green fodder yield (493.6 and 490.5q/ha) on mean basis. It was significantly superior to other treatments. These treatments improved the green fodder yields by 35.0% and 34.2%, respectively, over control (spray of water). Zn and Fe has an important role in photosynthesis and metabolic process augments the production of photosynthates and the translocation of these photosynthates to different parts of plant and iron plays an important role in catalytic function in biological oxidation and reduction in plant as well as it is principle constituent of a large number of metabolically active compounds like cytochromes, heme and nonheme enzymes and other functional metalloproteins, which ultimately increases the green fodder yield of fodder crops. In terms of dry matter, similar trend was noted and the improvement with T10 and T11 was to the tune of 36.8 % and 41.0 % over control. Triacontanol 10 ppm at 30 DAYS (foliar spray) (T1) improved the green fodder yield and dry fodder yield by 13.6% and 14.3% respectively over

T12 Water spray at the time of plant growth regulator application. Similarly, spray of T2: Salicylic acid 100 ppm at 30 DAS (foliar spray) improved the green fodder yield and dry fodder yield by 14.4% and 15.4% respectively over T12 Water spray at the time of plant growth regulator application. Similar trend was observed in case of crude protein yields on mean basis. It might be due to highest dry matter production and crude protein content as crude protein yield is a function of crude protein content and dry matter yield.

IV.CONCLUSION

The results of the study shows that treatment T10; 5 kg Zn/ha with 2 kg B/ha and Triacontanol @10ppm improved both growth and yield of sorghum which was statistically at par with 5 kg Zn/ha with 2 kg B/ha and 100 PPM Salicylic acid and the lowest growth and yield parameters were recorded with the treatment T12 (water spray at the time of PGR application)

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