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Yield and Quality Improvement of Fodder Cowpea through Zinc Foliar Nutrition

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A field experiment was conducted with the objective of assessing yield and quality of fodder cowpea by supplementing zinc through foliar nutrition in randomized block design with eight treatments and three replications. The treatments were T_1 (100% RDF), T_2 (75% RDF), T_3 (T_1 + zinc @ 0.25% as foliar spray at 20 DAS), T_4 (T_1 + boron @ 0.25% as foliar spray at 20 DAS), T_5 (T_1 + boron @ 0.125% + zinc @ 0.125% as foliar spray at 20 DAS), T_6 (T_2 + zinc @ 0.25% as foliar spray @ 20 DAS), T_7 (T_2 + boron @ 0.25% as foliar spray @ 20 DAS) and T_8 (T_2 + boron @ 0.125% + zinc @ 0.125% as foliar spray at 20 DAS). The results revealed that for augmented yield and quality of fodder cowpea in sandy loam soils has to be supplied with FYM @ 10 t/ha as basal dose along with N, P_2O_5 and K_2O @ 25:60:30 kg/ha along with foliar application of zinc sulphate heptahydrate @ 0.25 percent at 20 days after sowing.

Key Words: Foliar, Green fodder yield, Quality, Sandy loam, Yield.

INTRODUCTION

Good quality fodder is mandatory for the development of livestock sector. During summer, the quantity and quality of herbage available is very low. Introducing a fodder legume in the low lands during summer can improve fodder production and also enhance the productivity of rice-based cropping system. Fodder cowpea is the most widely cultivated fodder in areas where the soil is sandy and relatively infertile (Singh and Tarawali, 2011). Nutrient availability to crops is one of the limiting factors in crop production. Raising leguminous crops like fodder cowpea, fixes nitrogen from the atmosphere in their root nodules and thus enrich the soil. These legumes will serve as green fodder, dry fodder and also as silage during the lean summer months. Boron and zinc are essential plant micronutrients and their importance to crop productivity is similar to that of major nutrients (Rattan *et al*, 2009; Padbhushan and Kumar, 2014). Onattukara region has a cropping system of two crops of rice followed by sesame/pulses/vegetables which are raised during the summer. The sandy loam soils of Onattukara are low in nutrient contents (Mini and Mathew, 2015) and hence the fertilizer recommendation for each crop has to be followed strictly to obtain satisfactory yield. During summer, there is immense potential to raise fodder cowpea. Hence, the present study was undertaken with the objective of yield and quality in fodder cowpea through foliar nutrition of boron and zinc in the sandy loam soils of Onattukara.

MATERIALS AND METHODS

An investigation for yield and quality enhancement in fodder cowpea was undertaken during December 2022 to February 2023 at Onattukara Regional Agricultural Research Station, Kayamkulam. The field experiment was laid out in randomized block design with eight treatments and three replications. The treatments were T_1 (100% RDF), T_2 (75% RDF), T_3 (T_1 + zinc @ 0.25% as foliar spray at 20 DAS), T_4 (T_1 + boron @ 0.25% as foliar spray at 20 DAS), T_5 (T_1 + boron @ 0.125% + zinc @ 0.125% as foliar spray at 20 DAS), T_6 (T_2 + zinc @ 0.25% as foliar spray @ 20 DAS), T_7 (T_2 + boron @ 0.25% as foliar spray @ 20 DAS) and T_8 (T_2 + boron @ 0.125% + zinc @ 0.125% as foliar spray at 20 DAS). Dolomite @ 1 t/ha was applied uniformly in the experimental area and incorporated into soil along with tillage. Well decomposed farm yard manure was applied

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to all the plots as per treatments at the time of land preparation. The recommended dose of fertilizers was 25:60:30 kg N: P_2O_5:K_2O/ha and was given in split dose as half N, full P, half K as basal and the remaining half N and half K were given as top dressing at 15 days after sowing (KAU, 2016). Foliar nutrition of zinc was supplied as zinc sulphate heptahydrate @ 0.25 % and boron was applied as solubor @ 0.25%. Fodder cowpea var. Aiswarya released from ICAR-AICRP on Fodder Crops, College of Agriculture, Vellayani, Kerala was used for the study. It has a potential yield of 30 t/ha. The seeds of fodder cowpea were sown directly in lines in raised beds at a spacing of 30 cm x 15 cm. Interculture, weeding and earthing up for fodder cowpea were done at 10 days after sowing and at one month after sowing.

The yield characters *viz*., green fodder yield per plant, green fodder yield per hectare, dry fodder yield per plant and dry fodder yield per hectare were recorded at harvest. The fresh weight of observational plants from the respective treatments were recorded and the average was worked out for green fodder yield per plant. The plants in the net plot were harvested at the base and were weighed and expressed in t/ha for green fodder yield per hectare. The observational plants harvested separately were first shade dried and then oven dried at 65° C till constant weight was achieved. The dry weights of these samples were taken and total dry fodder yield per plant was calculated and expressed as g per plant. For dry fodder yield per hectare, the observational plants dried to constant weight were taken and calculated.

The quality characters like leaf: stem ratio, crude protein content and crude fibre content were also analyzed. To assess the quality parameters of fodder cowpea, composite samples were collected from each treatment plot and dried in the hot air oven at 65°C. The N content of fodder cowpea was determined by adopting standard procedures. Crude protein content of the fodder cowpea was determined by multiplying the N content of the sample with a factor 6.25, as prescribed by Simpson *et al* (1965). The content was then presented as percentage on dry weight basis. Plant crude fibre content at harvest was analyzed using AOAC method and expressed in percentage (A O A C, 1975). To assess leaf: stem ratio, the leaves and the main stem were separated from the observational plants. They were shade dried followed by oven drying at 65° C till the attainment of constant weight. The dry weight of leaves and stem of each plant was estimated and the ratio of leaves to stem was calculated. The data were statistically analyzed in GRAPES software (Gopinath *et al*, 2020) and the treatment means were compared at 5 per cent probability level.

RESULTS AND DISCUSSION

Yield and Yield Attributes

The green fodder yield per plant was significantly influenced by the treatment T_3 (106.72 g) followed by the treatment T_5 (101.69 g). There was a yield increase of 10.03 per cent compared to the treatment T_1 (control). The increase in green fodder yield might be due to the increase in growth parameters due to application of zinc foliar spray. Zinc also has an active role auxin synthesis and cell division Safak *et al.* (2009), which might have improved the yield of fodder cowpea. This was in agreement with the findings of Weldua *et al* (2012) who reported an increased yield and above ground biomass for *faba* beans due to zinc application. In general, the reduction in nutrient dosage brought down the green fodder yield per plant. The treatment t_7 registered the lowest green fodder yield per plant (78.45 g). The combined spray of boron and zinc along with the recommended dose of nutrients (T_5) produced a green fodder yield of 101.69 g per plant. This is in agreement with the findings of Debnath *et al* (2018) who reported an increased yield of cowpea with the application of boron and zinc.

The green fodder yield per hectare was significantly influenced by the treatment T_3 (23.74 t) and was 11.77 per cent higher than the control treatment (T_1). Since zinc is a co-factor of over 300 enzymes and also an important element in nucleic acid metabolism (Marschner, 1986), the application of zinc might have favoured a higher yield. Zinc is required for the biosynthesis of IAA and gibberellins (Taliee and Sayadian, 2000; Mousavi *et al.*, 2012) which might be the reason

Table1. Effect of treatments on yield of fodder cowpea.

Treatment	Green fodder yield /plant (g)	Green fodder yield/ ha (t)	Dry fodder yield/plant (g)	Dry fodder yield/ha (t)
T_1 – 100% RDF	96.53	21.24	8.52	1.90
T_2 – 75% RDF	86.89	19.95	8.38	1.86
T_3 – T_1 + zinc @ 0.25%	106.72	23.74	10.12	2.25
T_4 – T_1 + boron @ 0.25%	85.77	19.16	7.83	1.74
T_5 – T_1 + boron @ 0.125% + zinc @ 0.125%	101.69	22.45	9.74	2.17
T_6 – T_2 + zinc @ 0.25%	96.21	20.94	8.47	1.88
T_7 – T_2 + boron @ 0.25%	78.45	17.50	7.24	1.61
T_8 – T_2 + boron @ 0.125% + zinc @ 0.125%	79.33	17.95	7.43	1.65
SEm (±)	1.59	0.32	0.37	0.08
CD (0.05)	4.823	0.966	1.115	0.246

RDF - Recommended dose of fertilizers NS - Not significant

Table 2. Effect of treatments on quality characters of fodder cowpea.

Treatment	Leaf: stem ratio	Crude protein (%)	Crude fibre (%)
T_1 – 100% RDF	1.04	12.83	19.77
T_2 – 75% RDF	0.97	12.25	19.38
T_3 – T_1 + zinc @ 0.25%	1.26	13.42	19.55
T_4 – T_1 + boron @ 0.25%	0.91	13.42	19.75
T_5 – T_1 + boron @ 0.125% + zinc @ 0.125%	1.15	14.00	19.56
T_6 – T_2 + zinc @ 0.25%	1.00	13.42	19.96
T_7 – T_2 + boron @ 0.25%	0.81	11.67	19.34
T_8 – T_2 + boron @ 0.125% + zinc @ 0.125%	0.83	13.42	19.33
SEm (±)	0.02	0.60	0.25
CD (0.05)	0.053	NS	NS

dw -Dry wight RDF - Recommended dose of fertilizers NS - Not significant

for the vigorous growth and yield of fodder cowpea. Pandya and Bhat (2007) and Narayan *et al* (2008) had also observed that the application of sulphur and zinc along with the recommended dose of NPK could improve the green fodder yield of cowpea. Dhaliwal *et al* (2023) also opined that the productivity in fodder crops can be improved through the application of zinc. The treatment t_7 recorded the lowest green fodder yield per hectare. Close examination of data indicated that the plants that received zinc and boron exhibited a synergic effect on yield compared to boron alone.

The dry fodder yield per plant was significantly higher for the treatment T_3 (100 per cent RDF + zinc @ 0.25per cent @ 20 DAS) and was found to be on a par with the treatment T_5. Overall, there was an increase of 18.78 per cent compared to the control. The increase in dry fodder yield per plant might be due to the increase in growth parameters. The lowest dry fodder yield per plant was observed for the treatment T_7. The trend in dry fodder yield per ha was found similar to green fodder yield per ha. The dry fodder yield per hectare was also found significantly higher for the treatment T_3 (2.25 t) and remained at par with the treatment T_5 (2.17 t). The lowest dry fodder yield per hectare was observed for T_7.

Quality Parameters

Significantly higher leaf: stem ratio was recorded for the treatment T_3 (1.26) followed by T_5 (1.15). The lowest leaf: stem ratio was observed for T_7. The profound increase in number of leaves per plant in the treatment T_3 in response to foliar application of zinc might be the reason for the increased leaf: stem ratio in the treatment t_3. Similar results were also obtained by Kumar *et al* (2016) who reported that the application of $ZnSO_4$ significantly increased the leaf: stem ratio of cowpea. Earlier Singh (2001) had also reported a significant increase in leaf to stem ratio in alfalfa plants. There was no significant effect due to treatments on crude protein content and crude fibre content of fodder cowpea.

CONCLUSION

It could be concluded from the results that for augmented yield and quality of fodder cowpea in *Onattukara* sandy loam soils of Kerala, the crop has to be supplied with FYM @ 10 t/ha, N, P_2O_5 and K_2O @ 25:60:30 kg/ha (KAU POP) along with foliar application of zinc sulphate heptahydrate @ 0.25 percent at 20 days after sowing.

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