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Effect of organic and inorganic foliar nutrition on growth and yield attributes of barnyard millet (*Echinochloa frumentacea* L.) var. MDU1

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Abstract
The field experiment was conducted during 2018 at AC &RI, Madurai to find out the effect of organic and inorganic foliar nutrient on growth and yield attributes of barnyard millet. The treatments includes T_1 – Control (no fertilizer), T_2 – Organic fertilizer (FYM + vermicompost), T_3- Chemical fertilizer (Recommended-NPK;66:33:20 kg ha^{-1}), T_4 - RDF + 0.5% ZnSO4, T_5 – RDF + 1%PPFM, T_6 -RDF+ 1%Urea, T_7 - RDF+ 0.5%ZnSO4 + 1%Urea and T_8 –Integrated (RDF+ organic + 0.5% ZnSO4 + 1%Urea). The fertilizer was applied at the time of sowing and foliar nutrition was given at 10 days interval of peak flowering stage. Experiment results revealed that growth and yield attributes were significantly influenced by foliar nutrition and fertilizer application. Among the treatments, the integrated treatment proved positive results. Compared to other treatments, the integrated treatment had recorded significantly highest plant height (173.82cm), dry matter production (270.39 g/plant), leaf area index (13.72), number of productive tillers per plant (7.4) and seed yield per plant (18.88g).

Keywords: barnyard millet, foliar nutrition, growth and yield parameters

1. Introduction
Millets are one of the oldest food known to humans and possibly the first cereal grain to be used for domestic purposes. Small millet crops have a long history of cultivation of more than 5000 years (Gowda *et al*., 2006) [5] and will adapted to wide range of temperatures, moisture-regimes and input conditions supplying food and feed to millions of dryl and farmers, particularly in the developing world. Besides they also form important raw material for potable alcohol and starch production in industrialized countries. Millets are grouped under annual grasses mainly found in the arid and semi-arid regions of the world. They belonging to the grass family Poaceae with small edible seeds which do not shatter readily at maturity (Thurston, 1989) [18]. Now millets are called as 'Nutri Cereals' realizing the nutrient richness (Nautiyal and Kaechele, 2006) [9].

Barnyard millet (*Echinochlo afrumentacaea* L.) also known as sawa millet, is commonly grown in India, Nigeria, Niger, China, Burkina Faso, Mali, Sudan, Uganda, Chad and Ethiopia. It is an excellent source of dietary fibre (13 g/100 g) with good amounts of soluble (4.66 g/100 g) and insoluble (8.18 g/100 g) fractions and fair source of highly digestible (81.13 g/100 g digestibility) protein (Hadimani *et al.*, 1993 and Veena *et al*., 2005) [6, 19]. The lesser carbohydrate content which is slowly digestible (25.88 g/100 g digestibility) further increases its potential for development of functional foods.

The area under barnyard millet in India is about 1.95 lakh hectares and production of 1.67 million tonnes with the productivity of 8.57 q/ha. (Rashmi Yadav *et al.*, 2011) [12]. The grain is highly nutritious in comparison with other millets. It is a fair source of protein which is highly digestible and is an excellent source of dietary fibre with good amounts of soluble and insoluble fractions. The carbohydrate content is low and slowly digestible which makes the barnyard millet a nature's gift for the modern mankind who is engaged in sedentary activities. The grains of barnyard millet are low in phytic acid and rich in iron and calcium (Sampath *et al*., 1990) [14].

Nutrients are important and crucial elements, which are required for the plant for its growth and development. The translocation of photosynthates from source to sink is very important for the development of economic part. Foliar application of growth regulators and chemicals at the flowering stage may improve the physiological efficiency and may play a significant role in raising the productivity of the crop (Dashora and Jain, 2004) [3]. Use of integrated nutrient

management yields maximum counts and establishment of microbes in soil rather than sole application of chemical fertilizer treatments (Kumar *et al.*, 2014) [8]. Proper management of nutrients is essential to realize maximum potential of the crop and to get higher economic benefit.

Considering the above facts, an attempt has been made to study the impact of foliar spray with integrated use of inorganic and organic fertilizer on growth and yield attributes of barnyard millet MDU-1.

2. Material and Method

The field experiment was conducted during kharif 2018 with randomized block design comprising of eight treatments with three replications. The soil was well drained sandy clay loam in texture, high in available N (210 kg/ha), low in available P (20 kg/ha) and high in available K (331kg/ha). Genetically pure and freshly harvested seeds were formed the base material for the study. The treatment imposed wereT_1 – Control (no fertilizer), T_2 – Organic fertilizer (FYM + vermicompost), T_3- Chemical fertilizer (Recommended-NPK;66:33:20 kg ha^{-1}), T_4 – RDF+ 0.5%ZnSO4, T_5 – RDF+ 1%PPFM, T_6 -RDF+ 1%Urea, T_7 - RDF+ 0.5%ZnSO4 + 1%Urea and T_8 –Integrated (RDF+ organic + 0.5%ZnSO4 + 1%Urea). The fungicide (Thiram @ 2g kg^{-1}seeds) and Azophos (200g ha^{-1}seeds) were pre-treated and the seeds were hand dibbled with a spacing of 30×10cm. The required quantity of nitrogen, phosphorous and potassium applied in the form of urea, SSP and MOP respectively as soil application. All the agronomic practices werecarried out as per the recommendation. Foliar nutrient was given twice at flower initiation and 15 days after flowering of the crop. Plant growth parameters such as plant height (cm), dry matter production (g $plant^{-1}$), leaf area index(LAI) were measured. Yield parameters *viz.*, number of productive tillers $plant^{-1}$, days to 50% flowering and seed yield $plant^{-1}$(g) were measured. The data were subjected to statistical analysis as described by Gomez and Gomez (1984) [4].

3. Result and Discussion

Foliar application is one of the effective technique that could be effective for 6-20 times more than soil application. To achieve higher productivity, the mother plants can be supplemented with nutrients through foliar application.

Significant differences were observed among the treatments. The integrated treatment recorded higher plant height (173.82cm), dry weight (270.39g), leaf area index (13.72), number of productive tillers per plant (7.4) and seed yield per plant (18.88g) compared to other treatments. The percentage increase over control for seed yield per plant was by 35.12. The plant height is the indicative of the vigour and growth of plant. Among the different treatments, integrated treatment recorded highest plant height, which was superior over all other treatments. This may be due to balanced and increased availability of nutrients to the crop due to fertilizer and foliar application. The highest plant height might be due to the better nutrition, which plays a vital role in cell division and growth of the plant. Similar results were reported by Sharnkumar *et al.*, (2012) [15] and Reddy *et al.*, (2018) [13].

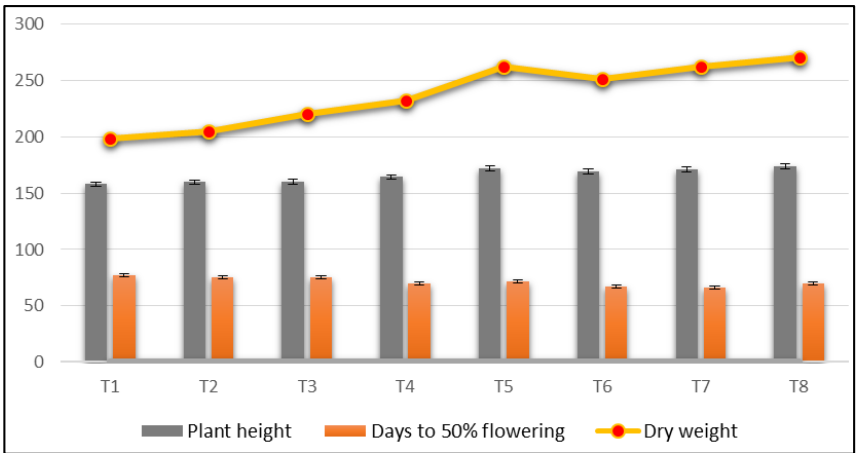

Fig1: Effect of different treatments on Plant height, Days to 50% flowering and Dry weight in Barnyard millet MDU1

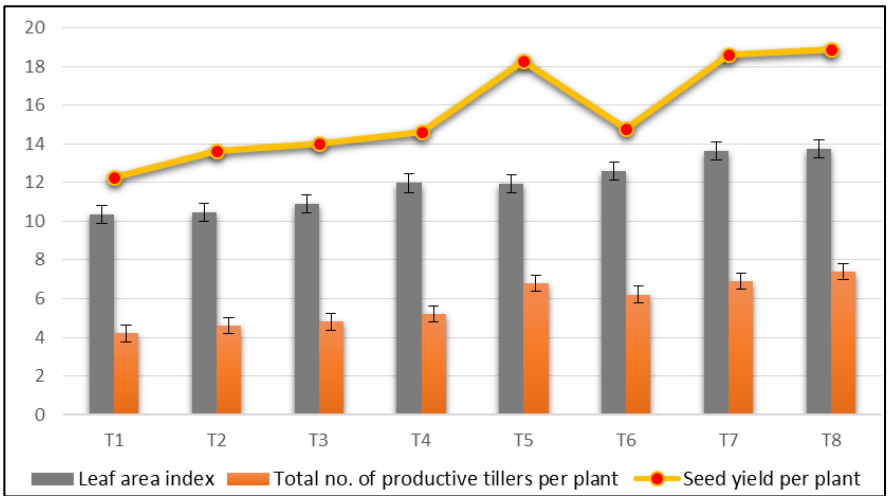

Fig 2: Effect of different treatments on Leaf area index, Total no. of productive tillers per plant and Seed yield per plant in Barnyard millet cv. MDU1

The highest dry weight, leaf area index was recorded by the T_8 –Integrated (RDF+ organic + foliar spray of0.5%ZnSO4 + 1% Urea) which could be due to better nutrition of crop. Foliar application of macro and micro nutrients at critical stages of the crop were effectively absorbed and translocated to the developing panicle thereby producing more number of productive tillers and better filling in barnyard millet. Similar studies were reported by (Jayabal *et al.*, 1999; Thiyageswari and Ranganathan, 1999 in soyabean; Rajesh and Paulpandi, 2013 in redgram and Ragupathi, 2017 in panivaragu) [7, 17, 11, 10]. Zinc is essential for several enzyme systems that regulates various metabolic activities in plants and also it is essential component responsible for assimilation of nitrogen and also helps in formation of chlorophyll and plays an important role in nitrogen metabolism. This might be due to the fact that zinc may serve as source of energy for synthesis of auxin which help in elongation of stem (Singh and Verma, 1991) [16]. Foliar spray of urea may be attributed by increasing the N status in the plant system which in turn might have resulted in more synthesis of nucleic acids, amino acid substances in growing region, meristematic tissues ultimately enhancing cell division and thereby increased the growth attributes. Urea retarded the loss of chlorophyll and leaf nitrogen with increased photosynthesis ability resulted in enhanced yield (Anamika and Dhaka, 2003) [1].

4. Conclusion

It could be concluded that RDF +FYM +Vermicompost along with foliar application of 0.5% $ZnSo_4$ + 1% Urea recorded higher growth and yield attributes.

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