



Growth and yield, nutrient uptake and post-harvest nutrient status of rainfed sorghum to foliar fertilization of different chemicals

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Abstract

Field Experiment was conducted during June-September-2018 with an objective to enhance growth and yield of rainfed sorghum through foliar fertilization. The experiment was laid out in randomized block design with seven treatments and replicated thrice. The treatment details includes, T1 – Control (Farmer practice), T2 – Full RDF, T3 - 50% RDF and foliar spraying of “Revive plus” @ 2 g litre-1 twice at 25 and 50 DAS, T4 - 50% RDF and foliar spraying of “Revive plus” @ 3g litre-1 twice at 25 and 50 DAS, T5 - 50% RDF and foliar spraying of “1% KCl” twice at 25 and 50 DAS, T6 – 50% RDF and foliar spraying of “100ppm Salicylic acid” twice at 25 and 50 DAS, T7 - 50% RDF and foliar spraying of “Orthosilicic acid” @ 2ml litre-1 twice at 25 and 50 DAS. The results of the experiments revealed that foliar application of different chemicals significantly influenced the growth and yield attributes and yield. Among the various treatments tried, T4 - “Revive plus” @ 3g litre-1 twice at 25 and 50 DAS recorded maximum values for growth attributes *viz.*, plant height, LAI, DMP, root length and chlorophyll content and yield attributes *viz.*, number of earheads plant-1, number of grains earhead-1, test weight, seed yield and stover yield and nutrient uptake. The lowest values for growth and yield attributes and yield were recorded in T1 – Control treatment, but with regard to post harvest nutrient status it recorded the maximum value.

Keywords: sorghum, foliar nutrition, yield, nutrient uptake and availability

Introduction

The term rainfed agriculture is used to describe farming practices that solely depend on rainfall for water. It provides much of the food consumed by poor communities in developing countries. Rainfed crop cover more than 80% of global cropped area and account for 60-70% of global crop production, but production is frequently limited by drought and soil moisture stress (Wood *et al.*, 2000) [12]. In India around 65-70% of cultivated lands coming under rainfed drylands and they contributing about 45% of nation's food grain production. Most of the crops belongs to millets (>95%), oilseeds (90%) and pulses 90-95% are cultivated on these lands with low productivity. The reasons attributed to low productivity may be inadequate rainfall, poor soil fertility, occurrence of dry spells drought during cropping season, high temperature, more PET than rainfall etc.,. Of these drought at critical period crops season drastically reduces the crop yield. The effect of water stress was found to decrease significantly in photosynthetic rate (Hejank, 2003) transpiration rate (Gupta *et al.*, 2003) [4] chlorophyll stability index stomata conductance and relative water content (Gupta *et al.*, 2003) [4]. Crops such as millet, foxtail, sorghum and cowpea are also grown in the arid and semi-arid areas affected by drought stress at the reproductive stage (Emam and Zavorakh, 2004). The All India coordinated Research Project for Dryland Agriculture (AICRPDA) in association with state Agricultural universities, Technical Universities and Research Institutes of Indian council of Agricultural Research have developed

location-specific rainfed technologies to cope with different drought situations. The key technologies for drought mitigation are in situ moisture conservation, rainwater harvesting and recycling, resilient crops and cropping systems including contingency crop plant, foliar spraying, integrated farming system etc., (Srinivasa Rao *et al.*, 2014) [11]. Among these dryland technologies foliar spraying of nutrients and anti-transpirants found to be effective in mitigating drought moisture stress during cropping seasons.

Materials and Methods

The Field Experiments were conducted during June-September-2018 at the farmer's field at Kunjaram village in Ulundurpet Taluk of Villupuram District, Tamil Nadu. The experimental site is situated at 11°41'26"N latitude, 79°17'30"E longitude with an altitude of 66 m above mean sea level. The texture of the experimental field soil is sandy loam which is low in available nitrogen, high in available phosphorus and high in available potassium content. Sorghum K8 variety was chosen for this study. The experiment consisted of seven treatments and was laid out in Randomized Block Design with three replications. The treatments imposed in the experiment with different chemicals *viz.*, T1- Control (Farmer's practice), T2 - RDF 40:20:0 Kgs of NPK ha-1, T3 - 50% RDF and foliar spraying of Revive plus @ 2g litre-1 at 25 DAS and 50 DAS, T4 -50% RDF and foliar spraying of Revive plus @ 3g litre-1 at 25 DAS and 50 DAS, T5 -50% RDF and foliar spraying of 1% KCl at 25 DAS and 50 DAS, T6 -50% RDF

and foliar spraying of 100ppm Salicylic acid at 25 DAS and 50 DAS and T7 -50% RDF and foliar spraying of Orthosilicic acid @ 2ml litre-1 at 25 DAS and 50 DAS. The recommended dose of 40:20:0 kgs of NPK ha-1 for sorghum varieties were applied in the form the urea (46 % N), DAP (18 % N and 46 % P₂O₅) respectively. Fertilizers were applied fully as basal.

Results and discussion: Growth attributes (Table 1)

Among the various foliar nutrition, foliar spray of Revive plus @ 3g litre-1 (T4) registered the higher plant height, LAI, DMP, chlorophyll content and root length of sorghum and it was comparable with foliar spraying of Revive plus @ 2g litre-1

(T3) but superior to other foliar fertilization. Increased plant height under this treatment might be due to balanced and increased availability of nutrients to the crop due to foliar application of nutrients. The increased chlorophyll content might be due to the fact that of nitrogen is a constituent of chlorophyll molecule which is expected during rapid grain filling leaves. These results are in agreement with the findings of by Reddy *et al.*, (2018) [2]. Increased leaf area index and dry matter production might be due to increased availability of nutrients and its uptake by the crop resulted in higher growth attributing characters which reflected in higher yield of sorghum. These results are in close conformity with the findings of Lakhan Singh *et al.*, (2017) [8].

Table 1: Effect of foliar fertilization of different chemicals on growth attributes of sorghum

Treatments	Plant height (cm) At harvest stage	LAI at flowering stage	DMP (Kg ha-1) at harvest stage	Chlorophyll content (mg g-1) at flowering stage	Root length (cm) at harvest stage
T1	171.9	2.99	12495.6	39.45	32.1
T2	175.4	3.15	12607.6	40.65	33.1
T3	182.8	3.40	12958.8	42.18	34.3
T4	184.4	3.44	13065.4	42.50	34.5
T5	179.8	3.24	12824.6	41.08	33.5
T6	173.2	3.09	12585.3	39.92	32.5
T7	180.5	3.32	12901.9	41.53	33.8
SE. d	2.99	0.05	345.12	0.97	0.79
CD (p=0.05)	6.52	0.12	751.95	2.11	1.72

Yield Attributes and Yield (Table 2)

Among the various foliar nutrition tried, foliar spray of Revive plus @ 3g litre-1 (T4) recorded the maximum number of earhead plant-1, number of grains earhead-1, test weight, grain yield and stover yield for sorghum. It is comparable with foliar spraying of Revive plus @ 2g litre-1 (T3) but superior to other foliar fertilization. The combined fertilizer application through foliar nutrition increased yield attributes and yield of sorghum might be due to the supplementation of plants with the three major nutrients and micronutrients together and these elements enhancing and including most of metabolic processes, N increased the protein formation, phosphorous in the formation of nucleic

acids and energy compounds while potassium affected the water adjustment and carbohydrate transportation. This was in line with the findings of Hussein *et al.* (2011). Grain yield increased by foliar application of potassium due to improving the enzymes activity in the plant, which leads to easy translocation of photosynthates from leaf to grain in sorghum. Similar finding was earlier reported by Abid Ali *et al.* (2016) [1]. Application of nutrients influenced the higher growth parameters and improves drymatter accumulation which in turn improves yield parameters. Later this drymatter was translocated to different yield components thereby increases grain yield. This was evidenced through the studies of Shankar *et al.* (2017) [9] in little millet.

Table 2: Effect of foliar fertilization of different chemicals on yield and yield attributes of sorghum

Treatments	No. of earheads plant-1	No. of grains earhead-1	Test weight (g)	Grain yield (Kg ha-1)	Stover yield (Kg ha-1)
T1	2.2	965	20.45	875.66	5759.66
T2	2.4	1029	20.96	1246.33	6048.66
T3	3.0	1254	21.74	1431.50	6608.66
T4	3.2	1288	21.88	1545.16	6765.00
T5	2.6	1107	21.08	1354.00	6216.33
T6	2.4	1007	20.88	1203.50	5933.33
T7	3.0	1182	21.59	1364.66	6427.33
SE.d	0.06	19.18	0.45	21.83	58.32
CD (p=0.05)	0.13	41.79	0.98	47.57	127.08

Table 3: Effect of foliar nutrition of different chemicals on nutrient uptake and post-harvest nutrient status of sorghum

Treatments	Nutrient uptake (Kg ha-1)			Post harvest nutrient status (Kg ha-1)		
	N	P	K	N	P ₂ O ₅	K ₂ O
T1	97.96	28.73	131.20	120.60	23.65	101.15
T2	98.94	28.99	132.37	110.15	19.98	96.98
T3	101.59	29.80	136.06	107.78	17.76	94.15
T4	102.43	30.05	137.18	106.54	16.65	92.36
T5	100.54	29.49	134.65	108.89	19.20	96.07
T6	98.66	28.94	132.14	111.65	20.68	97.15
T7	101.15	29.67	135.46	108.19	18.43	95.30
SE.d	2.16	0.63	3.24	1.82	0.37	2.35
CD (p=0.05)	4.72	1.37	7.07	3.96	0.81	5.13

Nutrient Uptake (Table 3)

Nutrient uptake of N, P and K were significantly influenced by the different chemicals through foliar nutrition in sorghum.

Nutrient status is an important and deciding factor in judging the total dry matter accumulation in plants. Among the different treatments tried, maximum N,P and K uptake was registered under foliar spray of revive plus @3 g/litre (T4) over rest of treatments. Application of nutrients enhanced the N,P and K uptake. The foliar spray of nutrients enhanced the N, P and K uptake. This might be due to increased DMP, easily available and rapid adsorption of nutrients by the crops and higher drymatter production could be attributed to higher nutrient uptake. Similar result was documented by Kuttimani and Velayutham (2011) ^[7].

Post-Harvest Nutrient Status (Table 3)

Foliar nutrition significantly influenced the post-harvest nutrient status of sorghum.

Among the foliar nutrition tried, control treatment recorded the maximum values for post-harvest available nutrient status in sorghum.

This might be due to poor nutrient uptake compared to rest of the treatments. Similar trend of result was earlier reported by Shashi kumar *et al.*, (2013) ^[10].

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