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Foliar nutrition management in summer forage sorghum for yield, nutrient uptake and economics

Pooja Lagad, BT Sinare, SS Dighe, SH Pathan and VS Patil

Abstract
A field experiment was undertaken during summer, 2018 at Post Graduate Instructional Farm, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra) to study the effect of foliar nutrient management on yield, nutrient uptake and economics of forage sorghum. The results revealed that, the application of GRDF (Gross Recommended Dose of Fertilizer) along with foliar application of 2% urea at 40 days after sowing recorded significantly higher green fodder yield (589.83 q ha^{-1}), higher gross returns (Rs. 117966 ha^{-1}) and net returns (Rs. 76620 ha^{-1}). Also the application of GRDF along with foliar application of 2% urea, 2% DAP and 0.5% 0:0:50 at 40 days after sowing recorded higher uptake of N, P and K respectively.

Keywords: Sorghum, foliar nutrition, green forage yield, nutrient uptake, economics

Introduction
At present, the country is facing a net deficit of 35.6% green fodder, 10.95% dry fodder and 44% concentrated feeds. Present availability of green fodder is 462 million tonnes and dry fodder availability is 394 million tonnes. (Anonymous, 2016) [1]. Feeds and fodders are the most important components of animal output. Sorghum being a short duration, drought and salt tolerant, well adoptive to arid regions is considered promising crop to overcome the fodder shortages. It is a palatable and nutritious fodder crop for animals and there is enormous demand for green and dry fodder particularly during lean winter and summer season in arid and semi-arid region. For better efficiency of livestock, both the quantitative production of fodder and their quality play significant role. Being a exhaustive crop, quality of sorghum fodder suffers heavily if proper amount of fertilizers is not applied.
Fertilizer is single most important input for securing higher production. The time and method of fertilizer application plays very important role. Foliar application may constitute the most effective method of application. This method provides for more rapid utilization of nutrient and permits the correction of observed deficiencies in less time that would be require in soil treatment.

Materials and Methods
An experiment was undertaken during summer season of 2017-18 at Post Graduate Instructional Farm, Department of Agronomy, Mahatma Phule Krishi Vidyapeeth, Rahuri. The experiment was laid out in randomised block design with three replication. The experiment consists of nine treatments *viz*., T_1 – GRDF (5 tonn ha^{-1} FYM + 100:50:40 kg ha^{-1} N, P_20_5, K_20), T_2 – GRDF + 2% foliar spray of urea, T_3 – GRDF + 2% foliar spray of DAP, T_4 – GRDF + 0.5% foliar spray of 20:20:20, T_5 – GRDF + 0.5% foliar spray of 12:61:0, T_6 – GRDF + 0.5% foliar spray of 13:0:45, T_7 – GRDF + 0.5% foliar spray of 0:52:34, T_8 – GRDF + 0.5% foliar spray of 0:0:50, T_9 – GRDF + water spray. The soils of experimental field was clay loam in texture, low in available nitrogen (140.56 kg ha^{-1}), medium in available phosphorus (17 kg ha^{-1}) and very high in available potassium (452 kg ha^{-1}). It was moderately alkaline in reaction (pH 8.28). Electrical conductivity of soil was 0.38 dSm^{-1} with 0.32 percent organic carbon. 50% N and full dose of P_2O_5 and K_2O as basal dose at sowing and the quantity of FYM will be applied common to all the treatments. The remaining 50% N will be top dressed at 28 days after sowing (DAS). Treatment wise foliar spray of water soluble fertilizers was applied at 40 days after sowing (DAS).

Results and Discussion

Yield

The application of GRDF + 2% foliar spray of urea at 40 DAS (T_2) shows significantly higher green forage yield (589.83 q ha^{-1}). However the application of GRDF + 2% foliar spray of DAP (T_3), application of GRDF + 0.5% foliar spray of 20:20:20 (T_4) and application of GRDF + 0.5% foliar spray of 12:61:0 (T_5) at 40 DAS were found on par at harvest in respect to green forage yield of forage sorghum (580.00, 571.00 and 565.83 q ha^{-1} respectively). The findings of Bhilare *et al.* (2002) [2], Pathan *et al.* (2006) [7], and Choudhary *et al.* (2014) [3] confirmed the results.

Nutrient uptake

The total nutrient uptake by forage sorghum was linearly increased with an increase in GRDF along with water soluble fertilizers. The application of treatment GRDF along with 2% foliar spray of urea, 2% foliar spray of DAP, 0.5% foliar spray of 0:0:50 was recorded significantly higher uptake of nitrogen, phosphorus and potassium respectively (161.22, 28.21, 159.03 kg ha^{-1} respectively). Similar trend was also indicated by Kumar *et al.* (2010) [4].

Table 1: Yield and nutrient uptake of forage sorghum as affected by different foliar nutrient management treatment

Treatments	Green forage yield (q ha^{-1})	Total Nutrient Uptake (kg ha^{-1}) N	P	K
T_1 - GRDF(5 tonn ha^{-1} FYM + 100:50:40 kg ha^{-1} N, P_2O_5, K_2O)	549.00	126.64	16.83	134.50
T_2 - GRDF + 2% foliar spray of urea	589.83	161.22	22.03	143.87
T_3 - GRDF + 2% foliar spray of DAP	580.00	158.03	28.21	146.50
T_4 - GRDF + 0.5% foliar spray of 20:20:20	571.00	153.32	25.07	153.30
T_5 - GRDF + 0.5% foliar spray of 12:61:0	565.83	146.81	27.42	141.77
T_6 - GRDF + 0.5% foliar spray of 13:0:45	560.83	136.92	20.17	156.20
T_7 – GRDF + 0.5%foliar spray of 0:52:34	555.33	139.16	23.43	152.57
T_8 - GRDF + 0.5% foliar spray of 0:0:50	553.67	134.44	19.23	159.03
T_9- GRDF + water spray	550.57	129.89	17.23	136.17
S.E m±	8.44	3.49	0.51	0.53
C.D. at 5%	25.31	10.47	1.54	1.61
General mean	564.01	142.96	22.18	147.10

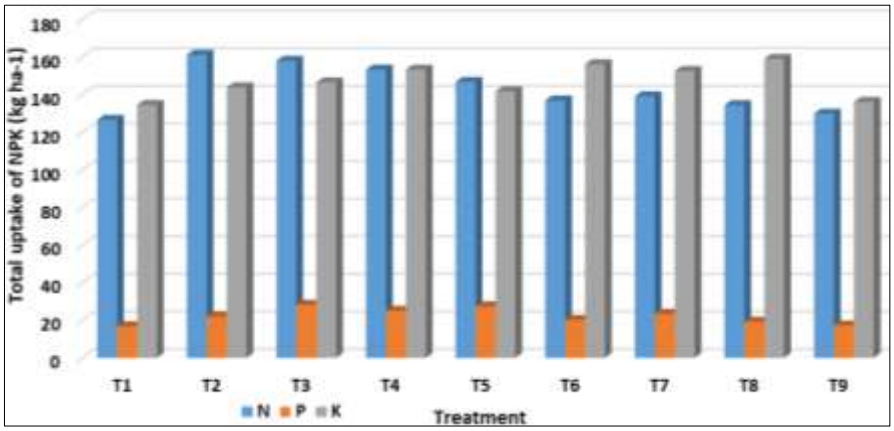

Fig 1: Total uptake of NPK (kg ha^{-1}) as influenced by different treatment

Economics

The gross monetary returns, net monetary returns and benefit: cost ratio of forage sorghum was significant influenced by different nutrient management treatments are presented in Table 2. The application of GRDF along with foliar application of 2% urea at 40 days after sowing recorded significantly higher gross returns (Rs. 117966 ha^{-1}) and net returns (Rs. 76620 ha^{-1}) and B: C ratio (2.85). These findings are in conformity with Naveed *et al.* (2014) [6] and Kumawat *et al.* (2016) [5].

Table 2: Economics of forage sorghum as affected by different foliar nutrient management treatment

Treatments	Gross monetary returns (Rs. ha^{-1})	Cost of cultivation (Rs. ha^{-1})	Net monetary returns (Rs. ha^{-1})	B: C ratio
T_1 - GRDF (5 tonn ha^{-1} FYM + 100:50:40 kg ha^{-1} N, P_2O_5, K_2O)	109800	40709	69091	2.69
T_2 - GRDF + 2% foliar spray of urea	117966	41346	76620	2.85
T_3 - GRDF + 2% foliar spray of DAP	116000	41577	74423	2.79
T_4 - GRDF + 0.5% foliar spray of 20:20:20	114200	41448	72752	2.75
T_5 - GRDF + 0.5% foliar spray of 12:61:0	113166	41318	71848	2.73
T_6 - GRDF + 0.5% foliar spray of 13:0:45	112166	41298	70868	2.71
T_7 – GRDF + 0.5% foliar spray of 0:52:34	111066	41400	69666	2.68
T_8 - GRDF + 0.5% foliar spray of 0:0:50	110734	41198	69536	2.68
T_9- GRDF + water spray	110114	41098	69016	2.67
S.E m±	1522	-	1522	-
C.D. at 5%	4564	-	4564	-
General mean	112802	41266	71536	2.73

Conclusion

The application of GRDF (5 tonn ha^{-1} FYM + 100:50:40 kg ha^{-1} N, P_2O_5 & K_2O) along with 2% foliar spray of urea should be the appropriate dose for achieving the higher green forage yield and net monetary returns from the forage sorghum *cv*. Phule Godhan during summer season.

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