International Journal of Farm Sciences **6(4):** 49-52, 2016

Balance sheet of soil available nitrogen and economics of rice fallow sorghum at different planting densities and nitrogen levels

H ARUNAKUMARI and PVN PRASAD

Department of Agronomy, Agricultural College (ANGRAU)
Bapatla 522101 Andhra Pradesh, India
Email for correspondence: hanumanthu.aruna@gmail.com

ABSTRACT

A field experiment was conducted during 2014-2015 to study the effect of planting density and N levels in zero till sorghum in randomized block design with factorial concept and was replicated thrice. The treatments comprised three planting densities viz S_1 (3.33 lakh plants/ha), S_2 (2.22 lakh plants/ha) and S_3 (1.66 lakh plants/ha) allotted to factor-A and four nitrogen levels viz N_0 (0 kg/ha), N_1 (50 kg/ha), N_2 (100 kg/ha) and N_3 (150 kg/ha) allotted to factor-B. Maximum grain yield of sorghum and the economic returns were obtained at a plant density of 2.22 lakh plants/ha with the application of 150 kg N/ha. Maximum net balance of nitrogen was recorded with increased nitrogen and spacing. The application of 150 kg N/ha with a plant density of 2.22 lakh plants/ha gave the highest net returns (Rs 64921) and B:C ratio (2.74).

Keywords: N levels; plant density; zero till sorghum; returns; B:C ratio

INTRODUCTION

Rice fallow sorghum is one of the important and stable crops grown under unassured water supply. In view of the scarcity of irrigation water in future the area under sorghum is expected to increase. Considering the advantage of residual moisture, saving the cost on land preparation, judicious use of seeds, irrigation water and weed management, farmers have shown positive attitude towards sorghum farming (Patel et al 1990).

Optimum planting density and N fertilizer dose to crops are important to establish maximum yields and profits. Higher grain yield depends on optimum plant density and adequate amount of nitrogenous fertilizer. It is the plant density that is important from the point of intercepting sunlight for photosynthesis besides efficient use of plant nutrients and soil moisture. Thus matching optimum plant density with fertilizer schedule is need of the hour to achieve the targeted yields . Increasing the amount of nitrogen will result

in loss than profit for the producer in terms of yield. Fertilizing the plant with nitrogen beyond the optimum level will lead to considerable loss in yield as well as profits. Sawyer et al (2006) observed that economic optimum rates of fertilization are rates that maximize profits for producers. Hence the present study was undertaken to evaluate the effective combination of planting densities and N levels and also to study the balance sheet of soil available nitrogen and economics of rice fallow sorghum at different planting densities and nitrogen levels.

MATERIAL and METHODS

A field experiment was conducted at agricultural college farm, Bapatla during Rabi 2014-2015. The soil of the experimental area was clayey, slightly acidic to neutral in reaction, high in organic carbon (0.9%), low in available nitrogen (269.6 kg/ha) and medium in available phosphorus (32.8 kg/ha) but high in available potassium (623.4 kg/ha). The experiment was laid out in randomized block design with factorial concept replicated thrice. The treatments comprised three planting densities viz S_1 (3.33 lakh plants/ha), S_2 (2.22 lakh plants/ha) and S_3 (1.66 lakh plants/ha) allotted to factor-A and four nitrogen levels viz N_0 (0 kg/ha), N_1 (50 kg/ha), N_2 (100 kg/ha) and N_3 (150 kg/ha) allotted to factor-B. The sorghum hybrid CSH-16 was sown on 3 January 2015. A total of 2.8 mm rainfall (negligible) was received during crop growth period. Sorghum was sown immediately after harvest of Kharif rice.

RESULTS and DISCUSSION

Soil available nitrogen balance under different planting densities and N levels

The computed balance of soil available N (kg/ha) was negative in all the

Table 1. Balance sheet of soil available nitrogen (kg/ha) in rice fallow sorghum during Rabi 2014-2015

Treatment	Initial soil N	Total N applied	Total quantity of N removed by the crop	Computed balance	Actual balance	Net gain (+) or loss (-)
S_1N_0	269.6	0	88.9	-88.9	156.2	-113.4
S_1N_1	269.6	50	107.2	-57.2	174.0	-95.6
S_1N_2	269.6	100	138.5	-38.5	194.3	-75.3
S_1N_3	269.6	150	172.8	-22.8	213.6	-56.0
S_2N_0	269.6	0	96.2	-96.2	159.0	-110.6
S_2N_1	269.6	50	129.9	-79.9	178.3	-91.3
S_2N_2	269.6	100	151.3	-51.3	201.0	-68.6
S_2N_3	269.6	150	209.3	-59.3	224.3	-45.3
S_3N_0	269.6	0	85.9	-85.9	176.4	-93.2
S_3N_1	269.6	50	104.1	-54.1	198.3	-71.3
S_3N_2	269.6	100	122.7	-22.7	223.3	-46.3
S_3N_3	269.6	150	155.1	-5.1	241.6	-28.0

treatment combinations the magnitude being different in the three planting densities and four N levels. However the net loss (difference between actual balance and initial value) of the soil available N was noticed under all treatment combinations. The highest quantity of N removed by the crop was in S_2N_3 treatment combination ie 2.22 lakh plants/ha with 150 kg kg/ha. The finding established that better results were obtained under S_3N_3 (3.33 lakh plants/ha with 150 kg N/ha) followed by S_2N_3 (2.22 lakh plants/ha with 150 kg N/ha) which shows that there was negligible loss of nitrogen which in turn promoted high productivity of sorghum and sustained the nutrient status of the soil.

Economics

The highest gross returns, net returns and B:C ratio were obtained under the treatment 2.22 lakh followed by 3.33 lakh plants/ha (Table 2). The highest net income (Rs 64921 ha) and B:C ratio (2.74) were obtained at a planting density of 2.22 lakh plants/ha (S_2) applied with 150 kg N/ ha followed by 100 kg N/ha due to higher grain yield. The lowest net returns (Rs 28145/ha) and B:C ratio (1.30) were noticed at lower planting density (1.66 lakh plants/ha) with application of 0 kg N/ha might be because of lesser grain and stover yield. Lower net returns obtained at 1.66 lakh plants/ha were due to lower yield of rice fallow sorghum. These results are in agreement with the findings of Balasubramanian and Ramamoorthy (1996), Singh et al (1996), Randall (2006), Singh et al (2012) and Fromme et al (2012).

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Table 2. Economics of rice fallow sorghum as influenced by planting density and nitrogen levels

Treatment	Grain yield (kg/ha)	Stover yield (kg/ha)	Gross returns (Rs/ha)	Cost of cultivation (Rs/ha)	Net returns (Rs/ha)	B:C ratio
S_1N_0	4111	11034	54845	22235	32610	1.47
S_1N_1	4722	11806	62571	22852	39719	1.73
S_1N_2	5231	12039	68792	23468	45324	1.93
S_1N_3	5581	12590	73275	24087	49188	2.04
S_2N_0	4420	10145	58117	21785	36332	1.66
S_2N_1	5532	11277	72030	22402	49628	2.21
S_2N_2	6191	11511	80051	23018	57033	2.47
S_2N_3	6889	11788	88558	23637	64921	2.74
S_3N_0	3808	8010	49705	21560	28145	1.30
S_3N_1	4283	8566	55683	22177	33506	1.51
S_3N_2	4581	10110	60023	22793	37230	1.63
S_3N_3	4842	11172	63690	23412	40278	1.72

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Received: 6.10.16 ***Accepted: 16.10.2016***