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Sorghum hybrids performance on the growth, yield and chemical analysis parameters under graded levels of nitrogen in zero tillage conditions

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Abstract
A field experiment entitled "Sorghum hybrids performance on the growth, yield and chemical analysis parameters under graded levels of nitrogen in zero tillage conditions." was conducted at Agricultural College Farm, Naira (India) in sandy loam soil during *rabi* 2016-17. The treatments comprised of combination of four sorghum hybrids and four nitrogen levels laid out in Split plot design with three replications. Sorghum hybrid CSH 25 and application of 120 kg ha^{-1} recorded the highest growth parameters as well as number of grains per panicle. Significantly higher grain yield was obtained with CSH 25 among hybrids and with 120 kg N ha^{-1}. However, stoveryield was highest with hybrid CSH 15R at 120 $kgha^{-1}$. Nitrogen uptake, agronomic efficiency, net returns and B: C ratio were also highest with CSH 25 at the highest level of N tried (120 kg ha^{-1}) and hence found promising for North Coastal Zone of Andhra Pradesh.

Keywords: rice-fallow sorghum, hybrids, yield, agronomic efficiency, nitrogen uptake and economics

Introduction
Sorghum (*Sorghum bicolor* L. Moench) is traditionally grown for food in semi-arid tropics of India and occupies an area of 6.32 m. ha with a total production of 6.03 m.t and a productivity of 1,004 kg ha^{-1}(ASG, 2011). As per the latest estimates, the crop is being grown under rice-fallows in an extent of 24,000 ha with a productivity of 6. 5 t ha^{-1} (Chapke *et al.*, 2014) [2]. Of late, Sorghum is emerging as a potential alternate food, fodder and bio-energy crop owing to its tolerance to high temperature and drought there by making it suitable for different agro climatic zones of Andhra Pradesh. Sorghum cultivation is an emerging scenario in rice-fallows under zero tillage. In this changed scenario, farmers are now growing maize in assured irrigated areas as *rabi* crop. However, there is a prospective situation especially in areas having frugal water resources in rice-fallows of this zone for taking up sorghum as an alternate crop to pulses. For any crop, standardisation of agro techniques for realizing the higher yields is a prerequisite. Therefore, to identify a suitable hybrid and to arrive at a required dose of nitrogen and to work out their best combination for achieving higher yield of sorghum under rice fallow situation of this zone is considered as utmost priority and hence this study was undertaken.

Material and Methods
A field experiment was conducted during *rabi*, 2016-17 at Agricultural college farm, Naira, Srikakulam (Dt), A.P. The soil was sandy loam in texture with a pH of 7.42 and EC of 0.064 dSm^{-1}, medium in organic carbon (0.56%), low in available nitrogen (96 kg ha^{-1}), low in available phosphorus (12.4 kg ha^{-1}) and medium in available potassium (151 kg ha^{-1}). The experiment was laid out in Split plot design with three replications. The treatments comprised of four sorghum hybrids *viz.*, V_1- CSH 15R, V_2- CSH 16, V_3- CSH 25and V_4- MLSH 296 and four nitrogen levels N_1: 0 kg N ha^{-1}, N_2: 80 kg N ha^{-1}, N_3: 100 kg N ha^{-1} and N_4: 120 kg N ha^{-1}. A total rainfall of 8.0 mm was received in 2 rainy days during the growth period of rice fallow sorghum. A recommended dose of 80 kg P_2O_5 and 80 kg K_2O ha^{-1} was applied as basal and nitrogen was applied in the form of urea in three splits at 15 DAS, 60 DAS and at flowering. Data on growth parameters like plant height at harvest and dry matter accumulation at harvest, Number of grains per panicle, grain yield stover yield and harvest index, N uptake, agronomic efficiency and economics of rice fallow sorghum was calculated. Statistical analysis of all the

Data collected are carried out following the analysis of variance technique for splitplot design as outlined by Panse and Sukhatame, 1967.

Results and Discussion

Growth parameters

The growth parameters recorded are presented in (Table 1). Plant height data of rice fallow sorghum varied significantly due to different hybrids and nitrogen levels while their interaction was found to be significant at harvest. CSH 15R (V_1) was significantly taller than all other hybrids except CSH 16 (V_2). Plant height recorded with CSH 25 (V_3) was on par with all the hybrids except CSH 15R (V_1). The lowest stature of sorghum was recorded with MLSH 296 (V_4).Plant height obtained was highest with N_4 120 kg ha^{-1}) and was significantly higher than other levels of nitrogen except N_3 (100 kg ha^{-1}) which it was comparable. Plant height recorded with N_2 (80 kg ha^{-1}) was in parity with all the levels of nitrogen doses except N_4. The lowest plant height was recorded with N_1(0 kg ha^{-1}).Interaction effect at harvest revealed that plant height was highest with the hybrid CSH 16 at 120 kg N ha^{-1}(V_2N_4) and the lowest was recorded by MLSH 296 at 0 kg ha^{-1}(V_4N_1).The variabilis in the plant height can be attributed to the variation in the genetic constitution of different hybrids Increase in plant height might be due to the fact that nitrogen promotes plant growth and increases the number and length of the internodes which results in progressive increase in plant height.

Yield attributing characters

Analysis of the data showed that panicle girth (diameter) of rice fallow sorghum hybrids were on significant with sorghum hybrids as well as with different N levels.

Test weight (1000 - seed weight) of rice fallow sorghum hybrids did not differ with each other. The results of data showed that test weight (1000-seed weight) at highest nitrogen level (N_4), which was significantly superior as compared to all other levels of nitrogen tried. Test weight obtained with the application of 100 kg ha^{-1} (N_3) was the next best treatment but was, however, significant with the application of 80 kg ha^{-1}(N_2). Test weight(1000- seed weight) with the combination of CSH 15R at 120 kg N ha^{-1}(V_1N_4) was the highest which was on par with MLSH 296 at 120 kg N ha^{-1} (V_4N_4) while the lowest test weight (1000 -seed weight) was recorded by CSH 15R at 0 kg N ha^{-1}(V_1N_1).The increase in test weight at higher level of nitrogen might be due to greater assimilating surface at reproductive development resulted in better grain formation because adequate production of metabolites and their translocation towards grain which shows improvement in nutrient concentration and up take. This might have resulted in increased weight of individual grain expressed in terms of test weight (1000 - seed weight). Similar observation was reported by Pushpendra Singh *et al*. (2012) [8].

Grain and stover yield

The data pertaining to grain and stover yield of rice fallow sorghum presented in (Table 2). Analysis of the data on grain yield of sorghum indicated that yield obtained with CSH 25 (V_3) was significantly higher than all the other hybrids except CSH 16 (V_2) with which it was statistically comparable (Table 1). Grain yield recorded with MLSH 296 (V_4) was on par with all the hybrids except CSH 25 (V_3). The lowest grain yield was recorded with CSH 15R (V_1) among all the hybrids taken for study. Grain yield obtained at highest nitrogen level (N_4) was significantly superior as compared to all the nitrogen levels tried. Yield obtained with the application of 100 kg ha^{-1} (N_3) was next best treatment but was, however, comparable with the application of 80 kg ha^{-1} (N_2). Both these nitrogen levels were significantly superior to N_4 and significantly superior to no application of nitrogen (N_1), which recorded the significantly lowest grain yield among all the four levels of nitrogen tested in this experiment.

The Superiority of hybrid CSH 25 (V_3) in terms of yield under rice fallow conditions of sorghum can be attributed to its higher number of grains per panicle, dry matter accumulation at harvest as compared to other three hybrids. It has also the ability to put up the growth under low temperature conditions at early stages. Similar observations were reported by Mishra *et al*. (2011) [4] and Chapke *et al*. (2014) [2]. The increase in the grain yields with enhanced N application could be ascribed to better plant growth and dry matter production due to higher photosynthetic area. This further supported by the fact that soil of the experimental field was low in nitrogen (96 kg ha^{-1}). These results are in corroboration with Madhu kumar *et al*. (2013) [3], Mishra *et al*. (2014) [5] and Vara Prasad *et al*. (2014) [9].

Stover yield obtained with CSH 15R (V_1) was significantly superior to all the hybrids. Yield of stover with CSH 25 (V_3) was found to be superior to all other hybrids except V_1, while yield with CSH 16 (V_2) was significantly superior to MLSH 296 (V_4). Stover yield at the highest nitrogen level (N_4) was significantly superior as compared to all the other the levels of nitrogen levels tried. Stover yield obtained with the application of 100 kg ha^{-1} (N_3) was the next best treatment but was, however, significant superior to 80 kg ha^{-1}(N_2). No application of nitrogen (N_1) recorded the significantly lowest yield among all the four levels of nitro gen tested in this experiment. Stover yield was highest with the hybrid CSH 15R at 120 $kgha^{-1}$ (V_1N_4) which was superior over other interaction combinations. The lowest stover yield was produced by MLSH 296 at 0 kg N ha^{-1}(V_4N_1). Higher stover yield with CSH 15R (V_1) might be owing to its tall growing nature as reflected by its highest plant height and also dry matter production. The same observations made by Patil (2007) [7] and Chapke *et al*. (2014) [2]. Highest stover yield recorded with the application of 120 kg N ha^{-1} might be due to the fact that nitrogen application increases the activity of cytokinin in plant which leads to the increased cell division and elongation. Madhukumar *et al*. (2013) [3] also made similar observations.

Chemical analysis

Nitrogen content (%) showed that CSH 25(V_3) was significantly highest than all other hybrids. It was followed by CSH 15R (V_1) and CSH 16 (V_2). The lowest N content of sorghum was recorded with MLSH 296 (V_4). N content by recorded at the highest nitrogen level (N_4) was significantly superior as compared to all the other the levels. N content with the application of 100 kg ha^{-1} (N_3) was significantly superior to 80 kg ha^{-1}(N_2) and no nitrogen (N_1). The higher nitrogen content in grains compared to stover shows the efficient partitioning of nitrogen to the grains. Higher biomass production might be the most pertinent reason for the higher N content of nutrients in the treatments which received higher levels of imposed nitrogen treatments. These results are in close conformity with the findings of Yakadri and Murali (2009) [10].

Protein content (%) obtained with CSH 25 (V_3) was higher than all the other hybrids except CSH 16 (V_2) with which it was statistically comparable. Protein content recorded with CSH 15R (V_1) was on par with all the hybrids except CSH 16 (V_2). The lowest protein content was recorded with MLSH 296 (V_4) among all the hybrids taken for study. Protein content at the highest nitrogen level (N_4) was superior as compared to all the other the levels of nitrogen levels but was in parity with 100 kg ha^{-1} (N_3). Protein content obtained with the application of 100 kg ha^{-1} (N_3) was significantly superior to 80 kg ha^{-1}(N_2). Significantly lowest protein content among all the four levels of nitrogen tested in this experiment was found with no application of nitrogen (N_1).

Highest carbohydrate (%) recorded significantly with hybrid CSH 15R (V_1) but was comparable with MLSH 296 (V_4). Both these hybrid levels were significantly superior to CSH 25 (V_3) and hybrid of CSH 16(V_2). The results of data showed that carbohydrate (%) at highest nitrogen level at 120 kg ha^{-1} (N_4), which was significantly superior as compared to all other levels of nitrogen tried.

Table 1: Effect of different hybrids and nitrogen levels on plant height (cm) and panicle girth (cm) of rice fallow sorghum.

Treatments	Plant height (cm) at harvest	Panicle girth (cm) at flowering
Hybrids		
CSH 15R	240.63	6.2
CSH 16	212.10	6.2
CSH 25	189.16	6.3
MLSH 296	185.60	6.2
CD @ 5%	4.96	NS
CV%	2.35	8.6
N-levels (kg ha^{-1})		
0	170.48	5.9
80	199.03	6.2
100	218.63	6.4
120	239.35	6.6
CD @ 5%	5.47	NS
CV%	3.1	9.2
H at N		
CD @ 5%	10.88	NS
N at H		
CD @ 5%	11.30	NS

Table 2: Effect of different hybrids and nitrogen levels on test weight, grain and Stover yield of rice fallow sorghum.

Treatments	1000-Grain weight (Test weight)	Grain yield (kg.ha^{-1})	Stover yield (kg ha^{-1})
Hybrids			
CSH 15R	33.5	5023	15477
CSH 16	35.0	6068	12873
CSH 25	33.5	6841	13536
MLSH 296	34.6	6044	9222
CD @ 5%	NS	1037	598
CV%	4.9	14	4.7
N-levels (kg ha^{-1})			
0	29.3	3436	8872
80	31.9	6296	11992
100	35.7	6751	14043
120	39.7	7491	16201
CD @ 5%	1.15	593	407
CV%	13	13	8.2
H at N			
CD @ 5%	2.63	NS	920
N at H			
CD @ 5%	2.47	NS	868

Table 3: Effect of different hybrids and nitrogen levels on N content (%), protein content (%) & carbohydrate content of rice fallow sorghum.

Treatments	N Content (%)	Protein content (%)	Carbohydrate content
Hybrids			
CSH 15R	1.47	9.1	43.25
CSH 16	1.55	9.6	41.09
CSH 25	1.66	10.1	42.20
MLSH 296	1.40	8.7	42.85
CD @ 5%	0.08	0.63	0.46
CV%	8.5	12	10
N-levels (kg ha^{-1})			
0	1.25	7.7	41.11
80	1.46	9.0	41.80
100	1.66	10.3	42.71
120	1.71	10.5	43.76
CD @ 5%	0.11	0.53	0.55
CV%	9.0	13	11
H at N			
CD @ 5%	NS	NS	NS
N at H			
CD @ 5%	NS	NS	NS

References

1. ASG. Agricultural Stastistics at a Glance. Directorate of Economics and Statistics. 2011-2013; 4.9(a-b):82-84.
2. Chapke RR, Mishra JS, Babu S, Aruna C, Patil JV. On farm evaluation of advanced sorghum hybrids in rice fallows under zero tillage. Current Advances in Agricultural Sciences. 2014; 6(2):180-182.
3. Madhukumar M, Munirathnam P, Srinivasa Reddy M. Studies on the effect of nitrogen fertilization on growth and yield of sorghum (*Sorghum bicolor*) varieties during post rainy (*Maghi*) season. The Andhra Agricultural Journal. 2013; 60(4):760-763.
4. Mishra JS, Subbarayudu B, Chapke RR, Seetharama N. Evaluation ofsorghum (*Sorghum bicolor*) cultivars in rice (*Oryza sativa*)-fallows under zero tillage. Indian Journal of Agricultural Sciences. 2011; 81(3):277-279.
5. Mishra JS, Thakur NS, Pushpendra Singh, Kubsad VS, Kalpana R, Alse UN. Tillage and integrated nutrient management in rainy- season grain sorghum (Sorghum bicolor). Indian Journal of Agronomy. 2014; 59(4):619-623.
6. Panse VG, Sukhatme PV. (Revised by Shukatme, P.V and Ambe, V.N.). Statistical Methods for Agricultural Workers. ICAR, New Delhi, 1985, 100-174.
7. Patil SL. Performance of sorghum varieties and hybrids during post rainy season under drought situation in Vertisols in Bellary, India. E journal. ICRISAT. org. 2007; 5(1):1-3.
8. Pushpendra Singh, Sumeriya HK, Solanki NS. Effect of fertilizer levels on productivity and economics of elite sorghum (*Sorghum bicolor* (L.) Moench) genotypes. Madras Agricultural Journal. 2012; 99(7-9):567-569.
9. Varaprasad PV, George Mahama, David B. Mengel, Tesfaye Tesso T. Influence of nitrogen fertilizer on growth and yield of grain sorghum hybrids and inbred lines. Agronomy Journal. 2014; 106(5):1623-1630.
10. Yakadri M, Murali V. Effect of Planting Geometry and Nitrogen levels on growth and yield of sorghum. ANGRAU Journal of Research. 2009; 37(1&2):14-17.