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Response of Direct Seeded Rice (*Oryza sativa* L.) to Brown Manuring and Nitrogen Levels

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ABSTRACT

A field trial was conducted on sandy clay soil of Agricultural College Farm, Bapatla, during *kharif,* 2018 to investigate the response of dry direct seeded rice to brown manuring and nitrogen levels. Brown manuring with *Sesbania aculeata* (B_1) recorded the highest panicles m^{-2}(393.3), grains $panicle^{-1}$(146.2), filled grains $panicle^{-1}$(131.1), 1000 grain weight (15.6g), grain yield (5754 kg ha^{-1}) and straw yield (6676 kg ha^{-1}). Among the levels of nitrogen, plots applied with 120 kg N ha^{-1}(N_4)recorded higher yield attributing characters (404.7 panicles m^{-2}, 141.2 grains $panicle^{-1}$, 128 filled grains $panicle^{-1}$and 15.7 g test weight) as a result recorded the highest grain (6525 kg ha^{-1}) and straw (7569 kg ha^{-1}) yield.

Key words: *Brown manuring, Dry direct seeded rice, Grain yield, Nitrogen levels and Straw yield.*

Rice (*Oryza sativa* L.), being the indispensable daily nourishment of more than half of the population of the world, is an important target to provide food security and livelihoods for millions. India, the second largest producer and consumer of rice in the world has an area of about 43.9 M ha under rice cultivation with a production and productivity of 109.69 M t and 2494 kg ha^{-1}, respectively (Ministry of Agriculture, 2017-18).

The two major bottlenecks causing lower yield of rice in direct seeding condition are weed menace and lesser nutrient use efficiency which might be due to various type of losses. Direct sown rice suffers more due to weeds menace since both the crop and weed compete for the same resources. Dry seeded rice is found to give similar yields if timely weed control is resorted. Brown manuring of late is an alternative practice to the green manuring designed for direct seeded rice with two major advantages *i.e.,* controlling late flush of weeds besides supplementing the soil available nutrient through decomposition resulting in better plant growth. Brown manuring, because of falling of dried leaves on the ground forms a mulch, which in turn checks the subsequent germination of second flush of weeds. This fallen dried leaves of legume decompose very fast to meet the nitrogen and other nutrients demands of the soil and thus impacts positively on nutrient availability to plant finally improvising the yield attributing characters.

MATERIAL AND METHODS

A field trial was conducted on sandy clay soils of Agricultural College Farm, Bapatla during *kharif,* 2018. The experiment soil was neutral in soil reaction, low in available nitrogen and medium in available phosphorus and potassium. The trial was laid out in randomized block design with factorial concept replicated thrice. The first factor consisted of two sources of brown manuring *i.e., Sesbania aculeata* (B_1),*Crotalaria juncea* (B_2) and Control (B_3) whereas, the second factor comprised four nitrogen levels *viz.,* 0 kg ha^{-1}(N_1), 40 kg ha^{-1} (N_2), 80 kg ha^{-1} (N_3) and 120 kg ha^{-1} (N_4). The entire dose of phosphorus@ 60 kg ha^{-1} was applied uniformly to all plots as basal. The scheduled nitrogen was applied in three equal splits as per the treatments *viz.,* $1/2^{th}$ as basal, $1/4^{th}$ as top dressing at 45 DAS and remaining $1/4^{th}$ as top dressing at 90 DAS. The data on growth parameters and yield attributes were recorded as per standard statistical procedures. The data was analyzed following the analysis of variance (ANOVA) for randomized block design with factorial concept as suggested by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

Yield Attributes

Brown manuring facilitated in augmenting the sink capacity of rice crop resulting in significantly more number of panicles m^{-2}, total grains $panicle^{-1}$, filled grains $panicle^{-1}$ under *Sesbania aculeata* brown manuring over no brown manuring. Total grains $panicle^{-1}$ and filled grains $panicle^{-1}$ recorded with *Crotalaria juncea* brown manuring and was found to be on par with *Sesbania aculeata* brown manuring. The lowest yield attributes were registered under plots without brown manuring. The maximum number of panicles m^{-2}, total and filled grains $panicle^{-1}$ were produced with higher N@ 120 kg ha^{-1}. However, these

Table 1. Yield attributes of rice as influenced by brown manuring and nitrogen levels

Treatments	Number of panicles m^{-2}	Total grains $panicle^{-1}$	Filled grains $panicle^{-1}$	Test weight (g.)
Brown Manuring (B)				
B1: Brown manuring with *Sesbania*	393.3	146.2	131.1	15.6
B2: Brown manuring with *Crotalaria juncea*	373.5	141.7	128.1	15.3
B3: No Brown manuring	321.0	121.3	107.5	14.5
SEm±	4.9	1.8	1.7	0.4
CD (0.05)	14.3	5.3	5.1	NS
Nitrogen levels (N)				
N1: 0 kg N ha^{-1}	307.3	130.7	115.2	14
N2: 40 kg N ha^{-1}	352.8	134.9	120.7	15.2
N3: 80 kg N ha^{-1}	385.6	138.8	125.1	15.6
N4: 120 kg N ha^{-1}	404.7	141.2	128	15.7
SEm±	5.6	2.1	2	0.4
CD (P=0.05)	16.5	6.2	5.8	1.2
Interaction (B x N)				
SEm±	9.7	3.6	3.4	0.7
CD (P=0.05)	NS	NS	NS	NS
CV (%)	5.7	5.6	5.9	8

Table 2. Grain and Straw Yield of rice as influenced by brown manuring and nitrogen levels

Treatments	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})
Brown Manuring (B)		
B1: Brown manuring with *Sesbania aculeata*	5754	6676
B2: Brown manuring with *Crotalaria juncea*	5708	6546
B3: No Brown manuring	4975	6189
SEm±	135	125
CD (0.05)	396	365
Nitrogen levels (N)		
N1: 0 kg N ha^{-1}	4121	5174
N2: 40 kg N ha^{-1}	5242	6175
N3: 80 kg N ha^{-1}	6029	6962
N4: 120 kg N ha^{-1}	6525	7569
SEm±	155.7	144
CD (P=0.05)	456.6	422
Interaction (B x N)		
SEm±	296.7	249
CD (P=0.05)	NS	NS
CV (%)	9.5	6.7

were found to be on a par with the yield attributes obtained with application of 80 kg N ha^{-1}except number of panicles m^{-2}. The minimum number of panicles m^{-2}, total and filled grains $panicle^{-1}$was noticed with no external nitrogen application. Plots applied with the highest quantity of nitrogen (120 kg ha^{-1}) recorded significantly more test weight compared to control. Conversely, brown manuring had no significant influence on test weight.

Improved nitrogen supply through *Sesbania* brown manuring might have facilitated in liberal and constant nutrient uptake and in turn increased photosynthetic efficiency. Ample release of nitrogen at critical growth stages of rice might be responsible for increased number of panicles m^{-2}. More number of grains $panicle^{-1}$ could be attributed to favorable nutrition at primordial initiation which decides length of panicle and number of grains $panicle^{-1}$. Brown manuring being the source of all macro and micro nutrients helped in better carbohydrate translocation, which in turn increased the number of filled grains $panicle^{-1}$. These findings were in agreement with the views expressed by Gouse Mohiddin *et al.* (2014) and Prabhakar *et al.* (2012).

Yield (kg ha^{-1})

Brown manuring treated plots with *Sesbania aculeata* resulted in recording maximum grain yield (5754 kg ha^{-1}) and was significantly superior over control treatment (4975 kg ha^{-1}). However, it was on a par with grain yield of rice in *Crotalaria juncea* brown manured plot. Application of nitrogen @ 120 kg ha^{-1} out yielded the remaining three levels and had shown its statistical supremacy in yielding the maximum grain yield (6525 kg ha^{-1}). Application of 80 kg N ha^{-1} was the next best treatment in producing higher grain yield (6029 kg ha^{-1}).

The maximum straw yield of rice (6676 kg ha^{-1}) was produced in the plots that received *Sesbania aculeata* as brown manuring, which was however found to be at par with the treatment plots applied with *Crotalaria juncea* brown manuring. Significantly lower straw yield was obtained from the treatment plot without brown manuring (6189 kg ha^{-1}). Application of Nitrogen @ 120 kg ha^{-1} (7569 kg ha^{-1}) resulted in maximum straw yield of rice which was significantly superior to all other treatments.

Significantly higher grain and straw yield were registered with the application of *Sesbania* as brown manuring that might be due to better nutrient availability around the eco-rhizosphere of dry direct seeded rice creating a favorable environment for constant absorption of sufficient quantities of nitrogen, besides essential micronutrients. These findings are in confirmation with those reported by Murthy *et al.* (2015) and Bhanu Prakash *et al.* (2013).

Interaction studies between varieties and nitrogen levels for parameters studied were found to be non-significant.

CONCLUSION

It can be concluded that direct seeded rice with *Sesbania aculeata* brown manuring performed well with greater yield attributes and yield. Among the nitrogen levels, 120 kg N ha^{-1} resulted in higher yields compared to all other treatments.

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