

Effect of sunnhemp brown manuring and nitrogen fertilization on growth and yield of rice-fallow maize

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ABSTRACT

A field experiment was conducted on sandy clay loamy soils of Agricultural College Farm, Bapatla during the 2024-2025 season to assess the response of maize on different brown manuring practice's and nitrogen levels in rice fallow condition. The experiment was laid out in a split plot design with four brown manuring practice taken on main plots with and three different nitrogen levels in sub plots and replicated thrice. The results of the investigation revealed that plant height at 60, 90 DAS and at harvest were not significantly influenced by brown manuring practices. At 30 DAS significantly higher plant height was recorded without brown manuring compared to other brown manuring treatments. Drymatter accumulation and days to 50 percent tasseling and silking were not influenced by brown manuring practices. Among the different nitrogen levels, significantly higher plant height, drymatter accumulation and days to 50 percent silking and tasseling were recorded under the 200 kg N ha⁻¹, which was on par with 175 kg N ha⁻¹

Keywords: *Brown manuring, Green manuring, Organic manures and Rice fallow maize*

In India, maize (*Zea mays* L.) is the third most important cereal crop after rice and wheat. Globally, maize is referred as queen of cereals because it has the greatest yield potential and wider adaptability among the cereal crops. In India maize is grown on 9.89 million hectares with a production of 31.65 million tonnes of grain yield at a productivity of 3.19 t ha⁻¹. In Andhra Pradesh, it is grown in an area of 3.85 lakh hectares with a production of 27.51 lakh tonnes and productivity of 7.13 t ha⁻¹. Modern agriculture aims to maximize yield but often depletes soil nutrients. While organic manures improve productivity but their availability is limited. On the other hand, there is a rising trend in chemical fertilizer cost, brown manuring and green manuring can be used as an alternative approach for higher production. The process of green manuring involves a greater number of tillage operations, which cause soil moisture depletion and increases labour, irrigation water and fuel costs for cultivation. Brown manuring, on the other hand, is less expensive and farmers can grow the manure crop in the standing main crops. In rice fallow maize, nitrogen management is vital, as maize is an exhaustive crop it

requires the large quantity of fertilizers for cultivation. This can be supplied through urea and other synthetic fertilizers. When these chemical fertilizers are applied in high quantities over an extended period of time, supply of other nutrients become unbalanced and in the absence of organic materials, the soil becomes infertile and less productive due to a total reliance on chemical fertilizers (Meisheri *et al.*, 2001). Keeping all the points in view, present investigation was carried out to study brown manuring practice with maize at different nitrogen levels to evaluate the growth and yield of rice-fallow maize influenced by sunnhemp brown manuring and nitrogen fertilization.

MATERIAL AND METHODS

A field experiment was conducted at Agricultural College Farm, Bapatla, Andhra Pradesh during *rabi*, 2024-25. The soil of the experimental field was sandy clay loamy in texture, slightly alkaline in reaction with 8.2 p^H and low in available nitrogen (213.2kg ha⁻¹), medium in available phosphorus (23.4 kg ha⁻¹) and potassium (262.3 kg ha⁻¹). Weekly mean maximum temperature during crop growth

period ranged from 29.4°C to 35.1°C with an average maximum temperature of 32.3°C while the weekly mean minimum temperature during crop period ranged from 18°C to 25.4°C with an average minimum temperature of 20.6°C. The weekly mean relative humidity ranged from 57 to 92 percent with an average relative humidity 75.7 percent and total rainfall of 4.8 mm was received during crop growth period with one rainy day. Experiment was laid out in split plot design and replicated thrice. The main plots consisted of four brown manuring treatments *i.e.*, M1-Maize without brown manuring, M2-Maize + sunnhemp brown manuring at 35 DAS, M3- Maize + sunnhemp brown manuring at 45 DAS, M4-Maize + sunnhemp brown manuring at 55 DAS and sub plots consisted of three nitrogen levels *i.e.*, (S1) - 150 kg N ha⁻¹, (S2) -175 kg N ha⁻¹, (S3)- 200 kg N ha⁻¹ (RDN). The field operations like irrigation, fertilizer application and plant protection measures were followed whenever necessary. The data regarding plant height, dry matter production, days to 50 % tasseling silking and kernel yield were recorded as per standard procedures. Data was analyzed statistically by following the standard procedures as described by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Plant Height (cm)

The perusal of data indicated that plant height continued to increase with the advancement of crop age. The results demonstrated that maize plant height was not influenced by brown manuring practices at all stages except at 30 DAS. At 30 DAS significantly higher (91.3 cm) plant height was observed in maize without brown manuring (M1). It might be due to the before the knock down of sunnhemp, it was grown as an intercrop in maize during the initial 30 days of the crop period. Compared to sole maize, brown manuring treated maize had lower plant heights as a result of interspecific competition during the early growth stage. The results are in close conformity with Mandal *et al.* (2014) and Manasa *et al.* (2021). Plant height at 60, 90 DAS and at harvest was found to be non significant. Plant height of maize was significantly affected by nitrogen levels. The higher plant height was recorded with application of 200 kg N ha⁻¹ RDN (S3), which was found to be on par with 175 kg N ha⁻¹ (S2). Whereas, lower plant height

was noticed under 150 kg N ha⁻¹ (S1) at different crop growth stages. The interaction of brown manuring practices and nitrogen levels on plant height was non-significant. Similar findings were reported by Manan *et al.* (2013) and Adhikari *et al.* (2021). (Table 1)

Table 1. Plant height (cm) of maize at different growth stages as influenced by brown manuring and nitrogen levels

Treatments	30	60	90	At harvest
	DAS	DAS	DAS	
Brown manuring				
M1 - Maize without brown manuring	91.3	237	251	252.5
M2 - Maize + Sunnhemp brown manuring at 35 DAS	82	223	247	250.3
M3 - Maize + Sunnhemp brown manuring at 45 DAS	85.4	228	251	252.9
M4- Maize + Sunnhemp brown manuring at 55 DAS	85.5	230	254	255.2
SEm (±)	1.44	6.39	5.69	5.78
CD (p=0.05)	5	NS	NS	NS
CV (%)	5	8.4	6.8	6.9
Nitrogen levels (kg ha ⁻¹)				
S1 - 150 kg N ha ⁻¹	80.6	212	239	241.1
S2 - 175 kg N ha ⁻¹	86.3	232	251	253
S3 - 200 kg N ha ⁻¹ (RDN)	91.1	245	262	264
SEm (±)	1.68	5.17	6.01	5.18
CD (p=0.05)	5	15.5	18	15.5
CV (%)	6.8	7.8	8.3	7.1
Interaction				
M x S	NS			
S x M	NS			

Dry matter accumulation (kg ha⁻¹)

The impact of brown manuring on dry matter accumulation (kg ha⁻¹) of maize at different crop growth stages was found to be non significant. At 30 and 60 DAS numerically, higher dry matter accumulation was recorded in maize without brown manuring (M1). At 90 DAS and at harvest numerically, maximum drymatter accumulation was recorded under maize + sunnhemp brown manuring at 35 DAS (M2) whereas, minimum was recorded under maize + sunnhemp brown manuring at 55 DAS (M2). Among the nitrogen levels significant higher drymatter accumulation was recorded at 200 kg N ha⁻¹ RDN (S3), which was statistically similar with the application of 175 kg N ha⁻¹ (S2), which was significantly superior to application of 150 kg N ha⁻¹ (S1) at all the crop growth stages. Similar positive effects of nitrogen on drymatter accumulation were also reported by Nikita *et al.*

(2015). (Table 2)

Days to 50 percent Tasseling and Silking

The influence of brown manuring practices on tasseling and silking of maize were found to be non significant. Tasseling and silking of maize was significantly hastened by application of 200 kg N ha⁻¹ RDN

Table 2. Dry matter accumulation (kg ha⁻¹) in maize at different growth stages as influenced by brown manuring and nitrogen levels

Treatments	30	60	90	At harvest t
	DAS	DAS	DAS	
Brown manuring				
M1 - Maize without brown manuring	684	9295	17725	18734
M2 - Maize + Sunnhemp brown manuring at 35 DAS	651	8986	17915	19067
M3 - Maize + Sunnhemp brown manuring at 45 DAS	681	8840	17555	18857
M4- Maize + Sunnhemp brown manuring at 55 DAS	669	8640	17302	18504
SEm (±)	27.2	255.9	485	485.29
CD (p=0.05)	NS	NS	NS	NS
CV (%)	12.2	8.6	8.3	7.7
Nitrogen levels (kg ha ⁻¹)				
S1 - 150 kg N ha ⁻¹	624	8364	16842	17799
S2 - 175 kg N ha ⁻¹	678	8957	17551	18733
S3 - 200 kg N ha ⁻¹ (RDN)	713	9500	18480	19840
SEm (±)	16.7	183.2	412	379.7
CD (p=0.05)	50	549	1236	1138
CV (%)	8.6	7.1	8.1	7
Interaction				
M x S	NS			
S x M	NS			

(S3) which were found to be on par with application of 175 kg N ha⁻¹ (S2) and plants grown under treatment 150 kg N ha⁻¹ (S1) resulted in delayed tasseling and silking. Similar findings were observed by Thimmappa *et al.* (2014).

Kernel yield (kg ha⁻¹)

The higher kernel yield was recorded with maize + sunnhemp brown manuring at 35 DAS (M2), which was on par with maize + sunnhemp brown manuring at 45 DAS (M3) and significantly superior over maize without brown manuring (M1) and maize

+ sunnhemp brown manuring at 55 DAS (M4). It might be due to after knock down of sunnhemp at 35 DAS, these brown manuring crops release organic acids that help solubilize adsorbed and fixed nutrients in the soil during the decomposition, improving the availability of all micro and macro nutrients (Rajan Kumar *et al.*, 2022). Among the nitrogen levels, 200 kg N ha⁻¹ RDN (S3) was recorded significantly higher kernel yield, which was on a par with 175 kg N ha⁻¹ (S2). Whereas, lower kernel was recorded with 150 kg N ha⁻¹ (S1). These results are consistent with the observations reported by Mallareddy and Padmaja (2014). There was no interaction effect between the brown manuring practices and nitrogen levels. (Table 3)

CONCLUSION

Brown manuring was significant in increasing plant height and dry matter production, however with increased in N levels, increased plant growth and yield

Table 3. Number of days to 50 percent tasseling and silking, kernel yield (kg ha⁻¹) of maize as influenced by brown manuring and nitrogen levels

Treatments	50 percent tasseling	50 percent silking	Kernel yield (kg ha ⁻¹)
Brown manuring			
M1 - Maize without brown manuring	61.8	65.8	6775
M2 - Maize + Sunnhemp brown manuring at 35 DAS	62.1	66	7328
M3 - Maize + Sunnhemp brown manuring at 45 DAS	62.4	66.3	6914
M4- Maize + Sunnhemp brown manuring at 55 DAS	62.4	66.4	6499
SEm (±)	0.53	0.36	138.68
CD (p=0.05)	NS	NS	480
CV (%)	2.6	1.6	6
Nitrogen levels (kg ha⁻¹)			
S1 - 150 kg N ha ⁻¹	62.9	66.6	6034
S2 - 175 kg N ha ⁻¹	62	66	6692
S3 - 200 kg N ha ⁻¹ (RDN)	61.7	65.8	7911
SEm (±)	0.21	0.19	211.78
CD (p=0.05)	0.6	0.6	635
CV (%)	1.2	1	10.7
Interaction			
M x S	NS		
S x M	NS		

up to 200 kg N ha⁻¹. Sunnhemp brown manuring at 35 DAS increased the yield significantly over sunnhemp BM at 55 DAS, and without brown manuring.

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