

Evaluation of growth parameters, yield parameters and yield of maize based intercropping systems in North coastal Andhra Pradesh

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ABSTRACT

A field experiment was conducted on sandy loam soils of Agricultural College Farm, Naira during the *rabi*, 2024-2025 to evaluate suitable maize (*Zea mays* L.) intercropping systems for North Coastal Andhra Pradesh region. Maize was planted with three intercrops *viz.*, Blackgram, Greengram and Cowpea in paired rows, *in-situ* Green manuring with maize and farmers's practice sole maize against three nitrogen levels in split plot design. The results of investigation had revealed that plant height (247.4 cm), drymatter accumulation (19050 kg ha⁻¹) found to be significantly higher under maize + *in-situ* green manuring with sunnhemp which was at par with maize + blackgram and maize + greengram in paired row planting. Significantly higher values of yield attributes such as cob length (19.6 cm), cob diameter (5.14 cm) and number of kernels per cob (490.8) and kernel yield (7754 kg ha⁻¹) was recorded under maize + *in-situ* green manuring with sunnhemp which was comparable with maize + blackgram and maize + greengram in paired row planting. Among the nitrogen levels significantly higher values of growth attributes and yield attributes were recorded with application of 100 % RDN which was statistically at par with 75 % RDN + Biological fertilizer application.

Keywords: *Biological fertilizer consortia, Green manuring, Maize intercropping and Paired rows*

Maize (*Zea mays* L.) is the third most farmed crop in India after rice and wheat. Maize is used as a basic raw material and ingredient in thousands of industrial goods, in addition to providing sustenance for humans and high-quality animal feed and it is an important raw ingredient for many industrial goods, including starch, oil, protein, alcoholic drinks, food sweeteners, medicines, cosmetics and bio-energy generation (Kumar *et al.*, 2018). Growing on 11.24 million hectares, maize yields about 37.67 million tonnes of grain with a productivity of 3351 kg ha⁻¹ in India (Directorate of Economics and Statistics, 2023/24). In Andhra Pradesh, 2.92 lakh hectares of maize were planted; yielding 18.19 lakh tons of production and 6225 kg ha⁻¹ of productivity (des.ap.gov.in, 2023-24). Intercropping in maize under crop intensification has become more and more common recently in Andhra Pradesh's southern agroclimatic zone. Being a demanding crop, maize has a significant need for fertilizers, particularly nitrogen. The key component of protoplasm, enzymes and chlorophyll is nitrogen. The stagnation of yield in maize in recent years in Andhra Pradesh had become a challenging task for the scientists and the policy

makers. So, integration of legumes as intercrop with maize improves the productivity and over all resource use efficiency. The nature and kind of associated legumes as well as the amount of fertilizer used determine the production potential and economic sustainability of the maize + legume intercropping system, which is based on a logical agronomic approach of uniform plant population of both base crop and intercrop. With all these in consideration, present investigation has carried out to study different intercrops with maize at different nitrogen levels to evaluate the most profitable maize intercropping system in the North Coastal Andhra Pradesh.

MATERIAL AND METHODS

A field experiment was conducted at The Agriculture College Farm, Naira of Acharya N. G. Ranga Agricultural University, Andhra Pradesh, which was geographically situated at 18°38'56" N latitude, 83°56'38" E longitude at an altitude of 12m above mean sea level in the Srikakulam district, North Coastal Zone of Andhra Pradesh. The experiment was laid out in Block-C of the Agricultural college farm during *rabi*, 2024-2025. The soil of the

experimental field was sandy loam in texture, neutral in pH (7.1) with an electrical conductivity of 0.17 dS m⁻¹ at 25°C, low in organic carbon (0.43 %) and low in available N (248.8 kg ha⁻¹), medium in available P₂O₅ (23.2 kg ha⁻¹) and medium in available K₂O (255.2 kg ha⁻¹). The average mean temperature ranged from 33.5 °C to 12.2 °C, with a total rainfall of 73.2 mm in 5 rainy days. The study comprised of fifteen treatments with following combinations in which maize intercropping systems M₁: Maize + Blackgram with paired row, M₂: Maize + Greengram with paired row, M₃: Maize + Cowpea with paired row, M₄: Maize + *in-situ* green manuring with sunnhemp and M₅: Farmer's practice Sole maize were assigned in main plots against different nitrogen levels in subplots

viz., S₁: 100 % RDN, S₂: 75 % RDN and S₃: 75 % RDN + Biological fertilizer consortia. The recommended dose of P and K were applied in the form of Single Super Phosphate (SSP) and Muriate of Potash (MOP) and treatments with 100 % RDN and 75 % RDN had given 240 kg N ha⁻¹ and 180 kg N ha⁻¹ through urea and Biological fertilizer consortia was applied @ 1250 ml ha⁻¹. The treatments with intercrops has followed a spacing of 80/40 x 20 cm and normal planting of maize followed a spacing of 60 x 20 cm. The field operations like irrigation, fertilizer application and plant protection measures were followed whenever necessary. The data regarding plant height, drymatter production, days to 50 % tasseling, cob length, cob diameter, number of

Table 1. Plant height (cm), drymatter accumulation (kg ha⁻¹) and days to 50 % tasseling influenced by maize intercropping systems and nitrogen levels

Treatments	Plant height (cm)	Drymatter accumulation (kg ha ⁻¹)	Days to 50% Tasseling
Maize intercropping systems			
M ₁ : Maize + Blackgram with paired row	235.70	18634.00	60.30
M ₂ : Maize + Greengram with paired row	232.70	18361.00	61.30
M ₃ : Maize + Cowpea with paired row	217.70	17141.00	61.20
M ₄ : Maize + <i>insitu</i> green manuring with sunhemp	247.40	19050.00	59.60
M ₅ : Farmer's practice -Sole maize (Control)	215.00	16712.00	62.20
SEm ±	6.75	508.90	1.80
CD (P=0.05)	22.00	1659.00	NS
CV %	8.80	8.50	8.90
Nitrogen Levels			
S ₁ : 100 % RDN	237.30	18810.00	60.10
S ₂ : 75 % RDN	216.20	17236.00	61.40
S ₃ : 75 % RDN +Biological fertilizer consortia	233.30	17893.00	61.20
SEm ±	4.96	390.70	1.29
CD (P=0.05)	14.50	1152.00	NS
CV %	8.40	8.40	8.20
Interaction			
SEm ±	10.96	873.70	2.89
Interaction M at S	NS	NS	NS
Interaction S at M	NS	NS	NS

kernels per cob 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

Growth attributes: All the growth attributes were significantly influenced by both maize intercropping systems and nitrogen levels. Among the maize intercropping systems tested, maize + *in-situ* green manuring with sunnhemp produced significantly higher plant height (247.4 cm) and drymatter accumulation (19050 kg ha⁻¹), which was comparable to maize + blackgram and maize + greengram in paired rows and lower values of growth attributes were recorded under farmer's practice-sole maize. Similar findings were reported by Kumar *et al.* (2021). Among the nitrogen levels, the application of 100% RDN had resulted in significantly higher

values of plant height (237.3 cm) and drymatter accumulation (19050 kg ha⁻¹), which were statistically comparable to the application of 75% RDN + Biological fertilizer consortia, while the application of 75% RDN resulted in lower values of plant height and drymatter accumulation. Similar findings were reported by Singh *et al.* (2025). Days to 50% tasseling showed no significant variation across maize intercropping systems or nitrogen levels.

Yield attributes and Yield: In the maize intercropping systems tested, the yield attributes had recorded significantly higher cob length (19.6 cm), cob diameter (5.14 cm) and number of kernels per cob (490.8) were recorded in maize + *in-situ* green manuring with sunnhemp, which were statistically at par with maize + blackgram and maize + greengram in paired rows and the lower values of yield attributes were recorded under farmer's practice-sole maize.

Table 2. Cob length (cm), cob diameter (cm), kernels cob⁻¹ and kernel yield (kg ha⁻¹) influenced by maize intercropping systems and nitrogen levels

Treatments	Cob length (cm)	Cob diameter (cm)	Kernels cob ⁻¹	Kernel yield (kg ha ⁻¹)
Maize intercropping systems				
M ₁ : Maize + Blackgram with paired row	19.4	4.69	487.1	7468
M ₂ : Maize + Greengram with paired row	18.9	4.65	479.6	7371
M ₃ : Maize + Cowpea with paired row	17.8	4.54	437.3	6836
M ₄ : Maize + <i>insitu</i> green manuring with sunhemp	19.6	5.14	490.8	7754
M ₅ : Farmer's practice -Sole maize (Control)	17.6	4.51	396.8	6407
SEm ±	0.54	0.141	12.08	211.9
CD (P=0.05)	1.7	0.5	39.4	691
CV %	8.7	9.4	9.2	8.9
Nitrogen Levels				
S ₁ : 100 % RDN	19.4	4.8	486.6	7568
S ₂ : 75 % RDN	17.8	4.36	441.1	6724
S ₃ : 75 % RDN +Biological fertilizer consortia	18.3	4.59	464.3	7210
SEm ±	0.42	0.11	9.01	161
CD (P=0.05)	1.2	0.3	26.5	475
CV %	8.7	9.6	8.9	8.7
Interaction				
SEm ±	0.94	0.261	20.15	360.2
Interaction M at S	NS	NS	NS	NS
Interaction S at M	NS	NS	NS	NS

Similar studies were in line with findings of Hiremath *et al.* (2019). Among the nitrogen levels significantly higher cob length (19.4 cm), cob diameter (4.80 cm) and number of kernels per cob (486.6), which were recorded with application of 100 % RDN, which was statistically comparable with 75 % RDN + Biological fertilizer consortia application. Maize + *in-situ* green manuring with sunnhemp produced significantly higher kernel yield (7754 kg ha⁻¹), which was statistically equivalent to maize + blackgram and maize + greengram in paired rows. The highest kernel yield was obtained with 100% RDN, which was comparable to 75% RDN + biological fertilizer consortia. The current findings are in close confirmation with Ray *et al.* (2022).

CONCLUSION

Maize intercropping with *in-situ* green manuring utilizing sunnhemp considerably improved growth and yield characteristics, comparable to maize + blackgram and maize + greengram in paired rows. The use of 100% RDN resulted in the higher plant height, dry matter and yield, which were comparable to 75% RDN with biological fertilizer consortium. Thus, incorporating legume intercropping and optimal nitrogen management boosts maize yield in a sustainable manner.

LITERATURE CITED

- Department of Economics and Statistics, 2023-2024.** <https://des.ap.gov.in>
- Directorate of Economics and Statistics, 2023-2024.** Agricultural Statistics at a Glance.
- Gomez K A and Gomez A 1984.** *Statistical procedures for agricultural research*. 1st ed. John Wiley Sons, New York.
- Hiremath K A, Halepyati A S, Chittapur B M, Bellakki M A, Kuchanur P H and Dodamani B M 2019.** Effect of green and brown manuring on productivity of maize-wheat cropping system under UKP command. *International Journal of Chemical Studies*. 7(1):1564-1569.
- Kumar R S, Bridgit T K and Chanchala A 2018.** Physical and chemical properties of sandy soil as influenced by the application of hydrogel and mulching in maize (*Zea mays* L.). *International Journal of Current Microbiology and Applied Sciences*. 7(07):36123618.
- Kumar V, Singh A K and Ray L I 2021.** Effect of planting pattern and organic nutrient sources on performance of maize in maize-cowpea intercropping system: Performance of maize in maize-cowpea intercropping system. *Journal of Agri Search*. 8(1):1-5.
- Ray M, Roul P, Behera B, Sahoo K, Mishra N and Das S 2022.** Analysis of productivity and profitability of sweet corn+ cowpea intercropping under rainfed condition in NCPZ of Odisha. *International Journal of Environment and Climate Change*. 12(11):13351347.
- Singh D, Syed S, Yadav K, Verma S K N, Tiwari J K, Kumar A and Kumar K 2025.** Improving Maize Yield and Soil Productivity through N Management Practices in Maize-legume Intercropping. *Journal of Experimental Agriculture International*. 47(1):317324.

Received on 15.04.2025 and Accepted on 25.05.2025