

Influence of integrated nutrient management on growth and yield attributes of pearl millet (*Pennisetum glaucum* L.)

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ABSTRACT

A field experiment entitled “Effect of integrated use of inorganic fertilizers, organic manure and bio-fertilizers on growth parameters of Pearl Millet (*Pennisetum glaucum* L.)” was conducted during the *rabi* 2024-25 at the Agricultural College Farm, Rajamahendravaram. The experiment was laid out in a Randomized Block Design (RBD) with ten treatments replicated thrice, and treatments were randomly allotted as per the design. The results revealed that the application of 100% RDF combined with *Azospirillum* as seed treatment resulted in significantly higher plant height (201.6 cm), dry matter accumulation (9733 kg ha⁻¹), grain yield (2707 kg ha⁻¹) and stover yield (6127 kg ha⁻¹) and it was at par with 75% RDF + FYM @ 2.5 t ha⁻¹ + *Azospirillum* as seed treatment @ 10 ml kg⁻¹ seed.

Keywords: *Azospirillum*, Integrated, Pearl millet and RDF

Pearl millet (*Pennisetum glaucum* L.) is a drought-tolerant cereal of the Poaceae family, is a vital food crop widely cultivated in the arid and semi-arid regions of India, owing to its adaptability to marginal soils and ability to withstand limited water. It is rich in protein (11.6%), fiber, iron, zinc and β -carotene, it holds superior nutritional value compared to many other grains. India leads in global pearl millet production, with cultivation spanning 7.08 million hectares and an annual output of 9.53 million tonnes. In Andhra Pradesh, it occupies about 0.25 lakh hectares with a productivity of 2252 kg ha⁻¹ (DA & FW, 2023-24). Major producing states include Rajasthan, Maharashtra, Gujarat, Uttar Pradesh and Haryana, where it supports food security, fodder needs and industrial uses such as poultry feed and alcohol extraction (Mohan and Singh 2022). Despite its resilience, pearl millet productivity remains limited by several constraints, including erratic rainfall, frequent droughts, nutrient deficient soils and low organic matter content. These challenges are further exacerbated under rainfed conditions by minimal external inputs and suboptimal crop management practices (Suzuki *et al.*, 2017). Integrated nutrient management (INM), combining inorganic fertilizers, organic manures and

biofertilizers enhances crop growth and soil health. While inorganic fertilizers provide immediate nutrients, organic manures improve soil structure and nutrient retention. *Azospirillum*, a nitrogen-fixing biofertilizer, promotes root development and nutrient uptake. Their combined use improves plant growth, nutrient efficiency and sustainability in pearl millet cultivation.

MATERIALS AND METHODS

A field experiment was conducted during *rabi* 2024-25 at the Agricultural College Farm, Rajamahendravaram, Andhra Pradesh. The soil of the experimental field was sandy loam in texture, neutral in reaction with a pH of 6.53 and an electrical conductivity of 0.10 dS m⁻¹. It was low in organic carbon (0.35%) and available nitrogen (152 kg ha⁻¹), medium in available phosphorus (21 kg ha⁻¹) and available potassium (192 kg ha⁻¹). During the crop growth period, the average maximum and minimum temperatures were 32.9 °C and 21.8 °C, respectively and a total rainfall of 73.8 mm was received. The experiment was laid out in a randomized block design with ten treatments replicated thrice. The treatments included T₁: 100% RDF, T₂: 100% RDF + *Azospirillum* as seed treatment 10 ml kg⁻¹ seed, T₃:

100% RDF + *Azospirillum* as soil application @ 5 kg ha⁻¹, T₄: 75 % RDF + *Azospirillum* as seed treatment 10 ml kg⁻¹ seed, T₅: 75% RDF + *Azospirillum* as soil application @ 5 kg ha⁻¹, T₆: FYM alone @ 10 t ha⁻¹, T₇: FYM alone @ 10 t ha⁻¹ + *Azospirillum* as seed treatment 10 ml kg⁻¹ seed, T₈: FYM alone @ 10 t ha⁻¹ + *Azospirillum* as soil application @ 5 kg ha⁻¹, T₉: 75 % RDF + FYM 2.5 t ha⁻¹ + *Azospirillum* as seed treatment 10 ml kg⁻¹ seed and T₁₀: 75 % RDF + FYM 2.5 t ha⁻¹ + *Azospirillum* as soil application @ 5 kg ha⁻¹. The crop was sown at a spacing of 45 cm × 10 cm. The recommended dose of NPK (80:40:30 kg ha⁻¹) was supplied through urea, Single Super Phosphate (SSP) and Muriate of Potash (MOP) as sources of nitrogen, phosphorus, and potassium, respectively. Nitrogen was applied in two equal splits-half as a basal dose and the remaining half at 30 Days After Sowing (DAS). The entire dose of phosphorus and potassium was applied as a basal application in all the plots. Healthy and well matured pearl millet seeds were treated with *Azospirillum* @ 10 ml per kg of seed in treatments T₂, T₄, T₇, and T₉, while in treatments T₃, T₅, T₈, and T₁₀, *Azospirillum* was applied to the soil @ 5 kg ha⁻¹.

RESULTS AND DISCUSSION

Growth Parameters: Among all the treatments tested, plant height at harvest was significantly influenced by the nutrient management practices. The highest plant height (201.6 cm) was recorded with the application of 100% Recommended Dose of Fertilizers (RDF) combined with *Azospirillum* seed treatment @ 10 ml kg⁻¹ seed, which was statistically at par with 75% RDF + Farmyard Manure (FYM) @ 2.5 t ha⁻¹ + *Azospirillum* seed treatment @ 10 ml kg⁻¹ seed.

In contrast, the shortest plants were recorded in FYM alone @ 10 t ha⁻¹, with a plant height of 155.20 cm at harvest. These findings are agreement with the results reported by Togas *et al.* (2017). Similarly, significantly higher dry matter accumulation at maturity (9733 kg ha⁻¹) was also recorded with 100% RDF + *Azospirillum* as seed treatment, which was statistically on par with 75 % RDF + FYM 2.5 t ha⁻¹ + *Azospirillum* as seed treatment 10 ml kg⁻¹ seed (T₉). However, the lowest dry matter accumulation was observed in FYM alone @ 10 t ha⁻¹, which also exhibited the shortest plant

stature. These findings are consistent with the observations reported by Nalini *et al.* (2020).

Table 1: Plant height and drymatter accumulation of pearl millet as affected by inorganic, organic and bio-fertilizer sources

Treatments	Plant height (cm)	Drymatter accumulation (kg ha ⁻¹)
T ₁ : 100% RDF	169.8	8296
T ₂ : 100% RDF + <i>Azospirillum</i> as seed treatment 10 ml kg ⁻¹ seed	201.6	9733
T ₃ : 100% RDF+ <i>Azospirillum</i> as soil application @ 5 kg ha ⁻¹	178.2	8676
T ₄ : 75% RDF+ <i>Azospirillum</i> as seed treatment 10 ml kg ⁻¹ seed	172.4	8578
T ₅ : 75% RDF+ <i>Azospirillum</i> as soil application @ 5 kg ha ⁻¹	168.9	8270
T ₆ : FYM alone @ 10 t ha ⁻¹	155.2	5096
T ₇ : FYM alone @ 10 t ha ⁻¹ + <i>Azospirillum</i> as seed treatment 10 ml kg ⁻¹ seed	165.3	6800
T ₈ : FYM alone @ 10 t ha ⁻¹ + <i>Azospirillum</i> as soil application @ 5 kg ha ⁻¹	162.4	6030
T ₉ : 75% RDF + FYM 2.5 t ha ⁻¹ + <i>Azospirillum</i> as seed treatment 10 ml kg ⁻¹ seed	197.9	9636
T ₁₀ : 75% RDF+ FYM 2.5 t ha ⁻¹ + <i>Azospirillum</i> as soil application @ 5 kg ha ⁻¹	175.3	8611
S.Em (±)	7.47	349.5
CD (P = 0.05)	22.2	1039
CV (%)	7.4	7.6

YIELD ATTRIBUTES

The grain yield and stover yield of pearl millet were significantly influenced by different treatments applied. Among all the treatments observed, significantly highest grain yield (2707 kg ha⁻¹) and stover yield (6127 kg ha⁻¹) was observed with the application of 100% RDF + *Azospirillum* as seed treatment and it was closely followed by treatment which received 75% RDF + FYM 2.5 t ha⁻¹ + *Azospirillum* as seed treatment and both treatments were at par with each other. The lowest grain (1170 kg ha⁻¹) and stover yield (3537 kg ha⁻¹) were recorded with the application of FYM alone @ 10 t ha⁻¹. The magnitude of increase with T₂ treatment was

Table 2: Grain yield, stover yield and harvest index of pearl millet as affected by inorganic, organic and bio-fertilizer sources

Treatments	Grain yield (kg ha ⁻¹)	Stover yield (kg ha ⁻¹)	Harvest index (%)
T ₁ : 100% RDF	2130	4973	30.06
T ₂ : 100% RDF + <i>Azospirillum</i> as seed treatment 10 ml kg ⁻¹ seed	2707	6127	30.73
T ₃ : 100% RDF+ <i>Azospirillum</i> as soil application @ 5 kg ha ⁻¹	2313	5300	30.38
T ₄ : 75% RDF+ <i>Azospirillum</i> as seed treatment 10 ml kg ⁻¹ seed	2190	5050	30.29
T ₅ : 75% RDF+ <i>Azospirillum</i> as soil application @ 5 kg ha ⁻¹	2040	4980	29.06
T ₆ : FYM alone @ 10 t ha ⁻¹	1170	3537	24.76
T ₇ : FYM alone @ 10 t ha ⁻¹ + <i>Azospirillum</i> as seed treatment 10 ml kg ⁻¹ seed	1670	4217	28.48
T ₈ : FYM alone @ 10 t ha ⁻¹ + <i>Azospirillum</i> as soil application @ 5 kg ha ⁻¹	1460	4007	26.72
T ₉ : 75% RDF + FYM 2.5 t ha ⁻¹ + <i>Azospirillum</i> as seed treatment 10 ml kg ⁻¹ seed	2553	5820	30.53
T ₁₀ : 75% RDF+ FYM 2.5 t ha ⁻¹ + <i>Azospirillum</i> as soil application @ 5 kg ha ⁻¹	2240	5143	30.35
S.Em (±)	97.1	231.6	1.514
CD (P = 0.05)	288	688	NS
CV (%)	8.2	8.1	9

31.33 and 73.23 per cent respectively, over T₆. This may be due to better nutrient availability and enhanced nitrogen fixation by *Azospirillum*, which supports plant growth and biomass production. Harvest index was not significantly differed by different treatments. These results are in accordance with Singh (2020) and Bhargavi *et al.* (2021).

CONCLUSION

Based on the findings, it can be concluded that nutrient management treatments significantly enhanced the growth and yield performance of pearl millet. Among the treatments, 100% RDF +

Azospirillum as seed treatment recorded the highest plant height, dry matter accumulation, grain yield, and stover yield, outperforming all other treatments. This highlights the effectiveness of integrating recommended chemical fertilizers with bio-fertilizers in improving crop productivity under field conditions.

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