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Influence of groundnut based millet intercropping system on growth, yield and yield attributes of groundnut

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Abstract

A field experiment was conducted during *kharif* 2024 at S.V. Agricultural College, Tirupati, to evaluate the effect of groundnut based millets intercropping systems on the growth and yield of groundnut. Ten treatments, including sole and intercropping systems with foxtail, finger, and little millets in 5:2 and 5:4 row ratios, were assessed using a randomized block design. Growth parameters such as plant height (52.0 cm), leaf area index (6.5) and dry matter (4638 kg ha⁻¹) were significantly higher in the sole crop of groundnut. Results of the experiment indicated that higher groundnut pod and haulm yield was recorded in the sole crop of groundnut (2295 kg ha⁻¹ and 3016 kg ha⁻¹, respectively). Among the intercropping treatments, significantly higher pod and haulm yield (1976 kg ha⁻¹ and 2689 kg ha⁻¹, respectively), total number of pods plant⁻¹ (22.1), number of filled pods plant⁻¹ (16.3), 100-pod weight (110g), kernel weight (69g) were recorded in groundnut + finger millet in the row proportion of 5:2. Intercropping with millets at a 5:2 ratio showed better compatibility and resource utilization. The study concluded that groundnut + finger millet (5:2) is the most effective system for maximizing yield under loamy sand soils in the Southern Agro-Climatic Zone of Andhra Pradesh.

Keywords: Groundnut, millets, intercropping, row proportion, yield optimisation

Introduction

Groundnut (*Arachis hypogaea* L.) is a major oilseed crop originally native to South America. Commonly referred to as the King of Oilseeds, Poor Man's Almond and Wonder Nut, it holds significant global importance. It ranks 13th among food crops and 6th among oilseed crops worldwide and is widely cultivated across the globe due to its versatility and high demand. India leads the world in groundnut cultivation area, covering approximately 47.07 lakh hectares. It is also the second largest producer globally, with an annual production of 101.8 lakh tonnes and a productivity of 2,163 kg ha⁻¹ (www.indiastat.com, 2023-24) ^[11]. In Andhra Pradesh, groundnut is cultivated on about 3.11 lakh hectares, yielding around 3.2 lakh tonnes annually, with a productivity of 660 kg ha⁻¹ (www.indiastat.com, 2023-24) ^[11]. Millets are robust and climate resilient crops that can grow under a wide range of challenging agro-climatic conditions. They play a crucial role in food security and are especially important for communities that rely on livestock for their livelihood. Intercropping is recognized as an effective strategy to adapt to unpredictable climatic variations. The effectiveness of intercropping is influenced by various factors such as seed ratios, planting arrangements, choice of crop varieties and the degree of competition between the component crops (Carr *et al.*, 2004) ^[3]. It seeks to maximize overall productivity per unit area by ensuring the efficient and balanced utilization of land, labor, and other agricultural inputs (Willey, 1979) ^[10].

Materials and Methods

A field experiment was conducted at S. V. Agricultural College Dryland farm, Tirupati campus of Acharya N. G. Ranga Agricultural University, during *kharif*, 2024. It is geographically situated at 13.5°N latitude and 79.5°E longitude, with an altitude of 182.9 m above the mean sea level (MSL) in the Southern Agro-Climatic Zone of Andhra Pradesh. The soil of the experimental site is loamy sand with soil pH (6.72), organic carbon (0.28%), available nitrogen

(183 kg ha⁻¹), available phosphorus (28 kg ha⁻¹) and available potassium (187 kg ha⁻¹). The experiment was laid out in randomized block design and each treatment replicated thrice. The crop received rainfall of 590.8 mm in 30 rainy days from sowing to harvest. The mean maximum and minimum temperature were 34.1°C and 22.5°C, respectively during the crop growth period. The treatments included in the experiment were T₁: Sole crop of groundnut, T₂: Sole crop of foxtail millet, T₃: Sole crop of finger millet, T₄: Sole crop of little millet, T₅: Groundnut + littlemillet (5:2), T₆: Groundnut + foxtail millet (5:2), T₇: Groundnut + finger millet (5:2), T₈: Groundnut + little millet (5:4), T₉: Groundnut + foxtail millet (5:4), T₁₀: Groundnut + finger millet (5:4). The varieties tested in this experiment were groundnut (Dharani), foxtail millet (SiA-3159), finger millet (Vakula) and little millet (BL-6) in 5:2 and 5:4 row proportion. Groundnut were sown at 30 cm × 10 cm and millets were sown at 22.5 cm × 10 cm. Each crop was provided with its recommended dose of fertilizers according to the area it occupied, and appropriate plant protection measures were implemented as required.

Five plants were selected at random from each net plot area and labeled with tags for recording growth and yield parameters at 25, 50, 75, 90 DAS and at harvest. As intercrop taken 90 days to harvest all the observations were recorded at 25, 50, 75 DAS and at harvest. For recording leaf area index and dry matter production, destructive sampling was done by taking five successive plants each time in the second row of borders rows leaving the adjacent rows intact, thus avoiding the border effect.

Results and Discussion

Effect of different intercropping systems on growth attributes of groundnut

Several growth parameters of groundnut such as plant height, leaf area index and dry matter production varied significantly in different sole and intercropping systems. Data presented in Table 1 revealed that, significantly higher plant height (52.0 cm), leaf area index (6.50) and dry matter production (4638 kg

ha⁻¹) was recorded in sole crop of groundnut (T₁) followed by groundnut + finger millet (5:2) (T₇) which was on par with groundnut + foxtail millet 5:2 ratio (T₆) and groundnut + little millet 5:2 ratio (T₅) while the lowest values were noticed in groundnut + little millet (5:4) (T₈). This might be due to the efficient utilization and balanced distribution of resources such as light, water, and nutrients between the groundnut rows, along with reduced competition for these resources. These results were in conformity with findings of Maitra *et al.* (2000) ^[5], Ansari *et al.* (2012) ^[1], Manjunath and Salakinkop (2017) ^[6] and Lenka *et al.* (2023) ^[4].

Effect of different intercropping systems on yield and yield attributes of groundnut

Among the various treatments evaluated, yield attributing characters including total number of pods per plant, number of filled pods per plant, 100-pod weight, kernel weight and shelling percentage were assessed. The sole crop of groundnut (T₁) recorded the highest total number of pods plant⁻¹ (24.1) and number of filled pods plant⁻¹ (18.0), followed by groundnut + finger millet (5:2) (T₇), while the lowest values were observed in groundnut + little millet (5:4) (T₈). Similarly, the sole crop of groundnut (T₁) exhibited the highest 100-pod weight (115g) and kernel weight (70.7g), with the lowest values recorded in groundnut + little millet (5:4) (T₈). No significant differences were observed in shelling percentage across the treatments (Table 2).

Significantly higher groundnut pod yield (2295 kg ha⁻¹) and haulm yield (3016 kg ha⁻¹) were recorded in sole groundnut followed by groundnut + finger millet (5:2) (T₇) which was on par with groundnut + foxtail millet 5:2 ratio (T₆) and groundnut + little millet 5:2 ratio (T₅) while the lowest values were noticed in groundnut + little millet (5:4) (T₈). Similar results were found by Reddy and Willey (1981) ^[7], Sampath Kumar (1992) ^[8], Singh and Arya (1995) ^[9], Berhanu *et al.* (2016) ^[2] and Lenka *et al.* (2023) ^[4].

Table 1: Growth parameters of groundnut as influenced by groundnut based millets intercropping system

Treatment	Plant height (cm)	Leaf area index	Dry matter production (kg ha ⁻¹)
T ₁ : Sole crop of groundnut	52.0	6.50	4638
T ₂ : Sole crop of foxtail millet	-	-	-
T ₃ : Sole crop of finger millet	-	-	-
T ₄ : Sole crop of little millet	-	-	-
T ₅ : Groundnut + little millet (5:2)	45.2	5.71	3870
T ₆ : Groundnut + foxtail millet (5:2)	46.0	5.83	4003
T ₇ : Groundnut + finger millet (5:2)	46.5	5.92	4149
T ₈ : Groundnut + little millet (5:4)	33.0	4.53	2710
T ₉ : Groundnut + foxtail millet (5:4)	39.5	5.11	3278
T ₁₀ : Groundnut + finger millet (5:4)	40.0	5.17	3412
SEm ±	1.49	0.16	140.7
CD (P=0.05)	4.6	0.5	433

Table 2: Yield and yield attributes of groundnut as influenced by groundnut based millets intercropping system

Treatment	Total no of pods plant ⁻¹	No of filled pods plant ⁻¹	100-Pod weight (g)	Kernel weight (g)	Shelling percentage	Pod yield (kg ha ⁻¹)	Haulm yield (kg ha ⁻¹)
T ₁ : Sole crop of groundnut	24.1	18.0	115	70.7	64	2295	3016
T ₂ : Sole crop of foxtail millet	-	-	-	-	-	-	-
T ₃ : Sole crop of finger millet	-	-	-	-	-	-	-
T ₄ : Sole crop of little millet	-	-	-	-	-	-	-
T ₅ : Groundnut + little millet (5:2)	19.7	14.2	105	66.0	63	1819	2376
T ₆ : Groundnut + foxtail millet (5:2)	20.8	15.4	109	68.0	63	1927	2510
T ₇ : Groundnut + finger millet (5:2)	22.1	16.3	110	69.0	63	1976	2689
T ₈ : Groundnut + little millet (5:4)	13.0	10.4	93	55.0	59	1061	1405
T ₉ : Groundnut + foxtail millet (5:4)	16.4	12.1	103	63.0	61	1370	1879
T ₁₀ : Groundnut + finger millet (5:4)	17.7	12.6	105	64.0	61	1480	2018

SEm ±	0.60	0.43	2.9	2.03	2.0	97.4	102.4
CD (P=0.05)	4.6	0.5	9.0	6.2	NS	300	316

Conclusion

The present study revealed that intercropping of groundnut + finger millet at 5:2 row ratio is the best combination for getting higher yield followed by groundnut + foxtail millet under same row ratio during *kharif* season on loamy sand soils of the Southern Agro-Climatic Zone of Andhra Pradesh.

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