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PRODUCTIVITY AND PROFITABILITY OF IMPROVED GROUNDNUT VARIETY KADIRI LEPAKSHI (K-1812) UNDER RAINFED ALFISOLS OF ANDHRA PRADESH INDIA

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ABSTRACT

Groundnut (*Arachis hypogaea* L.) is an important oilseed crop predominantly cultivated under rainfed conditions in the semi-arid regions of India, where productivity is often constrained by erratic rainfall, recurrent drought, and continued cultivation of older low-yielding varieties. Front Line Demonstrations (FLDs) play an important role in assessing the performance of newly released varieties under farmers' field conditions and accelerating their adoption. The present study evaluated the performance of the improved groundnut variety Kadiri Lepakshi (K-1812) against the farmer-preferred variety Kadiri-6 under rainfed Alfisols of YSR district, Andhra Pradesh, during three consecutive *kharif* seasons (2020–2022). Fifteen FLDs were conducted to assess growth, yield attributes, pod yield, haulm yield and economic returns. Kadiri Lepakshi produced significantly higher pods per plant, pod yield, haulm yield and profitability than Kadiri-6. The improved variety recorded an average pod yield of 1934 kg ha⁻¹, representing a 46.2% increase over the local check. Although Kadiri-6 exhibited slightly higher 100-pod and 100-kernel weights, Kadiri Lepakshi compensated through superior reproductive efficiency and greater pod production. Gross returns, net returns and benefit-cost ratio were consistently higher in the improved variety throughout the study period. The results demonstrate that Kadiri Lepakshi is a drought-resilient, high-yielding and economically viable variety suitable for large-scale cultivation under rainfed Alfisols of Rayalaseema and similar agro-ecological regions.

Keywords : Groundnut, Kadiri Lepakshi, Front Line Demonstration, Rainfed agriculture, Alfisols.

Introduction

Groundnut (*Arachis hypogaea* L.) is one of the world's major oilseed crops and contributes significantly to food, nutrition and livelihood security in tropical and subtropical regions. The kernels contain about 45–50% oil and 25–30% protein, making the crop an important source of edible oil and dietary protein. Besides oil extraction, groundnut is extensively utilized in confectionery, bakery products, value-added foods and livestock feed. Being a leguminous crop, it also improves soil fertility through biological nitrogen fixation and contributes to sustainable cropping systems (FAOSTAT, 2024).

India is among the leading producers of groundnut, cultivating the crop on more than five million hectares. However, average productivity remains considerably lower than the attainable yield because nearly 70% of the cultivated area depends on rainfall. Yield instability is mainly attributed to erratic rainfall distribution, terminal drought, poor soil fertility, high temperature stress, insect pests and diseases, and continued cultivation of obsolete varieties (Directorate of Groundnut Research, 2023; Reddy *et al.*, 2022).

Andhra Pradesh is an important groundnut-growing state, particularly the Rayalaseema region, where the crop is predominantly cultivated on rainfed

Alfisols. These soils are characterized by low organic carbon, poor nutrient reserves and limited water-holding capacity, making the crop highly vulnerable to intermittent moisture stress during flowering and pod development. Consequently, productivity is often reduced, especially when older cultivars with poor drought tolerance are grown (ICAR-Indian Institute of Groundnut Research, 2023).

Development and adoption of improved cultivars is one of the most economical and sustainable approaches to enhance crop productivity under rainfed agriculture. Modern groundnut breeding programmes emphasize high yield potential, drought tolerance, resistance to major pests and diseases, improved oil quality and yield stability under moisture-deficit conditions (Bera *et al.*, 2023). Among the recently released varieties, Kadiri Lepakshi (K-1812), developed at the Agricultural Research Station, Kadiri, possesses several desirable characteristics including drought tolerance, tolerance to major foliar diseases, approximately 51% oil content, about 28% protein content and stable performance under rainfed conditions.

Despite the availability of improved cultivars, their adoption by farmers is often slow because research station performance does not always reflect field conditions. Front Line Demonstrations (FLDs), conducted under the close supervision of scientists using recommended production technologies, provide an effective platform to evaluate new varieties under farmers' conditions while facilitating rapid technology dissemination. Several studies have demonstrated that FLDs significantly improve farmers' awareness, varietal adoption, productivity and profitability in groundnut cultivation (Meena *et al.*, 2022; Singh *et al.*, 2023).

Considering the importance of location-specific evaluation, the present study was undertaken to assess the agronomic performance and economic feasibility of the improved groundnut variety Kadiri Lepakshi (K-1812) in comparison with the farmer-preferred variety Kadiri-6 under rainfed Alfisols of YSR district, Andhra Pradesh, through Front Line Demonstrations conducted during three consecutive *kharif* seasons (2020–2022).

Materials and Methods

The study was conducted through Front Line Demonstrations (FLDs) during the *kharif* seasons of 2020, 2021 and 2022 in rainfed Alfisols of YSR district, Andhra Pradesh. The demonstrations were organized by the District Agricultural Advisory and Transfer of Technology Centre (DAATTC), Kadapa, to evaluate the field performance of the improved

groundnut variety Kadiri Lepakshi (K-1812) under farmers' conditions.

A preliminary survey was conducted in selected villages to identify the major production constraints in groundnut cultivation. The major constraints observed were cultivation of older low-yielding varieties, drought susceptibility, biotic stress and limited awareness regarding recently released improved cultivars. Based on the survey, farmer awareness programmes and training programmes were organized before initiating the demonstrations.

Five farmers were selected each year, resulting in fifteen demonstrations over three consecutive years. Demonstration plots were established with Kadiri Lepakshi (K-1812), while adjacent fields planted with Kadiri-6 served as the farmer's practice (local check). All recommended agronomic practices, including seed rate, sowing time, nutrient management, weed control and plant protection measures, were followed uniformly in both treatments, with varietal difference being the only treatment variable.

Kadiri Lepakshi is a Spanish bunch groundnut variety with a crop duration of approximately 110–115 days. The variety possesses tolerance to drought and major foliar diseases and contains approximately 51% oil and 28% protein, making it suitable for cultivation under rainfed ecosystems.

Observations were recorded from randomly selected representative plants in each plot. Growth and yield parameters included plant height (cm), number of pods plant⁻¹, 100-pod weight (g), 100-kernel weight (g), pod yield (kg ha⁻¹) and haulm yield (kg ha⁻¹). Economic analysis was performed by estimating gross returns, net returns and benefit-cost ratio using prevailing market prices. Data were statistically analysed using Student's *t*-test, and differences were considered significant at the 5% probability level ($P \leq 0.05$).

Results and Discussion

Plant height

Plant height is an important indicator of vegetative growth and adaptability of a variety under prevailing environmental conditions. During the three years of evaluation, Kadiri-6 consistently recorded greater plant height (35.8–37.1 cm) than Kadiri Lepakshi (28.6–30.3 cm); however, the differences were statistically non-significant ($P=0.24$) (Table 1). The comparatively shorter stature of Kadiri Lepakshi did not adversely affect productivity, indicating that plant height alone is not a reliable indicator of yield potential in groundnut.

The compact growth habit of Kadiri Lepakshi may have favored efficient assimilate partitioning towards reproductive organs rather than excessive vegetative growth. Similar observations were reported by Bera *et al.* (2023), who concluded that compact Spanish bunch varieties often exhibit superior partitioning efficiency and greater yield stability under rainfed conditions. Likewise, Reddy *et al.* (2022) reported that drought-tolerant cultivars maintain optimum canopy architecture, resulting in improved reproductive efficiency rather than increased plant height.

Number of pods per plant

Number of pods per plant is one of the most important yield-contributing characters in groundnut. Kadiri Lepakshi produced significantly higher numbers of pods per plant (21.7, 20.4 and 24.6 during 2020, 2021 and 2022, respectively) compared with Kadiri-6 (12.8, 11.4 and 12.8 pods plant⁻¹), with the differences being statistically significant ($P=0.03$) (Table 1).

The superior pod production of Kadiri Lepakshi may be attributed to its higher genetic yield potential, improved flowering behaviour, efficient peg penetration and greater tolerance to intermittent moisture stress during reproductive growth. Drought-tolerant cultivars generally maintain higher flower retention and pod set under moisture-deficit conditions, thereby producing more mature pods. Similar findings were reported by Singh *et al.* (2023) and Meena *et al.* (2022), who observed that improved groundnut cultivars evaluated through Front Line Demonstrations consistently recorded higher pod numbers and greater reproductive efficiency than farmers' varieties.

100-pod weight

Kadiri-6 recorded significantly higher 100-pod weight (93.8–96.2 g) than Kadiri Lepakshi (85.2–87.7 g), and the varietal difference was significant ($P=0.02$). This indicates that Kadiri-6 possesses comparatively larger pods, a characteristic largely governed by genotype.

However, lower pod weight in Kadiri Lepakshi did not limit productivity because the variety compensated through substantially higher pod numbers per plant. Similar observations have been reported by ICAR-IIGR (2023), which emphasized that total pod yield in drought-prone environments depends more on pod number than on individual pod size.

100-kernel weight

Kernel weight followed a trend similar to pod weight. Kadiri-6 produced slightly heavier kernels (38.4–40.1 g) than Kadiri Lepakshi (35.8–38.3 g);

however, the differences were statistically non-significant ($P=0.11$).

Kernel size is a genetically controlled character and usually exhibits less environmental variation than pod yield. Therefore, despite slightly smaller kernels, Kadiri Lepakshi maintained significantly greater overall productivity because of its superior pod-bearing capacity. Comparable results were reported by Bera *et al.* (2023) in recently released Spanish bunch varieties.

Pod Yield

Pod yield is the cumulative outcome of various growth and yield-contributing characters. Kadiri Lepakshi consistently outperformed Kadiri-6 during all three years of Front Line Demonstrations. The improved variety recorded pod yields of 1914, 1756 and 2133 kg ha⁻¹ during 2020, 2021 and 2022, respectively, compared with 1303, 1267 and 1398 kg ha⁻¹ obtained from the farmer's variety. Statistical analysis indicated that the differences were significant ($P=0.02$).

Overall, Kadiri Lepakshi recorded a mean pod yield of 1934 kg ha⁻¹, representing a 46.2% yield advantage over Kadiri-6 (Table 2). The higher yield was primarily due to greater pod production per plant and better adaptation to moisture-deficit conditions. Although individual pod and kernel weights were comparatively lower, increased reproductive efficiency substantially enhanced economic yield.

The superior performance of Kadiri Lepakshi under rainfed conditions agrees with findings of Reddy *et al.* (2022) and Singh *et al.* (2023), who reported that improved drought-tolerant groundnut cultivars consistently produced higher yields under farmers' field conditions. Similar improvements in pod yield through FLDs have also been documented by Meena *et al.* (2022), highlighting the effectiveness of improved varieties in reducing the technology gap and enhancing productivity.

Haulm Yield

Haulm is an important by-product of groundnut cultivation, particularly in mixed crop–livestock production systems where it serves as valuable livestock fodder. Kadiri Lepakshi produced significantly higher haulm yield (2659–3015 kg ha⁻¹) than Kadiri-6 (2084–2287 kg ha⁻¹), and the varietal differences were significant ($P=0.04$).

The improved haulm production may be attributed to better biomass accumulation and greater physiological efficiency under rainfed conditions. Despite being shorter in stature, Kadiri Lepakshi accumulated higher dry matter, indicating that biomass

production depends more on efficient canopy development and photosynthetic activity than on plant height alone.

Higher haulm yield provides an additional economic advantage to farmers by improving fodder availability for livestock, particularly in the drought-

prone Rayalaseema region. Similar observations were reported by ICAR-IIGR (2023) and Bera *et al.* (2023), who emphasized that recently released drought-tolerant varieties produce greater vegetative biomass while maintaining high pod productivity.

Table 1 : Performance of Kadiri Lepakshi and Kadiri-6 for growth, yield attributes and yield under Front Line Demonstrations conducted during *kharif* 2020–2022 in YSR district, Andhra Pradesh

Year	Variety	Plant height (cm)	Pods plant ⁻¹	100-pod weight (g)	100-kernel weight (g)	Pod yield (kg ha ⁻¹)
2020	Kadiri Lepakshi	28.6	21.7	86.3	36.2	1914
	Kadiri-6	35.8	12.8	94.6	38.8	1303
2021	Kadiri Lepakshi	30.3	20.4	85.2	35.8	1756
	Kadiri-6	37.1	11.4	93.8	38.4	1267
2022	Kadiri Lepakshi	29.8	24.6	87.7	38.3	2133
	Kadiri-6	36.7	12.8	96.2	40.1	1398
P-value		0.24 (NS)	0.03*	0.02*	0.11 (NS)	0.02*

Overall Performance of Kadiri Lepakshi

The present Front Line Demonstrations clearly established the superiority of Kadiri Lepakshi over the farmer-preferred variety Kadiri-6 under rainfed Alfisols of YSR district. Although Kadiri-6 exhibited taller plants with slightly heavier pods and kernels, these traits did not translate into higher yield. In contrast, Kadiri Lepakshi consistently produced significantly more pods per plant, resulting in higher pod and haulm yields across all three cropping seasons.

The superior performance of Kadiri Lepakshi can be attributed to its drought tolerance, greater reproductive efficiency and better adaptation to moisture-limited environments. Stable performance over three consecutive seasons demonstrates its suitability for rainfed production systems where rainfall variability frequently limits crop productivity.

The demonstrations also highlighted the importance of FLDs in promoting varietal replacement. Farmers observed clear advantages of Kadiri Lepakshi in terms of drought tolerance, crop stand, yield and profitability, thereby increasing confidence in the adoption of improved technologies. These findings are in agreement with recent studies showing that FLDs play a significant role in accelerating technology dissemination and improving farmers' income through enhanced productivity (Meena *et al.*, 2022; Singh *et al.*, 2023).

Table 2 : Mean performance of Kadiri Lepakshi over Kadiri-6 during three years (2020–2022)

Character	Kadiri Lepakshi	Kadiri-6	Improvement over Kadiri-6 (%)
Plant height (cm)	29.6	36.5	–18.9
Pods plant ⁻¹	22.2	12.3	80.5
100-pod weight (g)	86.4	94.9	–8.9
100-kernel weight (g)	36.8	39.1	–5.9
Pod yield (kg ha ⁻¹)	1934	1323	46.2
Haulm yield (kg ha ⁻¹)	2839	2178	30.4
Gross returns (Rs. ha ⁻¹)	102,646	78,587	30.6
Net returns (Rs. ha ⁻¹)	49,646	21,587	130.0
Benefit:Cost ratio	1.94	1.38	40.6

Economic Analysis

Economic evaluation revealed a distinct advantage of Kadiri Lepakshi over the farmer-preferred variety during all three years of Front Line Demonstrations (Table 3). The improved variety recorded gross returns of Rs. 1,01,386, Rs. 89,606 and Rs. 1,16,946 ha⁻¹ during 2020, 2021 and 2022, respectively, whereas Kadiri-6 registered gross returns of Rs. 75,989, Rs. 71,319 and Rs. 88,454 ha⁻¹.

Similarly, Kadiri Lepakshi produced substantially higher net returns (Rs. 48,386, Rs. 36,606 and Rs. 63,946 ha⁻¹) than Kadiri-6 (Rs. 18,989, Rs. 14,319 and Rs. 31,454 ha⁻¹). The benefit-cost ratio ranged from 1.69 to 2.21 in Kadiri Lepakshi compared with 1.25 to 1.55 in Kadiri-6.

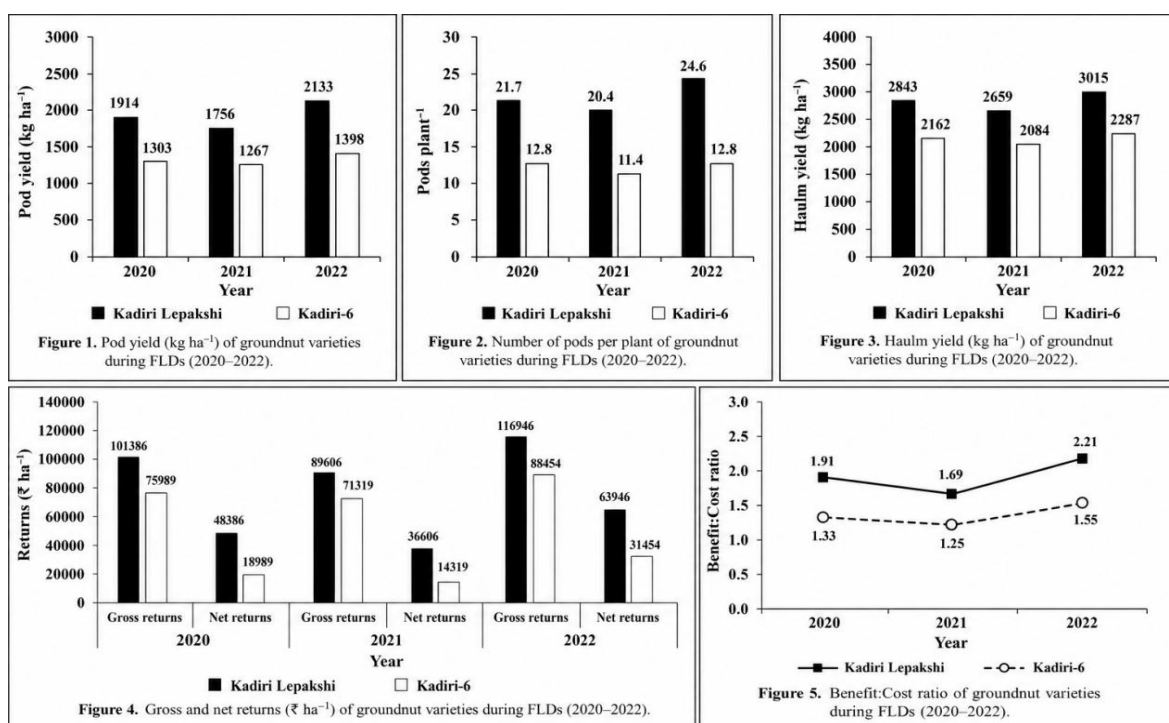
The higher profitability of Kadiri Lepakshi was primarily due to its significantly greater pod yield without any appreciable increase in cultivation cost. Since both varieties were cultivated using identical crop management practices, the increase in yield directly translated into higher gross income, net returns and benefit-cost ratio. These findings clearly indicate that replacement of older cultivars with improved drought-tolerant varieties can substantially improve farm profitability under rainfed production systems.

Similar economic advantages of improved groundnut varieties evaluated through Front Line Demonstrations have been reported by Meena *et al.* (2022), Singh *et al.* (2023) and Bera *et al.* (2023), who

observed significant increases in yield, net returns and technology adoption under farmers' field conditions.

Table 3 : Economic performance of Kadiri Lepakshi and Kadiri-6 under Front Line Demonstrations during *kharif* 2020–2022

Year	Variety	Gross returns (Rs. ha ⁻¹)	Net returns (Rs. ha ⁻¹)	Benefit: Cost ratio
2020	Kadiri Lepakshi	101,386	48,386	1.91
	Kadiri-6	75,989	18,989	1.33
2021	Kadiri Lepakshi	89,606	36,606	1.69
	Kadiri-6	71,319	14,319	1.25
2022	Kadiri Lepakshi	116,946	63,946	2.21
	Kadiri-6	88,454	31,454	1.55



FLDs – Front Line Demonstrations

Fig. 1 : Growth and yield attributes of Kadiri Lepakshi and Kadiri-6 under rainfed Alfisols of YSR district

Conclusion

The present investigation demonstrated that the improved groundnut variety Kadiri Lepakshi (K-1812) performed consistently better than the farmer-preferred variety Kadiri-6 under rainfed Alfisols of YSR district during three consecutive *kharif* seasons. Although Kadiri-6 recorded comparatively greater plant height and slightly heavier pods and kernels, Kadiri Lepakshi produced significantly more pods per plant, resulting in a 46.2% higher mean pod yield, greater haulm production and superior economic returns.

Therefore, Kadiri Lepakshi (K-1812) may be recommended for large-scale cultivation in the rainfed Alfisols of YSR district and other similar agro-

ecological regions of Andhra Pradesh. Wider dissemination through Front Line Demonstrations and extension programmes will contribute to improved groundnut productivity, enhanced farm income and sustainable oilseed production under rainfed farming systems.

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