RESEARCH ARTICLE Legume Research- An International Journal, Volume 49 Issue 9: 1610-1616 (September 2026)

Impact Study on Productivity and Sustainability of Groundnut (*Arachis hypogaea*) Cultivation Through Cluster Frontline Demonstrations (CFLDs) in Northern Agroclimatic Zone of Telangana

Kiran Pilli[1], Y. Venkanna[1], B. Bhaskar Rao[1], T. Vinod Kumar[1], Baireneni Navya[1], B. Naresh[1], T. Suresh Kumar[1], A. Srinivas[1]

10.18805/LR-5613

ABSTRACT

Background: Groundnut is a major oilseed crop supporting farmer livelihoods; however, yields remain suboptimal due to poor adoption of improved technologies. To bridge this gap, cluster front line demonstrations (CFLDs) were conducted during *rabi* 2022-23, 2023-24 and 2024-25 to assess the productivity, profitability and sustainability of integrated crop management (ICM) practices in the northern agroclimatic zone of Telangana.

Methods: A total of 88 demonstrations were laid out on farmers' fields using improved variety K-1812 (Kadiri Lepakshi) with recommended ICM practices, while adjacent plots under farmers' practices served as controls. Data on pod yield, technology gap, extension gap, technology index, benefit-cost ratio, sustainability yield index (SYI), sustainability value index (SVI), adoption level and horizontal spread were recorded and analyzed annually.

Result: Improved practices produced a mean pod yield of 25.75 q ha^{-1}, a 29.58% increase over farmers' practices (19.86 q ha^{-1}). The technology gap (5.89 q ha^{-1}), extension gap (19.25 q ha^{-1}) and technology index (42.78%) indicated further scope for yield improvement. Higher SYI (0.60, 0.64, 0.60) and SVI (1.74, 1.85, 1.99) under ICM compared to farmers' practice confirmed sustainability advantages. CFLDs achieved a superior B:C ratio (3.54) and generated an additional income of ₹ 34,789.95 ha^{-1} over traditional practice (2.72). Adoption of ICM increased substantially (overall 159.51%), with horizontal spread expanding to 282 ha (206.07%) by 2024-25. The findings highlight the strong potential of ICM-based CFLDs for enhancing groundnut productivity, profitability and sustainable technology dissemination under real farm conditions.

Key words: Adoption, Extension and technology gap, Groundnut, Horizontal spread, Integrated crop management, Sustainability yield, Value index.

INTRODUCTION

Groundnuts (*Arachis hypogaea*) are not only an important oilseed crop in India, but they are also a valuable agricultural export. Groundnuts are sometimes referred to as "wonder nuts" or "poor men's cashew nuts" due to their high protein, fat and other healthy nutritional content. Groundnut kernels contain 44-56% oil and 22-30% protein on a dry mass basis. Phosphorus, calcium, magnesium, potassium and the vitamins E, K and B group are among the many minerals found in groundnuts (Ingale and Shrivastava, 2011). Thus, groundnuts are not only a high-quality source of animal feed but also supply seven of the twenty important minerals and approximately half of the thirteen key vitamins needed for human growth and development.

India is the world's largest producer of groundnuts, with 43.75 lakh hectares, yielding 10.13 million tonnes in 2023-2024, with a productivity of 1314 kg ha^{-1} (Groundnut Outlook Report, 2024). In terms of groundnut production, Gujarat leads the states with 46.44 lakh tonnes produced on 16.35 lakh hectares, followed by Rajasthan (20.27 lakh tonnes) on 8.61 lakh hectares, (Groundnut Outlook Report, 2024).

[1]Krishi Vigyan Kendra-Sri Konda Laxman Telangana Horticultural University, Ramagirikhilla, Peddapalli-505 212, Telangana, India.

Corresponding Author: Kiran Pilli, Krishi Vigyan Kendra-Sri Konda Laxman Telangana Horticultural University, Ramagirikhilla, Peddapalli-505 212, Telangana, India. Email: kiranpilli205@gmail.com

ORCID: https://orcid.org/0000-0001-8775-5868

How to cite this article: Pilli, K., Venkanna, Y., Rao, B.B., Kumar, T.V., Navya, B., Naresh, B., Kumar, T.S. and Srinivas, A. (2026). Impact Study on Productivity and Sustainability of Groundnut (*Arachis hypogaea*) Cultivation Through Cluster Frontline Demonstrations (CFLDs) in Northern Agroclimatic Zone of Telangana. *Legume Research.* **49(9):** 1610-1616. doi: 10.18805/LR-5613.

Submitted: 29-11-2025 **Accepted:** 01-04-2026 **Online:** 16-04-2026

One of the most significant crops in Telangana, groundnuts are cultivated on 0.024 lakh hectares and produce 2.25 lakh tons and 3491 kg ha^{-1} of productivity annually. There is an enormous gap between the productivity that farmers can produce and what they actually produce, though, because they only partially adopt the

recommended package of practices. Variations in groundnut production yield are caused by a variety of factors, including irregular rainfall, a lack of high-yielding, disease-tolerant cultivars, the emergence of pests and diseases, low producer prices, poor agronomic practices and a lack of institutional support (Bucheyeki *et al.,* 2008).

In order to promote new agricultural innovations, technologies, crop management techniques like integrated nutrient management (INM) and integrated pest management (IPM), micronutrients, extension, training and a mass media campaign, the National Food Security Mission (NFSM) came up with the concept of cluster front line demonstrations (CFLD). As part of a new initiative under the National Food Security Mission to achieve self-sufficiency in pulse production, the Indian government launched new technology packages in pulse cultivation in partnership with Krishi Vigyan Kendra and the Indian Council of Agricultural Research. This plan recommends the implementation of cluster front line demonstrations (CFLDs) in each Indian state (Gautam *et al.,* 2023 and Pilli *et al.,* 2025). In addition to bridging the gap between farmers and research stations, these CFLDs will help introduce new technologies and verities and spread the technologies through trainings and extension programs (Madhushekar *et al.,* 2022). To increase the acreage and production of groundnuts in the Peddapalli district, Krishi Vigyan Kendra, Ramagirikhilla, carried out a study at farmers' fields deploying CFLD under irrigated conditions from *Rabi* 2021-2022 to *Rabi* 2024-2025.

MATERIALS AND METHODS

Krishi Vigyan Kendra, Ramagirikhilla, conducted cluster front line demonstrations (CFLDs) on groundnuts in multiple clusters in Telangana's Peddapalli district, covering 15 hectares each, between *Rabi* 2022-20223, 2023-24 and 2024*2025. In order to promote improved agricultural practices and increase groundnut production and area in the district, 88 demonstrations covering 40 hectares were conducted. In order to cultivate groundnuts, farmers received training in Integrated Crop Management and the necessary, need-based inputs (Table 1). The technological components and strategies for farmers' operations and demonstrations were shown in Table 1. The scientists conducted routine observations to make sure the technology was being used effectively and to get farmers' systematic input on the technology. Field days, mass media outreach, community mobilisation and cooperation with state agriculture department officials were all implemented to boost the adoption of the new technology showcased.

Significant disparities in performance were found when the harvest yields from the demonstration plots and farmer practices were meticulously recorded and compared. The data analysis, which also included cultivation costs, gross and net returns and benefit-cost

Table 1: Details of demonstration and farmers practice under CFLD in groundnut.

Particulars	Recommended practices	Farmer practice
Year	2022-23 to 2024-25	2022-23 to 2024-25
Total no. of demos conducted	88	88
Technology demonstrated	Integrated crop management	-
Need based input	Seed, rhizobium for seed treatment, herbicides, need based pesticides, trainings and group meetings	-
Variety	K-1812	K-6
Seed treatment	Rhizobium 10 ml kg^{-1} of seeds	No seed treatment done
Seed rate	75 kg/ha	120 kg/ha
Method of sowing	Line Sowing	Broadcasting
Fertilizer dose	Balanced fertilization: N:P:K @ 20:40:40 kg/ha. Application of gypsum @ 400 kg/ha followed by earthing up for better penetration and development of pegs.	Imbalance use of fertilizers and no application of gypsum and earthing up was done.
Weed management	Pre-emergence herbicides pendimethalin @ 1.2 lit per acre and post emergence herbicide Imazethapyr @ 750 ml acre at 20 days after sowing (DAS)	Manual weeding
Plant protection	Installation of pheromone traps, sticky traps and need based plant protection measures were taken like spraying of Neem oil @ 5 ml/lit and thiomethoxam 25% WG @ 0.2 g/litre of water for management of sucking pests. Drenching with metalaxyl-M 8% + mancozeb 64% WP @ 2 g/litre of water for management of collar rot.	Indiscriminate use of chemicals.

ratios, illustrated the positive impacts of advanced groundnut technology. The technological index, yield gap, technology gap and extension gap were computed using the following formulas (Pilli *et al.,* 2025).

Extension gap (q/ha.) =

Demonstration yield - Farmers practice yield

Technology gap (q/ha) = Potential yield - Demo yield

Additional yield increase (q/ha.) =

Demonstration yield - Farmers practice (or) state (or) national yield

Yield increase (%) =

$$\frac{\text{Yield under demonstration} - \text{Yield under farmers' practice}}{\text{Yield under farmers' practice}} \times 100$$

Whereas, the sustainability yield indices and sustainability value indices were calculated using the following formulas to determine the SYI and SVI. (Sustainability: The New Paradigm, 2017).

Sustainability yield index (SVI) =

$$\frac{\text{Average yield obtained for specific management practices - Standard deviatoin of yields}}{\text{Maximum yield observed with the specific management practices}}$$

Sustainability value index (SVI) =

$$\frac{\text{Average net returns for specific management practices}}{\text{Standard deviation of net profits}} \times 1.96$$

RESULTS AND DISCUSSION

Yield (q/ha)

According to data from cluster front line demonstrations (Table 2), improved groundnut cultivation technologies and varieties produce an average grain yield of 24.20, 26.55 and 26.50 q/ha, as compared to 19.06, 20.11 and 20.42 q/ha observed in farmer practices, with an average yield increases of 26.98, 31.99 and 29.77 per cent in 2022, 2023 and 2024, respectively. The average yield for the three years of groundnut production was 25.75 quintals per hectare which is 29.58 per cent higher as compared to farmers' practice (19.86 q/ha). Farmers were highly inspired by the new technology that was demonstrated through CFLD programs, which reflected by the clusters to increase the cropping area in the district. The quality seed, weed control methods, better packaging and practices and effective pest and disease management were the primary factors contributing to the higher grain production with improved technologies. The findings are consistent with those of Natarajan *et al.* (2024), who also found that CFLD groundnut demos produced an average yield of 40.48 q/ha, which was 53.34% more than farmers' traditional practice of 6.45 q/ha. These results are also consistent with those of Pilli *et al.* (2025) in green gram and Arunkumar *et al.* (2023) in groundnut under the cluster front line demonstrations program.

Table 2: Yield, extension gap, technology gap (q/ha), technological index (%) and per cent increase (%) in yield over farmers practice, state yield and national yield of groundnut as influenced by CFLD in Peddapalli district.

Year	Potential yield (q/ha)	Demo yield (q/ha)	FP yield (q/ha)	% increase in yield	Extension gap (q/ha)	Technology gap (q/ha)	Technology index (%)
2022-23	45.00	24.20±1.07	19.06±0.85	26.98	5.14	20.80	46.22
2023-24	45.00	26.55±0.91	20.11±0.83	31.99	6.43	18.45	41.01
2024-25	45.00	26.50±0.88	20.42±0.70	29.77	6.08	18.50	41.11
Average	45.00	25.75	19.86	29.58	5.89	19.25	42.78

*OFT- On farm trials, FLD- Front line demonstration, Demo- Demonstration conducted, FP- Farmers practice, q- Quintal, ha- Hectare.

Table 3: Cost of cultivation, gross return, net return and benefit cost ratio of groundnut under CFLD compared to farmers practice in Peddapalli district.

Year	Demo			FP			Net returns (Rs./ha) increase over FP	% increase of net returns over FP	B:C ration	
	Gross cost (Rs./ha)	Gross return (Rs./ha)	Net return (Rs./ha)	Gross cost (Rs./ha)	Gross return (Rs./ha)	Net return (Rs./ha)			Demo	FP
2022-23	43155.00±241.86	117370.00±5179.75	74215.00±5131.03	42007.78 ±424.95	92432.92±4116.26	50425.14±3715.00	47.18	23789.86	2.72±0.12	2.19±0.08
2023-24	44009.71±215.86	159282.86±5460.40	115273.14±5382.05	42695.71±245.82	120680.57±5001.60	77984.86±4802.40	47.81	37288.29	3.61±0.12	2.81±0.10
2024-25	41380.86±261.20	177530.86±5901.18	136150.00±5903.26	43955.71±910.85	136814.00 ±4708.81	92858.29±4525.67	46.62	43291.71	4.30±0.15	3.16±0.13
Average	42848.52	151394.57	108546.05	42886.40	116642.50	73756.09	47.20	34789.95	3.54	2.72

*OFT- On farm trials, FLD- Front line demonstration, Demo- Demonstration conducted, FP- Farmers practice, Rs.- Rupees, ha- Hectare.

Extension gap (q/ha), technology gap (q/ha) and technology index (%)

The enhanced dissemination process of recommended techniques, which result in higher grain yields than the farmer's practice, should be credited with the acceptance of the extension gap. The disparity between available agricultural technologies and farmers' actual adoption of them is known as the "technology gap". A number of things, such as inadequate access to technology, financial constraints, a lack of knowledge and social or cultural reasons, might contribute to this disparity. This can significantly impact food security, farm profitability and production. The viability of various varieties and other yield-maximizing technologies in farmers' fields is indicated by the technology index. The lower the technology index value of something, the more practicable it is. The technological gap is the basis for the technology index, which is expressed as a percentage (%). The greater value of the technology index indicates that farmers are adopting upgraded technologies at a lesser rate. According to Table 2, the cumulative average yields of groundnut demonstrations through CFLD showed a technology gap of 20.80, 18.45 and 18.50 q/ha and a technology index of 46.22%, 41.01 and 41.11% in 2022, 2023 and 2024, respectively, with an average of 19.25 q/ha technology gap and 42.78% technology index. The acceptance of the extension gap can be attributed to the enhanced dissemination process of recommended techniques, which results in a higher grain yield than the farmers practices. The lower technology index was brought about by the KVK Scientists' interventions and the farmers' adoption of groundnut techniques that maximized production. Favourable weather and a low incidence of pests and diseases, along with prompt and necessity-based advice from KVK scientists and extension personnel, all contributed to the lower technology index. Natarajan *et al.* (2024) observed similar results, showing that CFLD interventions reduced the technology gap and technology index. This implies that improved agronomic technology methods have a greater chance of increasing groundnut productivity through CFLD.

Economic analysis

Economic returns varied annually due to variations in grain yield and minimum support price (MSP) set by the Government of India. The CFLD demonstrations yielded the highest benefit cost ratio, maximum gross returns and net returns in the demonstration plots compared to the farmer's practices, as shown in the data in Table 3. Demonstration fields recorded the mean of gross returns of Rs. 1,51,394.57 and net returns of Rs. 1,08,546.05 with a gross cost of Rs. 42,848.52. Whereas, farmers practice recorded gross returns Rs. 1,16,642.50 and net returns of Rs. 73,756.09 with a gross cost Rs. 42,886.40. The implementation of innovative technologies, timely crop

management approaches, field days and regular field inspections were all credited with the higher net returns in demonstration fields. A mean benefit cost ratio of 3.54 was recorded in demonstrations with an increase of Rs. 34,789.95 net returns and with 47.20% increase of net returns than farmers practices (2.72). Considering the positive impacts of CFLD on grain yield and profitability, the benefit-cost ratio increased from at least 2.72 in 2022-2023 to 4.30 in 2024-2025. The findings are consistent with those of Natarajan *et al.* (2024), who likewise discovered that CFLD groundnut demonstrations had a higher benefit-cost ratio and higher net returns than farmers' practices, with an additional net income of Rs. 1,02,187. Lakhani *et al.* (2020) observed that CFLDs had higher net returns, 52.21 per cent higher than farmers' practices (BCR 1.86) and a high benefit cost ratio (2.49). When CFLD of improved variety was paired with tried-and-true technical intervention approaches in farmers' fields, groundnut productivity increased substantially.

Extension

Investigating the impact of CFLD oilseeds on groundnut crop adaptation and horizontal spread in Telangana's Peddapalli district was also one the aim of the current study (Table 4). Farmers' implementation of integrated crop management in groundnut crops was found to be extremely uncommon before the demonstration in 2022-2023 but it had increased by 267.82% during the demonstration in 2024-2025. According to the study, the horizontal spread of this technology was significantly influenced by CFLDs carried out by KVK, Ramagirikhilla, as the area expanded from 0 ha to 282 ha during the course of the three-year study, with a horizontal spread of 206.07%. Thus, regular field inspections, field days, an intensive awareness and training campaign on new groundnut varieties and mass media communications improved farmers' knowledge and skill levels, which in turn encouraged farmers in the Peddapalli district to adopt the technology. Pilli *et al.* (2025) state that the technology's adaptability and horizontal dissemination were increased *via* cluster frontline demonstrations employing an improved package of techniques.

Sustainability yield index (SYI) and sustainability value index (SVI)

A technique for assessing the long-term sustainability of farming practices, especially with regard to crop yields and soil health, is the sustainability yield index (SYI). In simple terms, it helps to evaluate a farming system's capacity to sustain soil resources while producing a steady output over time. A more sustainable strategy is indicated by a higher SYI score, which indicates that the management system is probably going to sustain a high level of produce

Table 4: Impact of cluster front-line demonstration (CFLD) on adoption of groundnut *var.* K-1812 (Kadiri lepakshi) in Peddapalli district.

Year	No. before adoption	No. after adoption	Impact on adoption (% change)	Area before (ha)	Area after (ha)	Impact on horizontal spread (% change)
2022-23	0	28	0.00	0	17.00	0.00
2023-24	28	87	210.71	17	63.00	270.59
2024-25	87	320	267.82	63	282	347.62
Average	38.33	145.00	159.51	26.67	120.67	206.07

*CFLD- Cluster front line demonstration, ha- Hectare.

Table 5: Sustainability yield index (SYI) and sustainability value index (SVI) of integrated crop management practices of groundnut var. K-1812 (Kadiri lepakshi) in Peddapalli district.

Particulars	2022-2023		2023-2024		2024-2025	
	Demo	FP	Demo	FP	Demo	FP
Pod yield (q/ha) max	32.55	26.20	33.10	31.20	35.63	31.75
Pod yield (q/ha) min	16.73	13.45	14.50	13.20	16.25	14.5
Mean pod yield (q/ha)	24.20	19.06	26.55	20.11	26.5	20.45
SD	4.53	3.60	5.38	4.93	5.21	4.16
CV%	18.72	18.89	20.28	24.52	19.67	20.36
Net returns (Rs/ha) max	114797.50	81190.00	154510.00	142900.00	198200.00	165725
Net returns (Rs/ha) min	38800.50	26252.50	44230.00	37700.00	68745.00	53530
Mean net returns (Rs/ha)	74215.00	50425.14	115273.14	77984.86	136150.00	92858.28571
SD	21769.10	15761.41	31840.66	28411.49	34924.19	26774.21
CV%	18.72	31.26	27.62	36.43	25.65	28.83
Sustainability yield index (SYI)	0.60	0.59	0.64	0.49	0.60	0.51
Sustainability value index (SVI)	1.74	1.63	1.85	1.40	1.99	1.77

Demo- Demonstration conducted, FP- Farmers practice.

without adversely affecting the health of the soil or other resources. On the contrary, low SYI levels indicate unsustainable practices that might need to be modified to guarantee long-term productivity. By encouraging improved resource management and reducing environmental impact, SYI assists farmers and academics in determining which agricultural practices have the best chance of resulting in long-term sustainability. The CFLD groundnut technology demonstration achieved greater SYI and SVI values than the farmers' practices. In the demo plot, the SYI varied between 0.60, 0.64 and 0.60, whereas in the farmers' practice, it was between 0.59, 0.49 and 0.51. This suggests that CFLDs that use improved groundnut cultivation management techniques are achieving sustained yields without compromising soil health.

Parallel to this, the sustainability value index (SVI) in agriculture focuses at both the economic and environmental components of an agricultural system to determine how sustainable it is. Typically, the SVI formula compares the average and maximum net incomes and includes a measure of variability, such as standard deviation, which is frequently expressed as a 95% confidence interval. A farming system that is more sustainable is indicated by a SVI rating that is closer to 1, which typically ranges from 0 to 1. A high degree of sustainability is indicated with a SVI near to 1, which implies that the agricultural system produces steady, high net profits with negligible variability. A low level of sustainability is indicated by a SVI near zero, which emphasizes the possibility that the agricultural system is not environmentally or economically sound. The SVI for the demo plot was 1.74, 1.85 and 1.99, whereas the farmers' practice was 1.63, 1.40 and 1.77 (Table 5). Compared to the farmer's practice, the improved approach showed the highest standard deviation and coefficient of variance (Table 5). The reason might be differences in yield in farmers' fields as a result of improved methods. It is possible to conclude from the statistics that the improved technology is more ecologically friendly than farmers' practices. Similar findings were made by Natarajan *et al.* (2024) and Reager *et al.* (2022), who claimed that, when compared to farmers' practices, improved methods yielded a greater and more sustainable production over time. The mean pod yield recorded with upgraded techniques was 29.48% higher than the farmer's practice.

CONCLUSION

Through cluster front line demonstrations (CFLDs), farmers were able to integrate the new technologies and achieve higher yields and net returns. During the three years of the study, the sustainability yield index and sustainability value index per hectare increased and the extension gap was minimized. The pre-season training of KVK scientists, the distribution of recommended technologies for farmers to use in demonstrations, the distribution of literature and frequent visits, the monitoring and management of pest and disease advisory services, implementation of extension activities like method demonstration and field day are some of the factors that may have an impact on the adoption of recommended technologies in groundnut.

ACKNOWLEDGEMENT

Funding received from ICAR-Agricultural Technology Application Research Institute, Zone-X, Hyderabad under general technical programme, Ministry of Agriculture and Farmers Welfare, Government of India is duly acknowledged. Authors also thankful to Dr. Danda Raji Reddy, Hon'ble Vice-Chancellor and Dr. T. Suresh Kumar, Director of Extension, Sri Konda Laxman Telangana Horticultural University for their constant support and guidance in smooth conducting of this study.

Conflict of interest

The authors declare that there is no conflict of interest exist (both financial and non-financial).

REFERENCES

Arunkumar, B.R., Sanketh, C.V., Rajegowda, Shrinivas Deshpande, Shivashankar, M., Nagaraja, T., Pallavi, N. and Sakamma, S. (2023). Impact of cluster front-line demonstrations on productivity and economics of groundnut in southern transition agro climatic zone (Zone-7) of Hassan District, Karnataka, India. *International Journal of Plant and Soil Science*. **35(20):** 931-938.

Bucheyeki, T.L., Shenkalwa, E.M., Mapunda, T.X. and Matata, L.W. (2008). On-farm evaluation of promising groundnut varieties for adaptation and adoption in Tanzania. *African Journal of Agricultural Research*. **3(8):** 531-536. https://doi.org/10.5897/AJAR.

Gautam, U.S., Singh, A., Dubey, S.K., Pandey, S., Yemul, S.N., Singh, R. *et al.* (2023). Cluster Front Line Demonstration as the Tool for Securing Self-sufficiency in Pulses. Experiences of KVKs of India 2020-21. Division of Agricultural Extension. Technical Bulletin-3 2023; Indian Council of Agricultural Research, New Delhi.

Groundnut Outlook (2024). Agricultural Market Intelligence Centre, PJTSAU.

Ingale, S. and Shrivastava, S.K. (2011). Nutritional study of new variety of groundnut (*Arachis hypogaea* L.) JL-24 seeds. *African Journal of Food Science*. **5(8):** 490-498. https://doi.org/10.5897/AJFS.

Lakhani, S.H., Baraiya, K.P. and Baraiya, A.K. (2020). Impact of cluster frontline demonstrations (CFLDs) on *Kharif* groundnut productivity and income of farmers in Jamnagar District of Gujarat. *International Journal of Current Microbiology and Applied Sciences*. **9(11):** 1116-1120. https://doi.org/10.20546/ijcmas.2020.911.129.

Madhushekar, B.R., Narendar, G., Goverdhan, M. and Avil, K.K. (2022). Impact of front-line demonstration in transfer of groundnut production technologies for the livelihood improvement of oilseed farmers. *International Journal of Bio-resource and Stress Management.* **13(8):** 806-814.

Natarajan, K., Noorjehan, A.K.A., Hanif, Jayakumar, J., Senguttuvan, K., Gayathry, G., Bharathi Kumar, K., Veeramani, P., Kannan, S. and Mailappa, A.S. (2024). A study on yield and value sustainability in groundnut (*Arachis hypogea*) through cluster frontline demonstrations approach in cuddalore District of Tamil Nadu. *Legume Research.* **47(7):** 1172-1178. doi: 10.18805/LR-5292.

Pilli, K., Venkanna, Y., Rao, B. B., Srinivas, A., Kumar, T. V., Navya, B., Archana, K., Naresh, B. and Vijaya, D. (2025). Enhancement of green gram productivity through cluster front line demonstrations in Northern agroclimatic zone of Telangana, India. *International Journal of Plant and Soil Science.* **37(4):** 1-8. https://doi.org/10.9734/ijpss/2025/v37i45382.

Reager, M.L., Kumar, U., Chaturvedi, D., Mitharwal, B.S., Dotaniya, C.K. and Aher, S.B. (2022). Study on yield sustainability and water productivity of groundnut on farmers' fields through improved technology under hyper arid partially irrigated zone of Rajasthan. *Legume Research-An International Journal.* **45(4):** 475-480. doi: 10.18805/LR-4422.

Sustainability: The New Paradigm: Environment-Agriculture Relationship. (2017). IGNOU. http://hdl.handle.net/123456789/12954.