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Adoption of the improved technologies by the farmers practicing groundnut based cropping systems in Tumkur district of Karnataka

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Abstract
Groundnut is the principal oilseed crop grown in Karnataka's Tumkur district. It's critical to understand how enhanced farming methods are currently being adopted in order to identify adoption and knowledge gaps that lead to lower yields and greater cultivation costs. Sixty farmers from the sira and pavagada taluks of Tumkur district were chosen for each cropping method; the majority of farmers engage in groundnut solo cropping and intercropping with redgram. Interestingly, the study found that farmers who intercrop groundnuts with redgram had a rather high degree of expertise. The wider the disparity in the uptake of production technology, such as the application of micronutrients, gypsum, seed treatment, and soil testing. These must be addressed by means of awareness-raising initiatives and supporting. These have to be addressed through awareness creation programmes and facilitating environment for adoption of improved cultivation practices, and reducing cost of cultivation, thereby increasing profits per unit area resulting in improvised livelihoods of the farmers in a sustainable way.

Keywords: Adoption, groundnut cropping systems

Introduction
India is one of the world's largest producers of oilseeds, with agriculture playing a crucial role in the country's economy. Key oilseed crops in India include groundnut, rapeseed-mustard, soybean, sunflower, safflower, sesame, castor, and linseed. Groundnut, often referred to as the "King" of oilseeds, serves as both a food and cash crop. Despite its rich nutrient content, groundnut is priced relatively low as a food crop. It is sometimes called the "cashew nut of the poor" due to its affordability.

In the 2020-21 agricultural year, the area under groundnut cultivation in India was 6.10 million hectares, with a production of 10.24 million tonnes and a productivity of 1,703 kg per hectare. The six leading states for groundnut production, which account for approximately 87.38% of the national area dedicated to groundnut farming, are Gujarat (2.16 million hectares, 35.96%), Andhra Pradesh (0.87 million hectares, 14.46%), Rajasthan (0.86 million hectares, 14.23%), Karnataka (0.72 million hectares, 11.99%), Tamil Nadu (0.41 million hectares, 6.80%), and Maharashtra (0.31 million hectares, 5.14%). Karnataka is one of the largest producers of groundnut, with key districts including Chitradurga, Ballari, Tumkur, Belagavi, Vijayapura, Gadag, Dharwad, Koppal, Haveri, Chikkaballapura, and Davanagere. Tumkur alone accounts for 47.62% of the state's groundnut production. The low yields of pulses and groundnuts in India need to be addressed through the adoption of proven technological interventions and enhanced knowledge among farmers. This study aims to evaluate the differences in farmers' knowledge of agricultural practices and the adoption of improved methods between the baseline and endline phases. The decline in groundnut cultivation area can be attributed to various factors, including climate change, insufficient government support, and a gap between knowledge and actual adoption of practices. These issues can be mitigated through effective technology dissemination by research institutions.

Methodology

The study was conducted in Tumkur district of Karnataka in 2023. Out of ten taluks, Sira and Pavagada are purposively selected for the study since these taluks have major area under groundnut cultivation compared to other taluks. From each taluk, three groundnut growing potential villages were selected. Further, from each village, 5 farmers practicing cropping system selected for the study are CS-I (Groundnut alone) and CS-II(Groundnut + Redgram) were selected respectively, making the sample size 30 each under category (CS-I and CS-II) from each taluk. Thus, the total sample size from these villages is 120. Ex-post facto research design was adopted. Data was collected by using pre-tested personnel interview method. Further, appropriate statistical tools were employed to analyze the collected data.

Results and Discussion

A. Adoption performance of farmers practicing CS-I

It is evident from the Table 1 that, majority (80.00%) of the respondents had harvested the crop on time and more than three-fourth (76.67%) of them sown the seed in recommended season. The other practices fully adopted by significant percentage of farmers were recommended seed rate (66.67%), recommended spacing (65.00%), timely weed management (53.33%), recommended variety (51.66%) and timely application of FYM. Adopting recommended seed rates and spacing practices optimizes resource use and plant density, allowing plants to access vital resources like water and nutrients, which leads to healthier crops and increased yields. Effective and timely weed management reduces competition for resources between weeds and the main crop, further supporting overall crop health.

Table 1: Adoption of the technologies by the farmers practicing CS-I (Groundnut alone) n_1=60

Sl. No.	Recommended Practices	Extent of adoption					
		Full Adoption		Partial Adoption		No Adoption	
		No.	%	No.	%	No.	%
1	Soil testing	26	43.33	00	00.00	34	56.67
2	Recommended variety	31	51.66	00	00.00	29	48.34
3	Recommended sowing season	46	76.67	14	23.33	00	00.00
4	**Seed treatment with**						
	a) Bio fertilizer	00	00.00	04	06.67	56	93.33
	b) Chemical	00	00.00	18	30.00	42	70.00
5	Recommended spacing	39	65.00	21	35.00	00	00.00
6	Recommended seed rate	40	66.67	20	33.33	00	00.00
7	**FYM**						
	a) Application of FYM	27	45.00	11	18.33	22	36.67
	b) Time of FYM application	31	51.66	13	21.67	16	26.67
8	**NPK**						
	a) Application of NPK fertilizer as basal dose	10	16.67	32	53.33	18	30.00
	b) Time of fertilizer application	15	25.00	31	51.67	14	23.33
9	Timely weed management	32	53.33	21	35.00	07	11.67
10	**Pest management**						
	Root grub	18	30.00	25	41.67	17	28.33
	Thrips	21	35.00	23	38.33	16	26.67
	Red hairy caterpillar	17	28.33	28	46.67	15	25.00
11	**Disease management**						
	Tikka disease	23	38.33	28	46.67	09	15.00
	Bud necrosis	15	25.00	17	28.33	28	46.67
	Stem rot	02	3.33	25	41.67	33	55.00
	Rust	08	13.33	27	45.00	25	41.67
12	Application of urea at flowering stage	00	00.00	08	13.33	52	86.67
13	Gypsum application	07	11.67	38	63.33	15	25.00
14	Application of borax and sulphate	00	00.00	03	05.00	57	95.00
15	Earthing Up	05	08.34	31	51.66	24	40.00
16	Timely harvesting	48	80.00	12	20.00	00	00.00

Whereas, more than two-fifth (45.00%) of the farmers practicing CS-I had applied FYM. More than three-fifth (63.33%) of the growers have not applied recommended quantity of gypsum followed by imbalance application of NPK fertilizer (53.33%), timely application of fertilizer (51.67%), poor management of tikka disease, rust and red hairy caterpillar (46.67%), poor root grub (41.67%) and thrips (38.33%) management. Factors such as resource limitations, practice complexity, financial concerns, risk perception, labor availability, farm size, and a tenacious attachment to conventional methods are among the potential causes of the limited adoption of technology. Enhancing extension education services, providing funding, and making customized suggestions can all help to address these concerns and increase the uptake of these beneficial agricultural practices.

A significant proportion of farmers using CS-I have not used borax and sulphate (95.00%), bio-fertilizer to seeds (93.33%), or urea during the blooming stage (86.67%). This might be the result of a lack of awareness, a lack of advantages that are recognized, a product's restricted availability, doubts about its effectiveness, perceived hazards, or financial concerns. Another explanation can be ignorance of the significance of applying micronutrients to improve groundnut oil content and its impact on soil health. Due to the high seed rate of groundnuts—40–60 kg per acre—a farmer would find it challenging to handle such a huge amount of seeds and to dry them before sowing, which is time-consuming and takes additional work.

With respect to soil testing, more than half (56.67%) of the growers had not done soil testing which was likely due to lack of soil testing lab facility in nearby place as it is available only in KVK, Hierehalli that requires more time to get the results. The

farmers had no knowledge on soil sample collection procedure they need to depend on the extension agents or line departments.
In terms of disease control, over half (55.00%) of the responders in CS-I had not implemented stem rot management strategies. Furthermore, a sizable fraction of the responders (46.67%) did not employ bud necrosis management techniques. The discrepancy between farmers' current and better techniques is referred to as the technology adoption gap. Lack of money, lack of talent, lack of conviction, fear of losing the crop, lack of input availability at the appropriate moment, and lack of awareness or understanding might all be contributing factors to the gap.

B. Adoption of the technologies by the farmers practicing CS-II (Groundnut + Redgram)

Key agronomic practices such as timely harvesting (93.33%), application timing of FYM (81.66%), sowing season, weed management, seed rate (76.66%), and the recommended ratio of groundnut and redgram (75.00%) were fully adopted by the majority of farmers practicing CS-II. The likely reason is that timely harvesting reflects farmers' deep understanding of groundnut cultivation. They likely rely on traditional knowledge and hands-on experience, using visual cues like leaf color changes and the size and color of pods to determine the optimal time for harvesting. This strong traditional knowledge motivates the complete adoption of these practices. Additionally, the simplicity and cost-effectiveness of these methods make them highly appealing to farmers, encouraging full integration into their farming systems, which ultimately boosts crop yields and overall productivity. Further, good number (78.33%) of farmers have used the recommended varieties, the possible reasons may be higher yield, more oil content than local varieties, adaptation to local climate and resistance to diseases and also it is majorly influenced by the greater acceptability in the market by oil processing industry and consumers. More than three-fifth (65.00%) of the respondents have tested their soil in order to know its fertility and nutrient status and 51.67 per cent of the farmers had applied FYM.
Nearly three-fifth of the respondents had not applied NPK fertilizer (58.33%) in time and required quantity of gypsum (56.67%) followed by earthing up (53.34%), application of NPK fertilizer, poor management of thrips and tikka disease (43.33%), root grub (41.66%) and red hairy caterpillar (38.34%). One likely reason could be the unavailability of gypsum and fertilizers when needed, transportation challenges, and their high costs, all of which contribute to the observed situation.

Table 2: Adoption of the technologies by the farmers practicing CS-II (Groundnut + Redgram) n_2=60

Sl. No.	Recommended Practices	Extent of adoption					
		Full Adoption		Partial Adoption		No Adoption	
		No.	%	No.	%	No.	%
1	Soil testing	39	65.00	00	0.00	21	35.00
2	Recommended variety	47	78.33	00	0.00	13	21.67
3	Recommended sowing season	49	81.66	11	18.34	00	0.00
4	**Seed treatment with**						
	a) Bio fertilizer	04	06.67	09	15.00	47	78.33
	b) Chemical	07	11.67	16	26.67	37	61.66
5	Recommended spacing	43	71.66	17	28.34	00	0.00
6	Recommended seed rate	46	76.66	14	23.34	00	0.00
7	**FYM**						
	a) Application of FYM	31	51.67	25	41.66	04	6.67
	b) Time of FYM application	34	56.66	16	26.67	10	16.67
8	**NPK**						
	a) Application of NPK fertilizer as basal dose	25	41.66	26	43.34	09	15.00
	b) Time of fertilizer application	17	28.33	35	58.33	08	13.34
9	Timely weed management	46	76.67	10	16.67	04	06.66
10	**Pest management**						
	Root grub	13	21.67	25	41.66	22	36.67
	Pod borer	08	13.33	18	30.00	34	56.67
	Thrips	12	20.00	26	43.33	22	36.67
	Red hairy caterpillar	19	31.66	23	38.34	18	30.00
11	**Disease management**						
	Wilt	08	13.33	17	28.33	35	58.34
	Leaf spot	16	26.67	14	23.33	30	50.00
	Mosaic virus	07	11.66	22	36.67	31	51.67
	Tikka disease	21	35.00	26	43.33	13	21.67
	Bud necrosis	14	23.33	15	25.00	31	51.67
	Stem rot	08	13.33	19	31.67	33	55.00
	Rust	11	18.33	14	23.33	35	58.34
12	Application of urea at flowering stage	00	0.00	04	06.67	56	93.33
13	Gypsum application	10	16.67	34	56.67	16	26.66
14	Application of borax and sulphate	03	05.00	17	28.33	40	66.67
15	Earthing Up	18	30.00	32	53.34	10	16.66
16	Recommended ratio of groundnut and redgram	45	75.00	15	25.00	00	0.00
17	Timely harvesting	56	93.33	04	06.67	00	0.00

The majority of farmers (93.33%) did not use urea during the blooming stage. They also did not treat seeds with chemical (61.66%), bio-fertilizer (78.33%), borax, or sulphate (66.67%). The most common reasons are that producers might not completely comprehend the benefits of using chemicals and biofertilizer to treat seeds, using urea during the blooming stage, or using borax and sulphate for groundnut farming. Because they are not experienced with the anticipated results, they can be reluctant to put these methods into effect. One significant obstacle to adoption may be the scarcity of these inputs on the market. Farmers may choose to use alternative techniques or give up on these practices entirely if they are unable to obtain urea, biofertilizers, chemicals for seed treatment, or micronutrients like borax and sulphate. Additionally, there may be a lack of awareness regarding the importance of micronutrient application in fostering groundnut pod development and enhancing soil fertility. It's possible that farmers were unaware of how important these micronutrients were for sustaining healthy soil and raising crop production. More than half of the farmers practicing CS- II have not adopted the management practices of wilt (58.34%), rust (58.34%), stem rot (55.00%), mosaic virus and bud necrosis (51.67%) as well also leaf spot (50.00%) management practices.

Conclusion

The non-adoption of essential agricultural practices is driven by a range of challenges. Farmers often lack adequate knowledge, especially about the importance of practices like micronutrient application and effective pest and disease management. Limited understanding of the long-term benefits these practices offer for improving crop yields and soil health further discourages their use. Additionally, market constraints, such as the high cost and limited availability of inputs, make it difficult for farmers to implement these methods. Another significant barrier is the lack of timely access to information and guidance from agricultural extension services. This often leads to misconceptions about the value and correct application of improved practices. Furthermore, resource limitations prevent many farmers from investing in new technologies or techniques. To overcome these challenges, targeted education and training programs are necessary to raise awareness about the benefits of these agricultural practices. Outreach initiatives, combined with better access to essential inputs and resources, can motivate farmers to adopt these methods. Strengthening extension services and improving the availability of inputs are crucial steps toward bridging the knowledge gap, ultimately enhancing agricultural productivity and sustainability.

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