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Bridging the technological gap: Enhancing sunflower production in Chamarajanagar district, Karnataka

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Abstract
India's agricultural sector, primarily rural, faces significant challenges, especially in oilseed production, where it remains the world's largest edible oil importer. This study focuses on sunflower cultivation in Chamarajanagar district, Karnataka, analyzing technological gaps and constraints affecting both small and big farm growers. Utilizing an ex-post facto research design, data were collected from 120 farmers across top sunflower-growing villages. The findings reveal that both small (38.33%) and big farmers (11.66%) exhibit medium to high levels of technological gaps, with small farmers experiencing greater discrepancies. Key technologies, including seed treatment with biofertilizers and nitrogen top dressing, showed complete gaps in adoption, largely due to limited knowledge and the non-availability of critical inputs. The reliance on rainfed conditions further discourages investment in essential agricultural practices. Recommendations emphasize the need for targeted extension strategies, such as training and timely provision of inputs, to enhance farmers' awareness and confidence in modern agricultural methods. By bridging these gaps, the study aims to improve sunflower productivity, contributing to India's self-sufficiency in edible oils and supporting rural livelihoods. Future research should explore innovative practices to promote sustainable agricultural growth in the oilseed sector.

Keywords: Technological gap and oilseed

Introduction

India is predominantly rural, with 70% of its population living in villages, making agriculture a cornerstone of its economy. Out of a total geographical area of 329 million hectares, only 159.7 million hectares are cultivable, with approximately 82.6 million hectares under irrigation. Given that two-thirds of the cultivable area is dry land, there is an urgent need to increase agricultural production to meet the projected demand for 284 million tonnes of food grains. The agricultural landscape in India is shifting toward a modern, commercial-oriented farming system. Despite improvements in resource efficiency, challenges in increasing land productivity persist. Technological advancements play a crucial role in addressing these challenges. Adopting improved agricultural practices can minimize yield instability, a hallmark of Indian agriculture, thereby enhancing production of food, cash and oilseed crops. The oilseed sector is particularly significant, as India is among the largest producers and consumers of vegetable oil globally, ranking fourth in the vegetable oil economy after the USA, China and Brazil. Oilseed crops are vital, contributing around 10% to the overall crop output. Key oilseed crops in India include groundnut, rapeseed, mustard, soybean and sunflower, which collectively account for the majority of oilseed production (Narayan *et al*., 2011) [4]. These crops not only provide vegetable fats for human consumption but also serve as raw materials for various industries. In the 2015-16 fiscal year, the demand for vegetable oil in India reached 235 million tonnes, met through both imports and domestic production. Domestic sources comprise primary oilseeds such as groundnut, sunflower and secondary sources like coconut and cottonseed. While primary sources accounted for around 60 million tonnes, the remaining demand was largely fulfilled through imports, which totaled 148.2 million tonnes in the same year (Anon, 2017) [1]. This dependence on imports highlights a significant supply-demand gap, making India the world's largest edible oil importer. The low productivity of oilseed crops poses a major challenge, exacerbated by cultivation on marginal lands and insufficient irrigation. Most oilseed production occurs in rain-fed areas, leading to unstable yields and lower returns on investment (Anon, 2017) [1]. Sunflower (Helianthus annuus), introduced in India in 1969, is one of the fastest-growing oilseed crops, known for its high oil content (48-53%) and nutritional benefits. However, India ranks low in sunflower production compared to leading countries like Russia and Ukraine. In Karnataka, particularly in Chamarajanagar district, sunflower cultivation is significant. As of 2016-17, Karnataka accounted for an area of 220,000 hectares with a production of 98,000 tonnes, establishing itself as the "Sunflower State" in India. Chamarajanagar district, with an area of 8,842 hectares and an annual production of 2,780 tonnes, leads sunflower production in South Karnataka (Anon, 2017) [1]. This research paper aims to analyze the yield gap, technological gap, and various constraints in sunflower production within Chamarajanagar district, ultimately seeking to enhance productivity and sustainability in the oilseed sector.

Methodology

“Ex-post facto” research design was used in the present investigation because the researcher is having no control over the independent variables which have already occurred. The Chamarajanagar district was selected purposively, because it is well known for Sunflower cultivation. It is one of the leading producers of Sunflower in Karnataka and also Sunflower cultivation is being taken up in almost all the taluks of the district. The top six villages having the highest area under Sunflower cultivation in Gundlupet taluk and top six villages having the highest area under Sunflower cultivation in Chamarajanagr taluk were selected from the district for the purpose of the study. The total sample constituted from two taluks was 120.

Technological gap: It refers to the difference between the recommended technology and the actual technology used by the farmers at field level. The gap for each major practice was computed by using three-point continuum viz. “full gap”, “partial gap” and “no gap” with the scores of 3, 2 and 1, respectively. Total score and mean score were calculated for each practice/statement and rank has been assigned on the mean score

$$Xg = Xr - Xa$$

Where,
Xg = Technological gap
Xr = Recommended technology
Xa = Actual technology used by the farmers at field level

Further, based on the score obtained, respondents were classified into three categories using standard deviation and mean as a measure of check.

Results and Discussion

Technological gaps of small and big farm sunflower growers

The technological gaps existing in sunflower production. Of all the technologies listed, cent percent gap was found in the technologies like seed treatment/soil application of biofertilizer, top dressing of plants with nitrogen and these operations secured first rank followed by installing bee hives with second rank, use of UAS hybrids ranked at third, chemical weed management (IV Rank), pest and disease management (V Rank) and application of micronutrients (VI Rank). This is due to the lack of knowledge about seed treatment/soil application of biofertilizer, top dressing with urea and micronutrients application. Further, non-availability of inputs like UAS hybrids, biofertilizer and micronutrients is also one of the reasons for gap. Apart from this, Sunflower is mainly grown under rainfed condition in the district; hence, they are not ready to invest more on plant protection chemicals, weedicides and top dressing with nutrients which involves more risk.

Table 1: Technological gaps of small and big farm sunflower growers

(n=120)

Sl. No	Recommended technologies	Small farmers (n1=60)		Big farmers (n2=60)		Total	
		Mean score	Rank	Mean score	Rank	Mean score	Rank
1	Land preparation	01.00	XVIII	01.00	XVII	01.00	XVIII
2	Time of sowing	02.00	IX	02.00	VIII	02.00	VIII
3	**Hybrids**						
	a. Use of UAS hybrids	02.90	III	02.70	III	02.80	III
	b. Use of Private hybrids	01.10	XVII	01.30	XIII	01.20	XIV
4	Recommended Seed rate	01.91	XI	01.93	X	01.92	X
5	Seed treatment with insecticide/fungicide	02.18	VIII	01.96	IX	02.07	VII
6	Seed treatment with biofertilizer	03.00	I	03.00	I	03.00	I
7	Spacing	01.95	X	01.96	IX	01.95	IX
8	Intercultivation	01.13	XV	01.25	XIV	01.19	XV
9	**Nutrient management**						
	a. FYM	01.41	XIV	01.13	XV	01.27	XIII
	b. Basal dose application	02.00	IX	02.00	VIII	02.00	VIII
	c. Top dressing	03.00	I	03.00	I	03.00	I
10	Application of Micronutrient	02.70	VII	02.33	VII	02.51	VI
11	Thinning	01.11	XVI	01.03	XVI	01.07	XVI
12	Inter cropping	01.81	XIII	1.73	XII	01.77	XII
13	Crop rotation	01.00	XVIII	01.00	XVII	01.00	XVIII
14	Chemical weed management	02.83	IV	02.65	IV	02.74	IV
15	Caterpillar management	02.75	V	02.53	VI	02.66	V
16	Bud necrosis management	02.71	VI	02.60	V	02.66	V
17	Installing bee hives	02.95	II	02.78	II	02.86	II
18	Timely harvesting and threshing	01.11	XV	01.00	XVII	01.05	XVII
19	Yield per unit area	01.90	XII	01.80	XI	01.85	XI

Further, gap was identified in seed treatment with insecticide/fungicide (VII Rank), time of sowing, basal dose application of fertilizer (VIII Rank), spacing (IX Rank), seed rate (X Rank), yield per unit area (XI Rank), inter cropping (XII Rank) and application of FYM (XIII Rank). The probable reason could be that, sunflower growers in the area generally take up sowing in early kharif (April-May) compared to other areas and they use higher seed rate and follow closer spacing to minimize the risk in rainfed farming. Further, lack of knowledge, lack of conviction about application of fertilizer, use of suitable inter cropping system and seed treatment chemical are the other reasons for the gap and these practices are adopted by sunflower growers with little modification to shoot their economic and ecological condition. The little technological gaps were found in practices like use of private hybrids (XIV), intercultivation (XV), thinning (XVI), timely harvesting, threshing (XVII), crop rotation and land preparation (XVIII). Hence, concerned extension organizations should identify and use appropriate extension strategies like training, method demonstrations, result demonstrations, field days to create awareness, to develop favourable attitude and conviction towards technologies. Further, organizations should make necessary arrangements to provide critical inputs like UAS hybrids, bio fertilizer, weedicides, plant protection chemicals at right time in order to reduce the technological gap.

Overall technological gaps among small and big farm sunflower growers

Overall technological gaps of small and big farm sunflower growers. A majority of small farmers had medium (46.67 %) to high (38.33 %) level of technological gap, followed by low level of technological gap (15.00%). On the other hand, in case of big farmers, majority of respondents had medium (46.67 %) to low (41.67 %) level of technological gap, followed by high level of technological gap (11.66 %). When the pooled sample was considered 46.67 percent, 28.33 percent and 25.00 percent of sunflower growers possessed medium, low and high level of technological gap, respectively. Higher technological gap (38.33 %) was found in case of small farmers compared to big farmers (11.66 %) (Fig.1).

Table 2: Overall technological gaps among small and big farm sunflower growers

(n=120)

Technological gap	Small farmers (n1=60)		Big farmers (n2=60)		Total	
	F	%	F	%	F	%
Low gap (< 40.54)	09	15.00	25	41.67	34	28.33
Medium gap (40.55- 43.00)	28	46.67	28	46.67	56	46.67
High gap (> 43.01)	23	38.33	07	11.66	30	25.00

The probable reason may be that, lack of knowledge about improved practices, lack of motivation and conviction to use innovations, non-availability of critical inputs. Majority of the respondents irrespective of size of holding had adopted simple practices. There were another two groups of respondents who adopted most of the practices and who did not adopt the practices. The possible reasons for medium overall technological gap of the respondents may be medium knowledge of the respondents regarding recommended sunflower cultivation practices. This clearly showed that there is immense scope for intensified extension efforts to increase the sunflower production. This brings to focus the need for strengthening the extension efforts by the concerned extension agency to increase the knowledge and in turn increase adoption of recommended cultivation practices and ultimately reducing technological gap.

Conclusion

The analysis of technological gaps in sunflower production among small and big farm growers in Chamarajanagar district reveals significant opportunities for improvement. The findings indicate that both small and big farmers experience medium levels of technological gaps, with small farmers facing a higher gap than their larger counterparts. This disparity is largely attributed to limited knowledge about improved agricultural practices, lack of motivation to adopt innovations, and non-availability of critical inputs such as UAS hybrids and biofertilizers. Key technologies, particularly seed treatment with biofertilizers and nitrogen top dressing, show a complete gap in adoption, highlighting the urgent need for targeted educational interventions. The reluctance to invest in plant protection chemicals and fertilizers under rain-fed conditions further exacerbates yield instability and low productivity. To address these challenges, it is imperative that extension organizations implement effective strategies, including training programs, method demonstrations, and timely distribution of essential inputs. Increasing awareness and fostering a positive attitude toward modern agricultural practices can help bridge the technological gap, ultimately leading to enhanced sunflower production. Overall, this study underscores the necessity for intensified extension efforts to empower farmers with the knowledge and resources needed to adopt recommended cultivation practices. By addressing these gaps, there is potential not only to boost sunflower yields but also to contribute to India's broader goal of achieving self-sufficiency in edible oil production, reducing dependence on imports, and enhancing the livelihoods of rural farming communities. Future research should continue to explore innovative solutions to overcome these barriers and promote sustainable agricultural practices in the oilseed sector.

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