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Examining the yield gap in sunflower farming: Insights from Karnataka's Chamarajanagar district

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Abstract

This study examines the disparity in sunflower production yields between small and large farmers in Karnataka's Chamarajanagar area, which is well-known for growing sunflowers. Data on the discrepancy between potential and actual yields was gathered from 120 respondents in 12 villages using an ex post facto study approach. The actual yields for large farmers and small farmers were 4.12 and 3.31 quintals per acre, respectively, but the potential yield was estimated to be 5 quintals per acre. This led to yield gaps of 0.88 and 1.69 quintals per acre. The yield gap index, which measures differences in knowledge, resource availability and access to better agricultural methods, was much greater for small farmers (33.80%) than for large farmers (17.60%). A statistical study showed that the two groups' yields differed significantly, with small farmers' output being hindered by both biological and socioeconomic factors. The results highlight the necessity of focused interventions, such as resource assistance and training, to close the yield gap and improve the sustainability of sunflower production. Improving food security and lowering India's reliance on imported edible oil require addressing these issues.

Keywords: Yield gap, oilseed, potential yield and actual yield

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. India is one of the world's top producers and consumers of vegetable oil, coming in at number four in the vegetable oil economy after the United States, China and Brazil, the oilseed industry is very important. Because they account for around 10% of total agricultural production, oilseed crops are essential. The majority of oilseed output in India is derived from key oilseed crops, which include sunflower, mustard, rapeseed, groundnut and soybean (Narayan *et al*., 2011) [2]. In addition to producing vegetable lipids for human consumption, these crops are used as raw materials in a number of industries. Both local and imported vegetable oil were used to meet India's 235 million-ton demand in the 2015–16 fiscal year. Primary oilseeds, like peanut and sunflower, and secondary sources like coconut are examples of domestic sources. Around 60 million tonnes came from primary sources, but 148.2 million tonnes were imported in the same year to meet the majority of the demand (Anon, 2017) [1]. The world's top importer of edible oil, India's reliance on imports reveals a substantial supply-demand imbalance.

Oilseed crops poor productivity is a significant problem that is made worse by their marginal soils and inadequate irrigation. Because rainfed regions produce the majority of oilseeds, yields are inconsistent and returns on investment are low (Anon, 2017) [1]. Introduced to India in 1969, sunflower (*Helianthus annuus*) is one of the fastest-growing oilseed crops and is prized for its nutritional value and high oil content (48–53%). On the other hand, India produces less sunflowers than top producers like Russia and Ukraine. Sunflower farming is an important industry in Karnataka, especially in the Chamarajanagar area. Karnataka became known as the "Sunflower State" of India in 2016–17, with a 220,000-hectare area and a 98,000-ton production. The largest producer of sunflowers in South Karnataka is the Chamarajanagar district, which occupies 8,842 hectares and produces 2,780 tons annually (Anon, 2017) [1]. By examining the yield gap, technology gap, and other limitations in sunflower production in the Chamarajanagar area, this study article seeks to improve the oilseed industry's sustainability and productivity.

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 Chamarajanagar taluk were selected from the district for the purpose of the study. The total sample constituted from two taluks was 120.

Yield gap- It refers to the difference between the potential yield obtained at the research station and farmer's actual yield. The index of Yield gap refers to the percentage of the yield potential realized *i.e.,*

$$\text{Index of Yield gap} = \frac{\text{Potential yield} - \text{Actual yield}}{\text{Potential yield}} \times 100$$

Potential yield -The maximum yield obtained in the farmers environment or research station. The potential Sunflower yields were arrived based on the yields obtained in the demonstrations conducted by the scientists of University of Agricultural Sciences, Bengaluru. The potential yield of Sunflower is 5q/acre.

Actual yield- It refers to the actual Sunflower yield per acre obtained by the farmers (respondents) in the study. It was used to compute the Yield gap index.

Results and Discussion

Comparison of sunflower yield in research station and on farmers field

The figures relating to potential farm yield and actual farm yield of sunflower arrived at in the present study are shown in Table 1. As it could be observed from the table, the potential yield of sunflower was 5 q per acre, while the average yield of big farmers on their field (actual farm yield) was 4.12 q per acre resulting in average yield gap of 0.88 q per acre. On the other hand, small farmers had high yield gap (1.69 q/acre) with the actual farm yield of 3.31 q per acre. Small farmers had high yield gap compared to big farmers. The gap percentage was 33.80 per cent in small farmers and 17.60 per cent in big farmers. The reason for more gap in yield may be due to lack of knowledge about improved technologies, lack of irrigation facilities and resource constraints. These findings are in accordance with the findings of Nagaraj (1999) [3].

Table 1: Comparison of sunflower yield in research station and on farmers field (n=120)

Sl. No	Category of farmers	Yield (quintals/acre)			
		Potential yield	Actual yield	Yield gap	% of gap
1	Big farmers	5.00	4.12	0.88	17.60
2	Small farmers		3.31	1.69	33.80

Overall yield gap of small and big farm sunflower growers

The data in Table 2 indicated the overall yield gap of small and big sunflower growers half of the big farm growers had low (50.00%) level of yield gap, followed by medium gap (46.66%) and high level of yield gap (03.34%). Whereas, in case of small farmers, majority of respondents had high (61.68%) level of yield gap, followed by medium gap (26.66%) and low level of yield gap (11.66%).

Table 2: Overall yield gap of small and big farm sunflower growers (n=120)

Level of yield gap	Small farmers (n1=60)		Big farmers (n2=60)		Total	
	F	%	F	%	F	%
Low (< 15.60%)	07	11.66	30	50.00	37	30.83
Medium (15.61- 32.14%)	16	26.66	28	46.66	44	36.67
High (> 32.15%)	37	61.68	02	03.34	39	32.50

When the pooled sample was considered, 36.67 per cent, 32.50 per cent and 30.83 per cent of sunflower growers possessed medium, high and low yield gap respectively. This might be due to small farmers had poor knowledge about recommended technologies, lack of motivation and resource crunch compared to big farmers. (Fig.1).

Yield gap index of small and big farm sunflower growers

A glance at Table 3 reveals that, big farm sunflower growers had lesser (17.60) yield gap index compared to small farmers (33.80). The data was subjected to 'z' test and the results indicated that there was significant difference in yield gap of small and big farm sunflower growers and the big farmers obtained higher yield than small farmers. The overall yield gap index of sunflower growers was 25.70. The farmers were not in a position to exploit the maximum yield potential because of two reasons. One was the environmental condition under which the potential yield was determined were different from those prevailing on the farmers field and the most important reason was the difficulties in duplicating certain aspects of technology on the farmers field. However, it is realistic to compare the potential farm yield with the actual yield. The higher yield gap observed in the study may be attributed mainly to the biological and socio-economic constraints operating in the farmers' fields. The biological constraints are related to the non-adoption of the recommended technology or non-application of essential inputs such as seed treatment with biofertilizer, top dressing with nitrogen, pest and disease management at appropriate time, weed management at right time and bird's problem at grain filling stage.

Table 3: Yield gap index of small and big farm sunflower growers (n=120)

Category of farmers	Frequency	Mean yield gap index	Mean value	'z' value
Small farmers	60	33.80	3.31	7.88**
Big farmers	60	17.60	4.12	
Total	120	25.70	3.71	

Lower quantities of inputs were used by small farmers than the big farmers such as seed treatment chemicals, FYM application and nutrient application. This depressed the productivity on small farmers' field thereby leading to large yield gap on these farms. Some of the management practices also might have contributed to the existence of yield gap. The farmers inability to take up the recommended management practices due to financial, labour and knowledge constraints within a stipulated time could cause a noticeable decline in output.

Conclusion

The study reveals notable differences in sunflower crop yields between large and small farmers in Karnataka's Chamarajanagar area, highlighting the urgent need for focused interventions. Sunflower yields were much lower than the estimated potential yield of 5 quintals per acre, with large farmers producing 4.12 quintals and small farmers producing just 3.31 quintals. A yield gap index of 33.80% for small farmers and 17.60% for their bigger counterparts was the outcome of this discrepancy. Small farmers' socioeconomic limitations, a lack of understanding about sophisticated agricultural techniques and poor irrigation infrastructure are some of the main causes of this output disparity. Farmers are unable to maximize their output potential because of the dependence on conventional methods and reduced input utilization, which worsens the problem. The oilseed industry needs to support better farming practices and provide small farmers better access to resources in order to increase production and sustainability. This might help close the gap between potential and actual yields by implementing customized training programs, providing financial assistance and improving irrigation infrastructure. India's agricultural sector may be strengthened, its oilseed output increased and its reliance on imports decreased by tackling these issues. To maintain food security and regional economic stability, future studies should concentrate on putting interventions into place and assessing their effectiveness in raising small farmers' production.

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