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Analyzing yield gap and technology adoption among sunflower growers in Chamarajanagar, Karnataka: The role of education, knowledge and extension services

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Abstract
This study investigates the relationship between various independent variables and the yield gap among small and big farm sunflower growers in Chamarajanagar district, Karnataka, highlighting the crucial role of education, knowledge, and extension services in agricultural productivity. Utilizing an ex-post facto research design, the study sampled 120 sunflower growers from selected villages known for sunflower cultivation. The findings reveal significant negative correlations between the yield gap and factors such as education, achievement motivation, and extension participation, indicating that higher education levels and increased knowledge lead to improved yields. Notably, annual income also shows a negative correlation with yield gaps, suggesting that financially stable farmers are more likely to adopt new technologies. While factors like age and farming experience did not significantly affect yield gaps, risk orientation and cosmopoliteness were linked to the successful adoption of advanced farming techniques. The study also finds a positive relationship between various independent variables and the extent of technology adoption among farmers, underscoring the importance of continuous learning and innovation in enhancing agricultural output. Overall, the results emphasize the need for targeted educational initiatives, effective extension services, and financial support to boost oilseed production, thereby contributing to India's food security and economic stability. These insights provide a roadmap for policymakers and agricultural stakeholders aiming to address challenges in the oilseed sector and improve overall agricultural performance.

Keywords: Yield gap, sunflower growers, Chamarajanagar district, Karnataka

Introduction
India is mostly dependent on agriculture, a crucial part of its economy, with 70% of its people residing in rural regions. Merely 159.70 million hectares out of the 329 million acre total geographical area are suitable for farming, with around 82.60 million hectares being irrigated. The predicted need for 284 million tons of food grains necessitates increasing agricultural output because two-thirds of the cultivable area is dry. India's agriculture is changing as it moves toward more contemporary commercial farming practices. Even if resource use has improved, there are still issues with raising production per unit of land, which emphasizes the need for technical innovation. Reducing the production volatility that has historically impacted Indian farming requires the adoption of sophisticated agricultural technologies. Increasing production of food crops, cash crops, and oilseeds is vital to support the growing population and supply raw materials for industries and exports.

To feed the world's growing population and provide raw materials for industry and exports, oilseed, cash crop, and food crop production must increase.

The oilseed sector holds a unique position in Indian agriculture, as the country ranks fourth globally in terms of vegetable oil production and consumption, after the US, China, and Brazil. Oilseeds contribute significantly to agricultural output, accounting for around 10% of the total crop sector production. Mustard, soybeans, groundnuts, rapeseed, and sunflower are important oilseed crops that have been growing rapidly since their introduction in 1969.

During the 2015-16 fiscal year, imports and local production accounted for the majority of India’s 235 million-ton vegetable oil consumption. Domestic sources include secondary crops like coconut and cottonseed, as well as groundnuts, sunflowers, and coconuts.

India's concerning dependence on foreign sources is shown by the fact that 148.20 million tonnes of imports were needed because domestic production could only satisfy 89 million tonnes of demand. During severe monsoon periods, this 60-65% dependency on imports worsens. The consumption of vegetable oil is increasing at a pace of 6% annually, which is substantially higher than the domestic supply, which has been increasing at a rate of just 2% annually. In India, Karnataka, Maharashtra, Odisha, and Andhra Pradesh are the main states that produce sunflowers; Karnataka is known as the "Sunflower State" because of its significant output.

Despite the expansion of sunflower output and area, productivity is still poor when compared to other nations since many sunflower fields are grown in rain-fed regions that are vulnerable to bird damage. A number of initiatives, including the Technology Mission on Oilseeds (TMO) and the National Oilseed and Development Project, have been launched by the Indian government to increase oilseed output. The issue of low oilseed crop production is still present overall, necessitating focused efforts to boost yields, enhance irrigation, and implement effective pest management techniques. In order to increase local oilseed production and reduce dependency on imports, these issues must be resolved. This would ultimately increase India's food security and economic stability.

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. 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.

Results and Discussion

Relationship between independent variables and yield gap of small and big farm sunflower growers

Table 1 shows that, at the one percent significance level, independent variables like education, knowledge, achievement motivation, risk orientation, management orientation, Cosmo politeness, scientific orientation, extension contact, and extension participation of small farm sunflower growers had a negative and significant correlation with the yield gap. At the five percent significance level, however, there was a negative and significant correlation between the yield gap and yearly income, inventive inclination, and mass media exposure. The yield disparity did not significantly correlate with age, family size, or agricultural experience.

At the one percent significance level, factors like education, knowledge, achievement motivation, cosmopoliteness, innovative proneness, extension contact, extension participation, and mass media exposure all had a negative and significant correlation with the yield gap in the case of large farm sunflower growers. Additionally, the yield gap has a negative and significant correlation with yearly income, management orientation, and scientific orientation at the five percent significance level. There was no significant correlation between the production gap of large farmers and the remaining variables, including age, family size, farming experience, and risk orientation. The production difference between small and large farm sunflower producers was shown to be negatively and significantly correlated with education, meaning that the greater the education, the higher the output. The possible reason could be formal education of the respondents that might have helped them to understand the improved technologies and to relate to his situation and thereby realize more yields. The findings revealed a negative and significant relationship between annual income and yield gap of small and big farmers, which means that more the annual income higher will be the yield. The probable reason could be that if the annual income is more farmers will adopt new technologies and follow the recommended practices which in turn increases the yield.

Table 1: Relationship between independent variables and yield gap of small and big farm sunflower growers, (n=120)

Sl. No.	Characteristics	Correlation co-efficient (r)	
		Small farmers (n1=60)	Big farmers (n2=60)
1	Age	0.480	0.093
2	Education	-0.597**	-0.433**
3	Family size	-0.165	-0.116
4	Annual income	-0.307*	-0.276*
5	Farming experience	0.297	0.068
6	Knowledge	-0.430**	-0.344**
7	Achievement motivation	-0.554**	-0.443**
8	Risk orientation	-0.442**	-0.244
9	Management orientation	-0.489**	-0.281*
10	Cosmopoliteness	-0.594**	-0.453**
11	Innovative proneness	-0.293*	-0.450**
12	Scientific orientation	-0.419**	-0.277*
13	Extension contact	-0.410**	-0.543**
14	Extension participation	-0.476**	-0.504**
15	Mass media exposure	-0.327*	-0.420**

** = Significant at 1 percent level. *= significant at 5 percent level

The findings revealed a non-significant relationship between experience in sunflower cultivation and yield gap of small and big farm sunflower growers. The possible reason might be that, since the study area is exclusively sunflower growing region and the general tendency of the farmers was to acquire latest knowledge in order to derive maximum

benefit out of it irrespective of their experience in cultivation. The length of experience of farmers had not come in the way of their attaining yield levels. Knowledge of both small and big farm sunflower growers had negative and significant correlation with the yield gap. The possible reason may be that, farmers with high knowledge are ready to take up new technologies and adopt improved practices for achieving higher yields. Naturally those farmers who adopt new practices will experience more yield. Achievement motivation of small and big farm sunflower growers observed to have negative and significant relationship with yield gap. This is due to the reason that, farmers took adequate risks to achieve success, stabilize and maximize yield and income in sunflower production in order to enjoy good lifestyle. Hence, achievement motivation was significantly correlated with the extent of adoption of improved cultivation practices.

The correlation coefficient value for the two variables *viz*., management orientation and yield gap of small farmers showed a negative and significant relationship. Small farmers with medium mass media exposure, low cosmopoliteness, medium scientific orientation and medium extension contact and extension participation are not likely to adopt new technologies. Cosmopoliteness was found to have negative and significant relationship with yield gap. The reason could be that, farmers with high cosmopoliteness can get information from other sources and they have good contact with agricultural officers.

The correlation coefficient value for the two variables *viz*., innovative proneness and yield gap of small and big farmers exhibited a negative and significant relationship. This might be due to the fact that farmers with medium to high innovative proneness are prone to try new ideas. Such disposition might have influenced them to adopt the recommended practices. A negative and significant relationship was observed between scientific orientation and yield gap of small and big farm sunflower growers. Scientifically oriented farmers would be more innovative and progressive and would like to get more income by increasing the productivity.

Extension contact, extension participation and mass media exposure had negative and significant relationship with yield gap of small and big farm sunflower growers. Because, if sunflower growers participate in extension activities and had good contact with the Agriculture officer to greater extent, they can get valuable advices to enhance their productivity and returns. Mass media play an important role in creating awareness about new and improved agricultural practices. Growers with higher mass media exposure are able to get acquaint with knowledge of new technologies and cultivation practices.

Relationship between independent variables and extent of adoption of technologies by small and big farm sunflower growers

Table 2 shows that, at the one percent significance level, the degree of adoption of sunflower technologies was positively and significantly correlated with the following variables: education, knowledge, achievement motivation, risk orientation, management orientation, cosmopoliteness, innovative proneness, scientific orientation, extension contact, extension participation, and mass media exposure of both small and large farm sunflower growers. At the one percent significance level, however, there is a positive and significant correlation between small farmers' yearly income and the degree of adoption. However, there is no significant correlation between the level of adoption and the age, family size, and agricultural experience of small and large farmers. Additionally, at the five percent significance level, there is a positive and significant correlation between big farmers' yearly revenue and small farmers' exposure to the media.

The aforementioned tendency may be explained by the fact that education increases the degree of acceptance among sunflower producers, and it goes without saying that more educated sunflower farmers will embrace innovations and better techniques in order to increase their level of profit. It is likely that farmers with larger holdings will have more opportunities and potentialities to try and adopt a large number of technological innovations in order to get higher yield and improve economic conditions, which is why annual income has a positive and significant relationship. It was discovered that the degree of adoption was substantially correlated with the knowledge of sunflower farmers, both large and small. The most likely explanations might be that knowledgeable sunflower farmers would follow the suggested procedures and readily comprehend the new technologies. Achievement motivation, risk orientation, cosmopoliteness and scientific orientation were significantly correlated. This is due to the reason that farmers took moderate risks to precisely to achieve success, stabilize and maximize yield and income in sunflower production in order enjoy good lifestyle.

Table 2: Relationship between independent variables and extent of adoption technologies of small and big farm sunflower growers, (n=120)

Sl. No.	Characteristics	Correlation co-efficient (r)	
		Small farmers (n1=60)	Big farmers (n2=60)
1	Age	-0.184	-0.231
2	Education	0.708**	0.630**
3	Family size	0.182	0.219
4	Annual income	0.338**	0.290*
5	Farming experience	-0.192	-0.164
6	Knowledge	0.558**	0.784**
7	Achievement motivation	0.631**	0.627**
8	Risk orientation	0.574**	0.391**
9	Management orientation	0.530**	0.391**
10	Cosmopoliteness	0.572**	0.510**
11	Innovative proneness	0.589**	0.685**
12	Scientific orientation	0.608**	0.663**
13	Extension contact	0.537**	0.412**
14	Extension participation	0.645**	0.659**
15	Mass media exposure	0.322*	0.438**

** = Significant at 1 percent level. * = Significant at 5 percent level

Innovative proneness, extension contact, extension participation and mass media exposure were found to be significantly related with their extent of adoption. The reasons for the above trend are that, sunflower growers consulting Agriculture officers, Assistant Agriculture officers and sunflower growers were actively participated in the extension activities conducted such as, demonstrations, field days, farmers fairs and meetings etc., which would promote acquisition and consequent adoption of improved cultivation practices.

Further, variables such as age, family size, farming experience of small and big farmers were found to be non-significant with extent of adoption. The possible reasons might be due to farmers of different age group having similar capacity to gain knowledge level regarding adoption improved cultivation practices in sunflower, the length of experience and family size of farmers in farming had not come in the way of their attaining knowledge and adoption of improved practices.

Conclusion

The study highlights critical relationships between various independent variables and the yield gap among small and big farm sunflower growers in Chamarajanagar district, Karnataka. The findings indicate that education, knowledge, achievement motivation, and extension participation are pivotal in reducing the yield gap, emphasizing the importance of improved agricultural practices and technology adoption. For both small and big farmers, higher levels of education and knowledge correlate significantly with better yields, suggesting that educational initiatives could play a vital role in enhancing productivity. Moreover, the negative correlation between annual income and yield gap underscores that financial stability allows farmers to invest in new technologies, thereby improving their yields. The findings also reveal that risk orientation and cosmopoliteness contribute to the successful adoption of advanced farming techniques. Interestingly, factors such as age and farming experience did not significantly influence yield gaps, indicating that newer farmers can still achieve competitive yields through education and access to information.

In terms of technology adoption, the study demonstrates that a positive relationship exists between various independent variables particularly education, knowledge, and extension activities—and the extent of technology adoption among farmers. This suggests that fostering an environment that encourages continuous learning and innovation is essential for enhancing agricultural productivity. Overall, addressing the identified gaps and promoting education, extension services, and financial support can significantly boost oilseed production, contributing to India's food security and economic stability.

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