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Effect of socio-economic characteristics of farmers on dragon fruit productivity in Beed district of Maharashtra

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ABSTRACT

The study examined the effect of selected socio-economic characteristics of farmers on dragon fruit productivity in Beed district of Maharashtra during the agricultural year 2025-2026. Primary data were collected from 80 dragon fruit growers through a structured interview schedule. The socio-economic characteristics considered were family size, age, education, landholding and occupation, along with year of orchard. Multiple linear regression analysis was used to estimate their effect on dragon fruit productivity. The regression model explained 80.00 per cent of the variation in productivity ($R^2 = 0.80$) and the F -value of 49.98 indicated that the fitted model was statistically significant. Age had a significant negative effect on productivity, while occupation and year of orchard had significant effects. Family size, education and landholding were non-significant. The coefficient of year of orchard was positive and highly significant, indicating a strong association between orchard maturity and productivity. The findings suggested that farmer characteristics and orchard age were important factors associated with differences in dragon fruit productivity in the study area.

Keywords: Dragon fruit, Socio-economic characteristics, Productivity, Multiple linear regression, R^2 , F -value

Introduction

Dragon fruit (*Hylocereus spp.*), popularly known in India as Kamalam, is an emerging high-value horticultural crop. Its relatively low water requirement, adaptability to suitable agro-climatic conditions and growing market demand have encouraged farmers to consider it as an option for crop diversification. In Maharashtra, dragon fruit cultivation has gained importance, particularly in dryland and semi-arid regions. The crop has potential to generate higher returns from relatively limited water resources and has therefore attracted increasing attention among farmers.

During 2024-25, the area under dragon fruit cultivation in India was reported at 14.64 thousand hectares with production of 55.78 thousand metric tonnes. Maharashtra accounted for 0.80 thousand hectares and 6.20 thousand metric tonnes of production. The increasing importance of the crop provides a basis for examining productivity at farm level. (Source: Ministry of Agriculture & Farmers Welfare, Govt. of India.)

Productivity of dragon fruit is influenced not only by production practices but also by the socio-economic conditions and management capacity of farmers. Age, education, family resources, landholding and occupation may influence access to information, adoption of improved practices and allocation of farm resources. Therefore, the present study was undertaken to examine the effect of selected socio-economic characteristics of farmers on dragon fruit productivity in Beed district of Maharashtra.

Objective

To know the effect of socio-economic characteristics of farmers on dragon fruit productivity.

Materials and method

Study area and sampling

The study was conducted in Beed district of Maharashtra during the agricultural year 2025-2026. Beed district comprises ten talukas, namely Beed, Georai, Majalgaon, Ambajogai, Kaij, Dharur, Parli, Ashti, Shirur (Kasar) and Wadwani. The district was selected considering significant area under cultivation and the importance of dragon fruit cultivation in the area.

A multistage sampling design was adopted for the selection of respondents. Maharashtra was selected in the first stage, Beed district in the second stage and dragon fruit growers were selected through simple random sampling in the final stage. A total of 80 dragon fruit growers were selected for the study. The list of growers was obtained from the District Agriculture Office and other relevant sources. Only farmers having bearing-stage dragon fruit orchards and actively engaged in cultivation and marketing were included, while farmers

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with newly established, non-bearing orchards were excluded. Primary data were collected through personal interviews using a structured and pre-tested schedule for the agricultural year 2025-2026.

Variables and analytical technique

Frequency distribution was used to classify and present the respondents according to their socio-economic and farm characteristics. The frequency and percentage of respondents in each category were calculated using the following formula:

$$P = (f/N) \times 100$$

Where,

P = Percentage of respondents in a particular category **f** = Frequency (number of respondents) in a particular category **N** = Total number of respondents

The dependent variable was dragon fruit productivity. The explanatory variables included family size, age, education, landholding, occupation and year of orchard. Multiple Linear Regression (MLR) was used to estimate the effect of these variables on productivity.

The regression model was specified as:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_p X_{pi} + \varepsilon_i$$

where Y_i = dependent variable for the i th observation;

β_0 = intercept; $\beta_1, \beta_2, \dots$,

β_p = regression coefficients;

$X_{1i}, X_{2i}, \dots, X_{pi}$ = independent variables;

ε_i = error term;

n = number of observations.

Results and discussion

Socio-economic characteristics of dragon fruit growers

The socio-economic characteristics of the sample dragon fruit growers are presented in Table 4.1. The results indicated that the respondents belonged to different age groups. Out of the 80 respondents, 15 farmers (18.75%) belonged to the age group of 21-30 years, while 16 farmers (20.00%) were in the 31-40 years age group. The number of respondents in the 41-50 years age group was 23 (28.75%), whereas the highest proportion, 26 farmers (32.50%), belonged to the above 50 years age group. Thus, the majority of the respondents (61.25%) were above 40 years of age, indicating that dragon fruit cultivation was predominantly undertaken by middle-aged and older farmers. This may be attributed to their greater farming experience, accumulated resources and ability to undertake investment in a relatively capital-intensive horticultural crop.

Regarding educational status, 2 respondents (2.50%) were illiterate, while 4 respondents (5.00%) had primary-level education. A total of

11 respondents (13.75%) had completed secondary education, whereas 24 respondents (30.00%) had higher secondary education. The highest proportion, 39 respondents (48.75%), were educated up to the graduate level. Therefore, 63 respondents (78.75%) had attained higher secondary education or above. The relatively high level of education among the sample growers might have helped them in understanding technical information, adopting improved cultivation practices, maintaining farm records and accessing market-related information.

The average family size of the sample respondents was 6.62 members per household. This indicated that the sample households had relatively large family units. A larger family size could provide greater availability of family labour for various farm operations, including intercultural operations, harvesting, grading and other post-harvest activities. However, it could also increase household consumption and expenditure requirements.

With respect to occupation, agriculture was the major occupation among the sample respondents. Out of 80 respondents, 54 farmers (67.50%) reported agriculture as their principal occupation. This was followed by business, accounting for 19 respondents (23.75%), while 7 respondents (8.75%) were primarily engaged in service. Thus, agriculture was the predominant occupation, indicating that dragon fruit cultivation formed an important part of the livelihood activities of the majority of the sample households. The involvement of respondents in business and service also indicated that dragon fruit cultivation was undertaken by farmers having diversified occupational backgrounds.

The average landholding of the sample dragon fruit growers was 3.37 ha. In terms of size of landholding, 30 respondents (37.50%) possessed land up to 2 ha, while 33 respondents (41.25%) had landholdings between 2 and 4 ha. The remaining 17 respondents (21.25%) possessed more than 4 ha of land. Thus, the largest proportion of growers belonged to the 2-4 ha landholding category (41.25%), followed by those having up to 2 ha (37.50%) and above 4 ha (21.25%). The average landholding of 3.37 ha suggested that the sample farmers generally had a moderate land base, enabling them to allocate a portion of their holdings to commercial horticultural crops such as dragon fruit.

The livestock position of the sample households showed that, on an average, each household possessed 0.72 pairs of bullocks, 1.58 buffaloes and 1.98 cows. Among the different categories, cows were the most commonly possessed livestock, followed by buffaloes and bullock pairs. The possession of livestock could contribute to the availability of farmyard manure and other organic resources for use in crop production. The presence of bullock pairs also indicated that some farm households continued to maintain draught animals for agricultural operations.

Overall, the socio-economic characteristics revealed that the sample dragon fruit growers were predominantly middle-aged and older farmers, relatively well educated, mainly dependent on agriculture and possessed moderate-sized landholdings with livestock resources

Table 1. Socio-economic characteristics of dragon fruit growers ($N = 80$)

Particular		Frequency / Average	Percentage
Age	21-30 years	15	18.75
	31-40 years	16	20.00
	41-50 years	23	28.75
	Above 50 years	26	32.50
Education	Illiterate	2	2.50
	Primary	4	5.00
	Secondary	11	13.75
	Higher secondary	24	30.00
	Education: Graduate level	39	48.75
Family size	Family size	6.62	-

(continued on next page)

Particular		Frequency / Average	Percentage
Occupation	Agriculture	54	67.50
	Service	7	8.75
	Business	19	23.75
Landholding (ha)	Landholding (ha)	3.37	-
	Up to 2 ha	30	37.50
	2-4 ha	33	41.25
	Above 4 ha	17	21.25
Livestock	Bullock pair	0.72	-
	Buffalo	1.58	-
	Cow	1.98	-

Effect of socio-economic characteristics on dragon fruit productivity

The effect of selected socio-economic characteristics on dragon fruit productivity was estimated using multiple linear regression analysis. The results presented in Table 2 showed that the coefficient of determination (R^2) was 0.80, indicating that 80.00 per cent of the total variation in dragon fruit productivity was explained jointly by the explanatory variables included in the model, namely family size, age, education, landholding, occupation and year of orchard. The remaining 20.00 per cent of the variation in productivity was attributed to other factors not included in the model and random variation. The F -value of 49.98 was statistically significant, indicating that the fitted regression model as a whole was significant. The estimated intercept was 47.72, indicating the expected level of productivity when the values of the explanatory variables were held at zero.

The coefficient of family size was -0.3724, with a standard error of 1.3295 and a t -value of -0.280, which was non-significant. The negative coefficient indicated an inverse relationship between family size and dragon fruit productivity. However, the non-significant result indicated that variation in family size did not have a statistically significant influence on dragon fruit productivity. Thus, an increase in family size, keeping other variables constant, was associated with a marginal decline of 0.3724 units in productivity, although this effect was statistically insignificant.

The coefficient of age of the farmer was -0.2825, with a standard error of 0.1691 and a t -value of -1.671, which was significant at the 5 per cent level. The negative coefficient indicated that age had an inverse relationship with dragon fruit productivity. Keeping other variables constant, a one-unit increase in the age of the farmer was associated with a decrease of 0.2825 units in productivity. The significant negative relationship suggested that younger growers may have been relatively more capable of adopting improved production practices, managing orchard operations efficiently and responding to technological and market changes.

The coefficient of education was -0.1634, with a standard error of 2.1555 and a t -value of -0.076, which was non-significant. The negative coefficient indicated an inverse relationship between education and dragon fruit productivity; however, the very low t -value and non-significant result indicated that educational attainment did not have a statistically significant influence on productivity after controlling for the other explanatory variables. A one-unit increase in the education variable was associated with a decrease of 0.1634 units in productivity, but this relationship was statistically insignificant.

The coefficient of landholding was 0.7030, with a standard error of 0.9119 and a t -value of 0.771, which was non-significant. The positive coefficient indicated a direct relationship between landholding size and dragon fruit productivity. A one-unit increase in landholding was associated with an increase of 0.7030 units in productivity, keeping other variables constant. However, the relationship was not statistically significant, indicating that differences in overall landholding size did not significantly affect dragon fruit productivity among the sample growers.

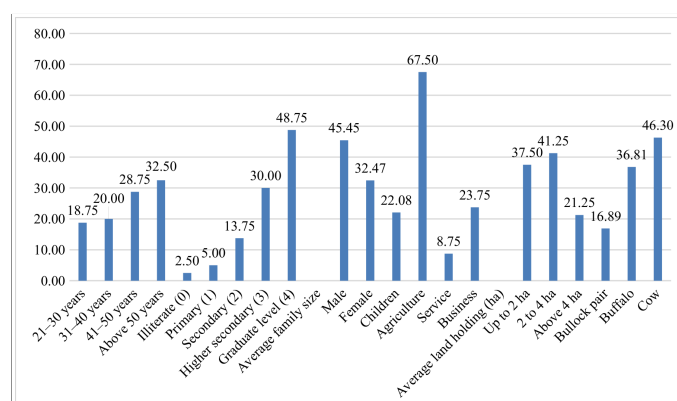


Figure 1. Socio-economic Characteristics of Dragon Fruit Growers

The coefficient of occupation was -8.8169, with a standard error of 2.5331 and a t -value of -3.481, which was significant at the 1 per cent level. The negative and statistically significant coefficient indicated that occupation had a significant influence on dragon fruit productivity. Since occupation was represented through coded categories, the coefficient should be interpreted according to the coding scheme adopted for the occupation variable. The magnitude of the coefficient suggested that differences in occupational category were associated with a 8.8169-unit difference in productivity, ceteris paribus.

The coefficient of year of orchard was 27.4653, with a standard error of 1.6315 and a t -value of 16.835, which was significant at the 1 per cent level. The positive coefficient indicated a strong direct relationship between orchard age and dragon fruit productivity. A one-year increase in the age of the orchard was associated with an increase of 27.4653 units in productivity, holding the other explanatory variables constant. The highly significant positive relationship indicated that orchard age was an important factor influencing dragon fruit productivity. This could be attributed to the increasing productive capacity of dragon fruit plants as orchards matured and reached higher yielding stages. Among all the explanatory variables included in the model, year of orchard recorded the highest t -value (16.835), indicating its comparatively strongest statistical association with dragon fruit productivity.

Overall, the regression results indicated that age, occupation and year of orchard significantly influenced dragon fruit productivity, while family size, education and landholding did not show a statistically significant effect. Among the significant variables, year of orchard had the strongest positive association, whereas age and occupation showed negative relationships with productivity. The R^2 value of 0.80 further indicated that the selected socio-economic characteristics jointly provided a substantial explanation of differences in dragon fruit productivity among the sample growers.

Intercept 47.72
 R^2 0.80
 F -value 49.98
 Observations 80

Table 2. Multiple linear regression estimates of socio-economic characteristics affecting dragon fruit productivity

Variable	Regression coefficient	Standard error	t-value
Family size	-0.3724	1.3295	-0.280 NS
Age (year)	-0.2825	0.1691	-1.671**
Education	-0.1634	2.1555	-0.076 NS
Landholding (ha)	0.7030	0.9119	0.771 NS
Occupation	-8.8169	2.5331	-3.481***
Year of orchard (year)	27.4653	1.6315	16.835***

Note: *** Significant at 1 per cent level

** Significant at 5 per cent level

NS = Non-significant.

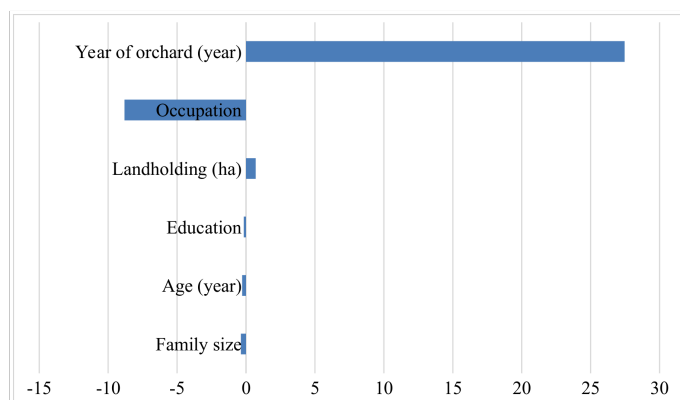


Figure 2. Regression coefficients of socio-economic characteristics affecting dragon fruit productivity

Discussion

The significant negative association of age with productivity suggested that younger farmers may have had relatively better productivity, possibly due to greater willingness to adopt improved production practices and manage orchard operations efficiently. This interpretation was an inference from the observed relationship and did not represent a direct causal effect.

The positive and highly significant association of year of orchard with productivity indicated that orchard age or maturity was an important factor associated with higher productivity. The finding was comparable with Jadhav *et al.* (2025) [1], who reported that the age of dragon fruit orchard had a positive and significant effect on productivity in Latur district of Maharashtra. The findings of the present study therefore provided an empirical basis for understanding variations in dragon fruit productivity in the study area.

The results were also considered in relation to earlier literature reviewed in the study. Dhakal *et al.* (2021) [2] reported that education was positively related to farmers' knowledge of dragon fruit cultivation, while Mehta *et al.* (2024) [3] highlighted the importance of extension services, cooperative participation, technical training and institutional support in dragon fruit development. Kolekar *et al.* (2024) [4] similarly reported that socio-economic characteristics and access

to institutional support influenced investment in improved orchard management and productivity among pomegranate growers in Maharashtra.

Conclusion

The study concluded that selected socio-economic and orchard-related characteristics were associated with variations in dragon fruit productivity among the 80 sample growers. The regression model explained 80.00 per cent of the variation in productivity and was statistically significant. Age had a significant negative effect, while occupation and year of orchard had significant effects. Family size, education and landholding were non-significant. The year of orchard showed the strongest statistical association with productivity. The findings indicated the importance of appropriate orchard management and farmer-oriented technical support for improving dragon fruit productivity in the study area.

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