ISSN Print: 2664-844X
ISSN Online: 2664-8458
NAAS Rating (2025): 4.97
IJAFS 2025; 7(8): 1325-1327
www.agriculturaljournals.com
Received: 10-05-2025
Accepted: 15-06-2025

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Determinants of adoption of Parbhani Suvarna (PBNS-154) safflower variety in Parbhani district of Maharashtra

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DOI: https://www.doi.org/10.33545/2664844X.2025.v7.i8m.706

Abstract
The research investigated the determinants affecting the adoption of the Parbhani Suvarna (PBNS-154) safflower variety and its impact on the production system in Parbhani district, Maharashtra. Using a multi-stage sampling approach, 120 farmers were selected, including 60 adopters and 60 non-adopters, across two tehsils of the district. To analyze the role of socio-economic and recommended factors in the adoption of PBNS-154, a Logit (logistic regression) model was employed. Results indicated that socio-economic attributes such as age, education, and farm size, along with recommended inputs like seeds and chemical fertilizers, significantly influenced adoption behavior. Among these, income showed significance at the 5% level, while the time of sowing was significant at the 10% level. Furthermore, seed usage and chemical fertilizer application were found to be significant at the 5% level.

Keywords: Determinants, Parbhani Suvarna (PBNS-154), significant, logit or logistic regression

Introduction
Safflower is among the oldest crops cultivated by humans, with evidence of its use dating back to around 2500 BC in Mesopotamia. Safflower offers several agronomic benefits, including improved crop yields, better soil health, increased farm income, and disease and weed suppression. It contributes to food and industrial oil production and supports environmental and economic sustainability. The Parbhani Suvarna (PBNS-154) is a high-performing safflower variety known for its desirable agronomic traits. It contains up to 30.9% oil in its seeds, making it valuable for oil extraction. In terms of maturity, the variety takes around 124 to 126 days to mature under rainfed conditions and 134 to 136 days under irrigated conditions. It offers good yield potential, producing about 10 to 12 quintals per hectare under rainfed conditions and 15 to 17 quintals per hectare when grown with irrigation. The PBNS-154 variety exhibits moderate resistance to Fusarium wilt and Alternaria leaf spot diseases, as well as to aphid infestations. Additionally, it shows resistance to biotic stresses, making it a reliable choice for cultivation under varying environmental conditions.

Methodology Logit or Logistic model
The third objective, identifying the determinants of adoption, was addressed using logistic regression-a statistical method employed to examine the relationship between a single dependent variable and multiple independent variables. The corresponding multiple regression equation is expressed in the following form.

$$\text{Logit} = Li = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \ldots\ldots\ldots\ldots + \beta 7X7 + \mu$$

Where,
Y = Dependent variable B0 = Intercept

B1, B2, B3……., B7 = Regression coefficients.

With respect to……. X1, X2, X3…….X=Explanatory variables.

Sr. No.	Dependent Variable (Y)	Particular	Independent Variable (X)	Particular
1	Adopter	1	Age	X1
2	Non-Adopter	0	Education	X2
3			Income	X3
4			Seed	X4
5			Sowing Time	X5
6			Spacing	X6
7			Chemical Fertilizer	X7

The basic model of Logit estimation (Gujrati, 2004)

IIPi = E(Y = 1/Xi) = 1/ 1+e −(β1+β2xi) (1)

For ease of exposition, we right (1) as

Pi =1/1+e^{-z} i = e^{z} /1+e^{z} (2)

Where, Zi= β1+β2Xi

Let PiP_iPi denote the probability that a farmer adopts the Parbhani Suvarna (PBNS-154) safflower variety. Then 1−Pi1 - P_i1−Pi represents the probability that the farmer is a non-adopter, and eee is the base of the natural logarithm (the exponential constant).
Equation (2) denotes a cumulative logistic distribution function. It can be observed that ZiZ_iZi varies from −∞-\infty−∞ to +∞+\infty+∞, pip_ipi lies within the range of 0 to 1, and the logit extends from −∞-\infty−∞ to +∞+\infty+∞.

Dependent variable: (Y)

- **Adopter:** adopter of Parbhani Suvarna (PBNS-154) safflower variety taken '1' as a particular.
- **Non-adopter:** Non-adopter of Parbhani Suvarna (PBNS-154) safflower variety taken '2' as a particular.

Independent Variable: (X)

Socio-economic determinants

- **Age:** According to the study, the age of farmers adopting Parbhani Suvarna (PBNS-154) is generally higher than that of non-adopters, indicating that adopters possess greater farming experience compared to non-adopters.
- **Education:** The rate of illiteracy was found to be higher among non-adopters compared to adopters. Similarly, the majority of both adopters and non-adopters had completed higher education.
- **Yield:** The yield of safflower is classified into two categories, namely the main produce and the by-produce. The study revealed that farmers adopting Parbhani Suvarna (PBNS-154) safflower obtained a higher yield compared to non-adopters.
- **Income:** The annual income of farmers adopting Parbhani Suvarna (PBNS-154) was higher compared to that of non-adopters.

Recommended Determinants

- **Seed:** As per the recommendations, the seed rate for the Parbhani Suvarna (PBNS-154) safflower variety is 10-12 kg per hectare, which helps in maintaining an adequate plant population in safflower fields.
- **Sowing time:** As per the recommendation sowing time was between 15 October 15 November.
- **Spacing:** 45×15 cm. recommended spacing for Parbhani Suvarna (PBNS-154) Safflower variety.
- **Chemical fertilizer:** The recommended dose of chemical fertilizers for safflower is Nitrogen (N), Phosphorus (P), Potash (K), and Sulphur (S) at the rate of 40:25:0:20 kg/ha (NPKS).

Results and Discussion

The results of the logit model analysis highlighted the variables influencing farmers' adoption of the Parbhani Suvarna (PBNS-154) variety. The explanatory variables incorporated a range of socio-demographic and economic factors, including age, education, income, and yield, along with recommended agronomic practices such as seed rate, sowing time, spacing, application of manure, use of chemical fertilizers, and intercultural operations.

Logit or Logistic Model

Logit or Logistic Model					
Determinants of Adoption of Safflower PBNS-154 (Parbhani Suvarna) Variety					
Sr. No.	**Variable**		**Estimate Coefficient**	**Standard error**	**z value**
1	Intercept		-16.61	10.1	-1.641
2	Age	X1	0.08678	0.077	1.114
3	Education	X2	0.06966	0.1223	0.57
4	Income	X3	0.002066**	0.0008992	2.298
5	Seed	X4	-8.555**	4.048	-2.113
6	Sowing time	X5	3.344*	1.939	1.724
7	Spacing	X6	-0.7624	1.37	-0.556
8	Chemical fertilizer	X7	0.6123**	0.2594	-2.36

(Dependent variable: Adoption of Parbhani Suvarna (PBNS-154) Variety (Yes = 1; No = 0). The symbols '**' and '*' denote significance levels at 5 percent and 10 percent, respectively.
The conclusion was the among the significant variables, income shows a positive and statistically significant impact at the 5% level. This indicates that farmers with higher income levels are more likely to adopt the PBNS-154 variety, likely due to better access to resources and lower risk aversion. Similarly, chemical fertilizer use is also positively associated with adoption and significant at the 5% level, suggesting that farmers who are already using chemical inputs are more inclined to adopt improved

varieties, possibly due to their openness to modern agricultural practices.

On the other hand, seed availability has a strong negative effect and is statistically significant at the 5% level. This implies that lack of availability or access to quality PBNS-154 seed is a major barrier to its adoption. Improving the seed supply chain is therefore critical for wider dissemination of this variety. Sowing time is positively associated with adoption and is significant at the 10% level, indicating that farmers who sow on time are more likely to adopt the variety, likely due to better awareness and technical knowledge.

In contrast, variables such as age, education, and spacing did not show statistically significant influence on adoption. This suggests that demographic factors and certain agronomic practices may not have a direct impact on the decision to adopt the PBNS-154 variety in this context.

In summary, the adoption of the Parbhani Suvarna (PBNS-154) safflower variety is significantly influenced by income, seed availability, sowing time, and chemical fertilizer use. These findings highlight the need for targeted interventions, such as improving seed distribution systems, promoting timely sowing practices, and supporting the use of inputs, to enhance adoption rates. Understanding these determinants can help policymakers and agricultural extension services design more effective strategies for promoting improved safflower varieties.

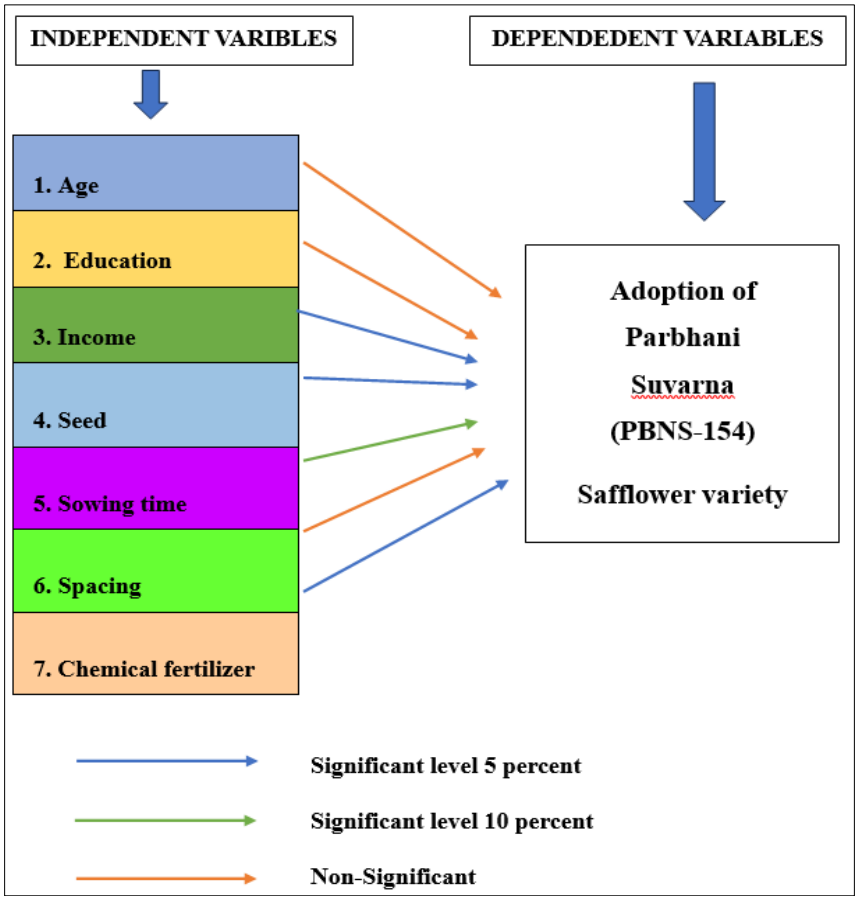

Fig 1: Determinants of adoptation of Parbhani Suvarna (PBNS-154) Variety of Safflower

Conclusion

The logistic regression analysis on the adoption of Safflower PBNS-154 (Parbhani Suvarna) variety reveals that income, sowing time, and use of chemical fertilizer significantly and positively influence adoption decisions, indicating that higher income levels, timely sowing, and use of fertilizers encourage farmers to adopt the variety. Conversely, the seed variable has a significant negative effect, suggesting that issues like high cost or limited availability may hinder adoption. Other factors such as age, education, and spacing show no significant impact on adoption, implying that demographic and agronomic factors play a lesser role compared to economic and management-related variables in influencing the adoption behavior of farmers.

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