

# Identification of factors that influence farmers' buying behavior towards tomato seed through factor analysis: a case study in Chittoor District of Andhra Pradesh

Mantrabuddi Bala Krishna <sup>1\*</sup>, Seedari Ujwala Rani <sup>2</sup>, Indla Bhavani Devi <sup>3</sup>, Guttapalle Mohan Naidu <sup>4</sup>

<sup>1</sup>Research Scholar, Institute of Agribusiness Management, S.V. Agricultural college, Tirupati, ANGRAU, India.

<sup>2</sup>Assistant Professor, Department of Agricultural Economics, S.V. Agricultural college, Tirupati, ANGRAU, India.

<sup>3</sup>Professor, Department of Agricultural Economics, S.V. Agricultural college, Tirupati, ANGRAU, India.

<sup>4</sup>Professor Department of Statistics and Computer Applications, Agricultural College, Naira, ANGRAU, India.

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\*Correspondence  
M. Bala Krishna  
gangakrishna504@gmail.com

Considering the increasing market space among the all vegetable crops and its profitability nature, farmers used to cultivate tomato crop in their major portion of their available land when comparison to other crops. The study was undertaken in Chittoor district to identify the reasons for farmers to buy specific seed or brand of tomato crop. Through factor analysis, it was found that the majority of farmers consider the buying factors is the product value factor with highest mean score (3.89), second factor is product image with mean score (3.83) followed by product convenience with mean score of (3.81), social influence and experiences (3.50). While location and accessibility (3.29) of seed availability, it was also noticed that, after using the brand and once he satisfied from specific brand, farmer will purchase the same brand repeatedly over the years even though its cost is high, anticipating that good returns will cover the cost of cultivation.

*Key words:* tomato, buying, factor analysis, mean score, chittoor district

## INTRODUCTION

Tomato cultivation is one of the most profitable agriculture businesses. Cultivating tomato is an excellent option for those looking to harvest a commercially important crop four times a year. It can be cultivated in both traditional farming and greenhouse farming. Globally, it is cultivated in an area of 4.9 million hectares with the production of 182.3 MT (www.Indiastat.com, 2018). China is the largest producer of tomato with the share of 31.81 percent and United States leads in the productivity. India, it is grown in a prominent area of 0.78 M ha, with the production of 19.75 MT and productivity of 25.04 MT/ ha. Among all states in India, Andhra Pradesh stands first in production (13.9 percent) followed by Madhya Pradesh (12.25percent) and Karnataka (10.54 percent). Chittoor district in Andhra Pradesh contributes to 46.4 per cent and 45.4 per cent of the state's total area and production of tomato crop. Its productivity in district is 1.75 times more than State's productivity and about 3 times more than country's productivity. Farmers give priority to grow tomatoes because of suitable climate. The scope for profit is faster and more than in any other crop which resulted the acreage under tomato increased by 63.3 per cent in the past four years. There is

great need for the good quality seeds which should be made available to the farmers at right time, at right place with required quantities. Before purchasing the seed, farmer gather information from various sources about prices of seed, its yield potential, resistance to pest and diseases, availability of seed brand. Buying behavior is the process where in individuals decided whether, what, when, where, how and from whom to purchase goods and services. Farmer develops loyalty toward brand when farmer get good yield and it is also observed that farmer switch to other brand when the seed is not resistance to pest and disease and credit is not available on specific brand by the dealers. It would be necessary for the tomato seed producing firms or companies to develop perspectives on farmers buying behavior and problem faced by marketers in marketing of tomato seed. The study was undertaken to identify the factors influencing the buying behavior of the tomato growers and the driving forces that influence the loyalty towards a particular brand of the tomato growers.

**MATERIALS AND METHODS**

Purposively selected two mandals or talukas in the Chittoor district. The two talukas are Mulakalacheruvu and Nimmanepalli. Three villages in each mandal were selected based on the highest area and production of tomato. Hence, total of 6 villages were selected for the study. The selected villages were Thavalam, Reddivaripalle, Nimmanapalle, Deverapalle, Peddapalem, Sompalle. From each village twenty farmers will be selected randomly and total sample size of farmers accounted to 120 and also surveyed 15 dealers from different seed companies. Factor analysis was used to identify the factors that influence farmers buying behavior towards purchase of tomato seed. It can accommodate a large number of variables and reduce the information to a convenient size. The major objective to employ this analysis is to group the various identified information needs of farmers. It uses the correlation matrix as input to identify interrelations between variables. Using those correlations one can see information and hypotheses which is be obtained. Factor loadings provide the correlation between the variable and the underlying dimension. The product of corresponding factor loadings can obtain the correlation between any two variables. Since the objective of the factor analysis is to represent each of the variables as linear combination of the smaller set factors, we can express this as

$$\begin{aligned}
 X_1 &= \lambda_{11} F_1 + \lambda_{12} F_2 + \dots + \lambda_{1m} F_m + e_1 \\
 X_2 &= \lambda_{21} F_1 + \lambda_{22} F_2 + \dots + \lambda_{2m} F_m + e_2 \\
 &\dots \dots \dots \\
 &\dots \dots \dots \\
 X_n &= \lambda_{n1} F_1 + \lambda_{n2} F_2 + \dots + \lambda_{nm} F_m + e_n
 \end{aligned}$$

Where,

- X1 to Xn : Standardized scores
- F1 – Fn : Standardized factor scores
- $\lambda_{11} - \lambda_{mn}$ : Factor loadings
- e1-en: Error variance

To test the sampling adequacy, the Kaiser-Meyer-Olkin measure of sampling adequacy was calculated. The Bartlett's test of sphericity was employed to test the validness of factor analysis. The variables with communalities greater than 0.50 were retained. The factors with Eigen-values greater than 1.0 were considered and the analysis was conducted.

**RESULTS AND DISCUSSION**

*Kaiser-Meyer Olkin and Bartlett's test*

Kaiser-Meyer Olkin (KMO) measures sample adequacy and Bartlett's test of sphericity was used to examine the appropriateness of factor analysis and the results are provided in Table 1.

Table 1. KMO and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.575
Bartlett's Test of Sphericity	Approx. Chi-Square	221.662
	Df.	78
	Sig.	0.000

\* Significant at 5 per cent level

Table 1 shows that KMO value was 0.575 which indicated that the sample was fairly adequate to proceed factor analysis. Bartlett's test of sphericity shows that approximate of chi-square was 221.662 with 78 degrees

of freedom and significant at 0.05 level (p-value is 0.00). Hence factor analysis is valid.

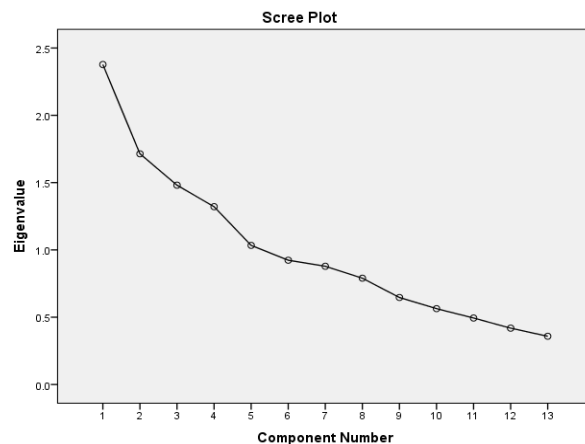
*Principal Component Analysis*

Using SPSS software, principal component analysis was done to extract the factors from the underlying 13 variables taken for the study and the variables are discounts offered by dealer, dealer recommendation, Promotional strategies applied by private companies, distance of the shop, availability of seed in the village, brand image of seed, financial options in available with the dealer, peer group references, package quantities available in the market, quality of seed material, high yield, popularity of image and cost of seed. Factors analysis for these 13 factors was done by using PCA shown in Table 2. The eigen values column of Table 2, inferred that initially, SPSS extracted all the thirteen factors from the thirteen variables analyzed for the study. But as the selected off criterion of eigen value was greater than one accordingly five factors were extracted. The rotation sums of the squared loading columns represent the distribution of the variance after the varimax rotation with Kaiser Normalization. 13.499 per cent of variance was accounted by factor one and has the corresponding eigen value of 1.755, 26.123 per cent of variance was accounted by second factor and has the eigen value of 1.641, 38.287 per cent of variance was accounted by third factor and has the eigen value of 1.581, 50.134 per cent of variance was accounted by fourth factor and has the eigen value of 1.540 and 60.976 per cent of variance was accounted by fifth factor and has the eigen value of 1.409.

*Screen Plot*

The screen plot was used to determine retained factors. The screen plot is a graph of the eigen values against all the factors. The point of interest is where the curve starts to flatten and the graph plotted is explained in figure 1. Screen plot shows the eigen value falls under which component number or factor number. Each factor with eigen value contributes to the variance in the data and the factor with the highest eigen value shows more variation and factor with eigen value near to one contributes to less variance.

Figure 1. Screen plot shows the Eigen value falls under which component number



It can be inferred from the graph that eigen value after the fifth factor was nearer to one so the curve is not flattened at the fourth factor. It started to flatten after the sixth factor. Finally, five factors with eigen value more than 1 were extracted from thirteen factors for study.

Table 2 . Total variance explained

Component/factor	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.377	18.287	18.287	2.377	18.287	18.287	1.755	13.499	13.499
2	1.714	13.184	31.472	1.714	13.184	31.472	1.641	12.623	26.123
3	1.481	11.392	42.863	1.481	11.392	42.863	1.581	12.164	38.287
4	1.321	10.162	53.025	1.321	10.162	53.025	1.540	11.846	50.134
5	1.034	7.951	60.976	1.034	7.951	60.976	1.409	10.842	60.976
6	0.923	7.103	68.079						
7	0.878	6.758	74.837						
8	0.790	6.076	80.912						
9	0.647	4.973	85.886						
10	0.564	4.336	90.221						
11	0.494	3.799	94.021						
12	0.419	3.221	97.242						
13	0.359	2.758	100.000						

Table 3. Rotated component matrix of Variables

Variable	Component				
	1	2	3	4	5
Availability of seed in the village	0.523				
Dealer recommendation	-0.664				
Promotional strategies applied by private companies	0.550				
Distance of the shop		0.837			
Discount offered by the dealer		0.797			
Package quantities available in the market			-0.703		
Financial options in available with the dealer			0.630		
Peer group references			0.512		
Brand image of seed				0.695	
Quality of seed material				0.815	
High yield				0.794	
Popularity of image					0.761
Cost of seed					0.684

Extraction Method: Principal Component Analysis.  
Rotation Method: Varimax with Kaiser Normalization.

Table 4: Grouping of extracted variables into 5 factors

Particulars	Factor	Variables	Factor loading
Factor1	Product value	Quality of seed material	0.815
		High yield of crop	0.794
		Cost of seed	0.684
Factor 2	Product image	Brand image	0.695
		Popularity of image	0.761
		Package available in quantities	-0.703
Factor 3	Product convenience	Financial options in available with the dealer	0.630
		Discount offered by the dealer	-0.703
		Peer group influence	0.512
Factor 4	Social influence and experiences	Dealer recommendation	-0.664
		Promotional strategies	0.550
Factor 5	Location and accessibility	Distance of shop	0.837
		Availability of seed in the village market	0.523

Table 5. Ranking of grouped factors for factors considered by farmers (N=120)

S. No	Factors considered by farmer	Mean score	Rank
1.	Product value	3.89	1
2.	Product image	3.83	2
3.	Product convenience	3.81	3
4.	Social influence and experiences	3.50	4
5.	Location and accessibility	3.29	5

### Rotated component matrix

The rotated component matrix shows the factor loadings for each variable in extracted factors. Grouping is done with the variables having factor loadings greater than 0.5 across the row among the extracted eight factors. The result of the analysis presented in Table 3. It was inferred that variable distance of the shop has highest factor loading of 0.837 represented in second factor, variable (provision for technical guidance) has highest factor loading of 0.835 represented in first factor, variable (quality of seed material) has highest factor loading of 0.815 represented in fourth factor, variable (timely supply) has highest factor loading of 0.797 represented in second factor, variable (high yield) has highest factor loading of 0.794 represented in fourth factor, variable (previous experience) has highest factor loading of 0.761 in fifth factor, variable (Cost of seed) has highest factor loading of 0.684 represented in fifth factor, variable (Credit facility) has highest factor loading of 0.630 represented in third factor, variable (promotional strategies) has highest factor loading of 0.55 represented in first factor and variable (peer group references) has highest factor loading of 0.512 represented in third factor.

### Grouping of extracted variables into 5 factors

For this study, a total of 13 variables on various aspects were selected and grouped into 5 factors. The consumers were asked to indicate their responses on a 5 point scale, whether they strongly disagree, disagree, neutral, agree and strongly agree.

Factor 1 (Product value) consisted of three variables that collectively explained about quality of seed material, high yield of crop, Cost of seed, resistance to pest and diseases.

Factor 2 (Product image) consisted of two variables that collectively explained about brand image and popularity of image.

Factor 3 (Product convenience) consisted of three variables that collectively explained about package quantities available in the market, financial options in available with the dealer, discount offered by the dealer, dealers display.

Factor 4 (Social influence and experiences) consisted of three variables that collectively explained about Peer group influence, dealer recommendation, Promotional strategies.

Factor 5 (Location and accessibility) consisted of three variables that collectively explained about distance of shop and availability of seed in the village.

The mean scores of each factor were calculated and ranking is given according to the scores obtained in results as shown in Table 5. It is inferred from the table 5, shows that the highest mean score (3.89) was obtained for product value factor followed by product image with mean score (3.83). The mean scores of product convenience (3.81), Social influence and experiences (3.50), location and accessibility (3.29) were obtained. The sample farmers majorly consider product value factor, followed by product image. Product convenience and social influence and experiences are the moderately considered factors means they are also important but not primary. Location and accessibility is the least considering factor by the farmer in the study area.

### CONCLUSION

The sample farmers majorly consider quality of seed, high yield potential, resistance to pest and diseases which are under product value group. Location and accessibility is the least considering factor by the farmer in the study area. As majority of the farmers are illiterate and unaware of branded quality seed in the market, the government should give emphasis on organization of training courses for the farmers on different aspects such as quality seed, awareness of suitable varieties in their locality, familiar with mobile app for online purchase of seed material, farm inputs and also should focus on establishing seed retail outlets in the study area which will be helpful to the farmers for easy procuring of seed.

### AUTHOR CONTRIBUTIONS

This study was carried as a part of master research work of Bala Krishna and the data was collected through field survey in Chittoor district of Andhra Pradesh. The co authors are advisory committee who has guided and helped in choosing the study area and methodology. The work is in collaboration between the authors. Bala Krishna has gathered the initial data and Mohan Naidu has given idea for preliminary data analysis. Seedar Ujwala Rani and I. Bhavani Devi managed the literature searches and done corrections in manuscript.

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### COMPETING INTERESTS

The authors declare that they have no competing interest

### ETHICS APPROVAL

Not applicable

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