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Measurement of Quality Attributes of Mango for Export : A Conjoint Analysis Approach

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ABSTRACT. *The export demand for mango is influenced by the various quality attributes vested in them. In order to see which attributes are most important for export of mango, the conjoint analysis, a recent technique widely used in marketing research, is used to determine the relative importance of each attribute. The identification of choice alternatives and associated attributes involves the estimation of partworth contributions of each attribute to obtain overall utility. In the estimation of the partworths, the total utility for a multi attribute alternative is obtained as a weighted sum of the alternatives perceived attribute levels and associated value ratings, as separately judged by the respondents. The present paper intends to identify the most preferred attributes of different varieties of mango for exports.*

INTRODUCTION

The liberalisation policy of the government has given a fillip to India's agricultural exports in general and horticultural exports in particular. Horticultural crops constitute a significant component of agricultural production in the country. Mango is the most popular tropical fruit in the world and has been rightly described as the 'King of fruits'. Though India is the largest producer of mango in the world, its share in international trade is abysmally low. The total world production of mango is estimated at 15 million tonnes out of which 9.22 million tonnes alone is contributed by India. The quantity of mango exports from India during 1993 – 94 was about 22,793 tons, while the earnings of 43.9 crores accounted for 9 percent of the total earnings from horticultural products. Export of fresh mango by the year 2000 is projected to reach 38 to 43 thousand tonnes. From 1980 – 81 to 1993 – 94

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there is an increasing trend in export of mangoes with an average growth of 7.8% per annum. The average Nominal Protection Coefficient is below unity indicating that mango is moderately export competitive. India's exports have been mainly to Middle East countries (90%) with minor quantities exported to England, Canada, Singapore and Australia. The main reason for the low exports is the lack of quality and non-availability of surplus for export. There is a need to systematically identify the relative importance of each of the quality attributes of export grade mangoes which influence demand for mangoes in the world market. The specific objective of this paper is to study the quality attributes of mangoes suitable for exports.

MATERIALS AND METHODS

The primary data for the study were collected from 10 exporters in Bangalore city, the capital of Karnataka, during the month of July 1996. Data were collected on a full concept design. This method is considered as more realistic and economically valid since all factors are considered simultaneously. The three conjoint analysis procedures used in statistical package for social sciences (SPSS) categories are : ORTHOPLAN PLANCARDS and CONJOINT. Conjoint measurement has been developed primarily by mathematical psychologists, Debreu (1960) and Luce and Tukey (1964) and was introduced into marketing research by Green and Rao (1971).

The plancards used for the purpose included important attributes of the fruit essential for export of mangoes. These attributes are :

1. Variety (Alphanso, Baneshan, Totapuri)
2. Colour (yellow to red, brown to red, green to yellow)
3. Shape (oval oblong, ovate oblique, elongated)
4. Flavour (very attractive, attractive, pleasant)
5. Price – Alphanso (Rs. 7/- to Rs. 10/-), Baneshan (Rs. 5.5 to Rs. 8/-), Totapuri(Rs. 3.5 to Rs. 5/-) per kg of fruits.

Orthogonal array of cards was prepared and the complete product was put on a separate card. The stimuli was standardised by making sure that all cards were similar in physical appearance except for the different combinations of attributes. The PLANCARDS were based on SPSS categorization procedure. The total number of plancards given for the attributes was 27 (Appendix I).

Each exporter in the study was given a complete set of cards and asked to indicate preferences for the export of mangoes. The exporters were asked to arrange the cards according to his preferences. From these rankings or scores, conjoint derived utility scores for each factor level. These utility scores analogous to regression coefficients are called partworths and can be used to find the relative importance of each factor.

Conjoint measurement is based on the assumptions that:

(i) A product can be described according to the levels of a set of attributes and

(ii) The consumers' overall judgement in respect of that product is based on these attribute levels.

Both these assumptions are commonly made in economics and marketing. Conjoint measurement, seeks to quantify and predict exporters' overall judgement on the basis of these underlying product attributes.

RESULTS AND DISCUSSION

The important quality attributes of the mangoes studied were variety, price, colour, flavour and shape. For each of these attributes partworths were estimated using OLS regression analysis in the conjoint analysis framework. The fit of the additive model to the individual data was good. Pearson rank correlation was 0.583 ($P = 0.0007$) and this testifies to the suitability of the model.

The individual respondents results are presented in Appendices I and II. The relative importance of the part worth functions was compared across different attributes within segments in order to arrive at the relative importance of each attribute (Moore, 1980). Average partworths and the relative importance of the attributes are presented in Table 1. A higher positive or lower negative part worth denotes, *Cetaris paribus*, a higher perceived quality.

Among all the attributes studied, variety attribute was found to have the greatest influence on the export of mangoes since it accounted for 36.74 percent of relative importance. The individual utility for each variety of

Table 1. Group results from Conjoint analysis.

Characteristic	Level	Utility	Relative importance (%)
Variety	Alphanso	2.6543	36.74
	Banganapalli	1.1235	
	Totapuri	-3.7778	
Price	High	5.9815	22.78
	Medium	3.9877	
	Low	1.9938	
Colour	Brown to yellow	1.6296	18.62
	Yellow to red	3.2593	
	Green to yellow	4.8889	
Flavour	Very attractive	3.8148	14.53
	Attractive	2.5432	
	Pleasant	1.2716	
Shape	Oval	0.4444	7.33
	Ovate	0.3951	
	Elongated	-0.8395	
Constant	= 9.2963	P = 0.0007	
Pearson's R	= 0.583		

mangoes, *viz.*, Alphonso, Banganapalli and Totapuri was 2.6543, 1.1235 and –3.7798, respectively. The Totapuri variety was least preferred by the exporters.

Price and quality have a strong influence on exports. If the quality attribute of mangoes increase, the price would be high. For the Alphonso variety the price was high and the utility value was 5.9815, followed by Banganapalli for which the utility value was 3.9877. Totapuri variety had the lowest utility value for exports. Its relative importance was 22.78 percent.

Colour also plays a vital role in promoting the export of mangoes. The relative importance of colour was 18.62 percent. The green-to-yellow colour was most preferred for the exports, with a utility value of 4.8889 followed by yellow-to-red, with a utility value of 3.2593. The least preferred colour for exports was brown-to-yellow, for which the utility value was 1.6296.

Flavour is yet an another important attribute for export of mangoes. Its relative importance was 14.53 percent. Flavour had negative utility values, *i.e.*, for very attractive mangoes the utility value was 3.8148, for attractive mangoes the utility value was 2.5433 and for the pleasant mangoes, flavour had the utility value of 1.2716 which had the least influence on the export of mangoes.

Shape is a less important quality attribute for export. Oval shape however had the highest preference with a utility value of 0.444 followed by ovate shape for which the value was 0.3951. The utility value for elongated shape was lowest and negative. Hence, it had the least influence on the export of mangoes. Its relative importance was 7.33 per cent.

Variety attribute is the most important primary criterion to be considered for exports since each variety has its own inherent characteristics. Because of this, Alphonso variety has greatest demand both in domestic and international markets. Due to its excellent characteristics the utility would be more. This was followed by Baneshan and Totapuri varieties. The results of the present study also corroborate the findings of Brosen (1984) on quality attributes of rice by hedonic scale measurement. The results are also in conformity with the results of Steenkemp and Benedict (1990) on ham quality evaluation. He had selected four important quality attributes of ham, *viz.*, brand name, packing, selling store and price whose relative importances were 41.0, 40.5, 6.2 and 12.3 percent respectively.

POLICY IMPLICATIONS

The study helps to enlighten some important policy implications. The success of mango exports depends heavily on the quality of mangoes. This is a case for setting up a mango marketing federation to oversee the marketing of mangoes for which an effective extension net work, which is not available at present, is required. The responsibility could vest with the proposed mango marketing federation. The mango federation should have a quality assurance cell which should look into and maintain international standards. This organisation should regularly monitor the quality standards and develop backward linkages (credit, input supply) and forward linkages (marketing, storage, infrastructure facilities *etc.*) in the production and marketing of mangoes. The government at both the state and central levels should invest in creating infrastructure facilities for export of mangoes. Variety is the important primary criterion to be considered for exports since each variety has its own inherent characteristics. Because of this, Alphanso and Baneshan varieties have great demand in domestic and international markets. Hence, these grafts should be increased through multiplication by stone grafting. At the same time quality attributes such as colour, shape, size and flavour should also be maintained in newly evolved varieties so that India can increase its presence in the international market.

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Appendix I. Plan cards for the exporters based on SPSS categorization procedure of Conjoint analysis.

Card No.	Variety	Colour	Flavour	Shape	Price
1	3.00	2.00	2.00	1.00	1.00
2	2.00	3.00	2.00	3.00	3.00
3	1.00	1.00	1.00	1.00	1.00
4	3.00	1.00	2.00	2.00	1.00
5	1.00	1.00	3.00	3.00	3.00
6	1.00	2.00	3.00	2.00	3.00
7	2.00	2.00	1.00	3.00	2.00
8	2.00	3.00	1.00	2.00	2.00
9	1.00	3.00	3.00	1.00	3.00
10	1.00	3.00	1.00	2.00	1.00
11	1.00	2.00	1.00	3.00	1.00
12	2.00	3.00	3.00	1.00	1.00
13	1.00	2.00	2.00	1.00	2.00
14	1.00	1.00	2.00	2.00	2.00
15	3.00	1.00	3.00	3.00	2.00
16	3.00	3.00	1.00	2.00	3.00
17	2.00	2.00	3.00	2.00	1.00
18	1.00	3.00	2.00	3.00	2.00
19	2.00	1.00	1.00	1.00	2.00
20	2.00	1.00	2.00	2.00	3.00
21	3.00	3.00	2.00	3.00	1.00
22	3.00	2.00	3.00	2.00	2.00
23	3.00	3.00	3.00	1.00	2.00
24	3.00	1.00	1.00	1.00	3.00
25	2.00	1.00	3.00	3.00	1.00
26	3.00	2.00	1.00	3.00	3.00
27	2.00	2.00	2.00	1.00	3.00

Number of cases read = 27 Number of cases listed = 27

Variety	Shape	Price	Colour	Flavour
1 for Alphanso	1 for oval oblong	1 for high	1 for yellow to red	1 for very attractive
2 for Baneshan	2 for ovate oblique	2 for medium	2 fpr brown to red	2 for attractive
3 for Totapuri	3 for elongated	3 for low	3 for green to yellow	3 for pleasant

Appendix II. Preference ranks of quality attributes of mangoes indicated by the exporters.

```
ORTHOPLAN/FACTORS = colour ('br' 'yel' 'red')
flavour ('vatr' 'atr' 'pleas')
shape ('ol' 'ot' 'el')
var ('alp' 'ben' 'tot')
price ('hi' 'med' 'lo')
/replace
/minimum = 20
list variables = all
SAVE/OUTFILE = 'd:\splan.sps'.
data list free/id pref1 to pref27.
BEGIN DATA
```

Exporter	Preferences
1	8 13 26 6 9 15 20 24 12 18 3 14 10 2 23 25 17 22 16 2721 4 7 11 1 19 5
2	3 8 6 9 13 11 20 26 27 2 7 24 10 15 4 16 18 23 21 25 1 22 5 14 19 17 12
3	9 13 6 27 7 4 8 26 14 11 21 15 20 5 12 2 10 25 19 16 22 23 18 24 17 1 3
4	6 11 3 8 27 13 20 24 18 10 2 26 9 12 7 25 15 17 4 16 19 22 14 23 21 1 5
5	3 9 8 13 16 18 25 27 6 11 26 20 24 12 10 23 17 21 5 14 19 1 22 2 4 7 15
6	8 6 9 3 20 27 26 11 13 10 16 23 18 2 24 7 15 4 25 12 19 21 17 22 1 5 14
7	8 9 3 6 2 7 22 25 13 20 27 26 21 4 11 12 23 10 14 16 24 17 1 18 5 19 15
8	9 6 3 8 7 13 2 21 25 4 20 12 23 27 22 10 26 11 5 17 1418 16 24 1 15 19
9	8 9 6 3 13 20 25 7 2 27 22 11 26 12 10 23 14 24 17 16 18 5 19 4 15 21 1
10	9 6 8 3 7 2 20 11 26 12 22 25 13 27 21 10 4 24 23 18 14 5 19 16 17 1 15

```
END DATA.
CONJOINT PLAN = 'D:\SPLAN.sps.'
/DATA = */SEQUENCE = pref1 to pref27 /SUBJECT = id
/factors = colour flavour (linear more) share var (discrete)
price (linear less)
/print = all /utility = 'util.sys'.
save outfile = 'd:\rugran.cs'.
```