THE IDEAL VEGETABLE ATTRIBUTES BASED ON CONSUMER PREFERENCES: A CONJOINT ANALYSIS APPROACH

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ABSTRACT

Consumers' purchase decisions are influenced by the attributes that they attach to the product. This study was conducted in the major vegetable markets of the Philippines from April 2005 to April 2007 to understand the relevant attributes and the respective attribute levels that consumers identified with carrots and cabbage. It also aimed to identify market segments according to relevant vegetable attributes assigned.

The important product attributes of carrot for consumers, according to order of importance are: price, origin, freshness, size, and color. Similarly, cabbage consumers gave the highest importance value to price followed by production method, origin, shape, and freshness.

The market segments were: Cluster 1 – "Origin-sensitive" and Cluster 2 – "Price-conscious". Origin-sensitive consumers prefer carrots coming from Baguio-Benguet while price-conscious consumers prefer a low price of PhP15/kg.

The market segments for cabbage consumers are the: health-conscious and the price and origin conscious. The former gave the highest utility score to the attribute level organic under production method indicating that they connect food much more with their well-being. On the other hand, the latter gave high importance to cabbage with the lowest price of PhP 10/kg and cabbage originating from Benguet.

KEYWORDS: Conjoint analysis, consumer preference, vegetable attributes

INTRODUCTION

Market-oriented production is the key element in successful business practice, as well in agriculture. Delivering superior customer value is crucial to business success in competitive markets. Among other things, this involves identifying and understanding the consumers, their needs, wants, and product preferences. Understanding why consumers prefer some foods to others is of utmost importance to food producers and suppliers in the "real life" situation of marketing, advertising, and new product development (Clark, 1998).

In the Cordillera region, particularly Benguet and Mountain Province, the main agricultural activity is vegetable production. It covers 32,643 hectares produce which about 80% of the country's total vegetable production (Digal & Concepcion, 2004).

Consequently, the farmers have been confronted by several problems that includes supply glut crisis, which has left the province, according to the Department of Agriculture-Cordillera, "177% sufficient in vegetables" (Aquino, 2004). Another problem that confronted the farmers is the threat of imported vegetables that have become more evident as importations of vegetables have grown sevenfold since 1996-2002. Imported vegetables are said to be cheaper by 30%-50% compared to some of the locally-produced ones. They are better packed and generally of better quality. These attributes make them more attractive to the institutional markets and the supermarkets that cater to the high-end consumer markets (Digal and Concepcion, 2004).

With these problems, product development and upgrading in the marketing system of the

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vegetable industry is very much needed in order to increase its competitive edge. Gellynck (2002) mentioned product development and innovation as an additional task for the farmer in order to benefit from and respond to consumer requirements. Understanding the consumers' requirements towards fresh vegetables holds a vital role in ensuring the efficiency in the market. Concepcion (2004) stressed that with effective and efficient communication and information infrastructure, farmers will be able to access correct and valid information about market preferences and quality standards.

MATERIALS AND METHODS

The study was conducted at the Benguet State University from 2005 to 2007. The respondents were consumers from the different regions in the country.

Respondents and Data Collection

Phase 1. The profiling of the attributes were done using the responses of consumers from Baguio-Benguet, Metro Manila, and Nueva Ecija. The survey was undertaken from January to March of 2006.

Phase 2. The final set of respondents was surveyed from April 2006 to February 2007. The survey in the different regions of the country yielded a total of 342 respondents for carrots and 363 for cabbage.

For carrot respondents, there were 23.1% from Central Luzon, 17.8% from Cordillera Administrative Region, 17.5% from Visayas, 16.4% from the National Capital Region, 15.8% from Ilocos Region, and 9.4% from Mindanao. Within specific profiles, the highest percentages of respondents were female (69.3%), married (64.2%), 27 years old to 36 years old (26.9%), college graduates (74.0%), full-time employees (51.5%), and purchase carrots once a week (46.8%).

Table 2 shows the profile of respondents for cabbage where 22.3% came from Central Luzon, 17.6% from CAR, 16.5% from the Visayas, 17.1% from the National Capital Region, 14.6% from the Ilocos Region, and 11.8% from Mindanao. Like the carrot respondents, the respondents for cabbage were dominantly female (68.3%), married (69.7%), many are under the age range of 37-46 years old (27.5%), college graduate (72.5%), full time employees (43.6%), and purchase cabbage once a week (46.6%)

Table 1. Socio-demographic profile of respondents for carrots (n=342)

PROFILE	PERCENTAGE
Address	
Central Luzon	23.1
CAR	17.8
Visayas	17.5
National Capital Region	16.4
Ilocos Region	15.8
Mindanao	9.4
Sex	
Female	69.3
Male	30.7
Civil Status	
Married	64.2
Single	35.8
Age	
26 and below	23.7
27-36	26.9
37-46	24.3
47 and above	25.1
Educational Attainment	
College graduate	74.0
Non-college graduate	26.0
Occupation	
Farmer	2.3
Full time employee	51.5
Housewife	13.7
Self-employed	22.5
Student	9.9
Purchase frequency	
More than once a week	25.7
Once a week	46.8
Few times a month	15.2
Less than few times a month	12.3

Statistical Analysis (Conjoint Analysis)

The study was done following the procedures for Conjoint Analysis. Conjoint analysis is a technique that attempts to determine the relative importance consumers attach to salient attributes and the utilities they attach to the levels of attributes (Malhotra, 2004). It is the most widely applied and studied method for assessing consumer's multi-attribute utility functions. By using Conjoint, one could gain a better understanding of the real value consumers attach to certain attributes when making purchasing decisions in a retail situation.

Conjoint analysis consists of five steps:

1. Determination of the relevant product attributes;

Table 2. Socio-demographic profile of respondents for cabbage (n=363)

PROFILE	PERCENTAGE
Address	
Central Luzon	22.3
CAR	17.6
Visayas	16.5
National Capital	17.1
Region	14.6
Ilocos Region	11.8
Mindanao	
Sex	
Female	68.3
Male	31.7
Civil Status	
Married	69.7
Single	30.3
Age	
26 and below	21.8
27-36	26.7
37-46	27.5
47 and above	24.0
Educational Attainment	
College graduate	72.5
Non-college graduate	27.6
Occupation	
Farmer	3.0
Full time employee	43.6
Housewife	18.7
Self-employed	22.6
Student	9.4
Purchase frequency	
More than once a week	25.9
Once a week	46.6
Few times a month	18.7
Less than few times a month	8.8

2. Determination of the different levels for each of the product attributes;
3. Determination of the method to generate data and of the scale type;
4. Estimation method;
5. Analysis of results.

Determination of relevant carrot attributes and levels

Data gathering was done using qualitative and quantitative research techniques. Focus Group Discussions (FGDs) and the Repertory grid or triadic sorting were used to determine relevant product attributes and attribute levels. The Repertory Grid is a qualitative elicitation technique that uses the concept of the individual possession of personal constructs in an interview situation and from this is determined the individual's view of the subject. This method comprises two components, namely the elements (products) which constitute the objects of thought on which the grid is built and the constructs (attributes) which are the dimensions used by the subject to evaluate those elements (Gellynck, 2002). The FGDs and triadic sorting were conducted to homogenous groups of women and men considering the following characteristics: responsible or takes part in deciding family food purchases and does purchasing food for the family. These procedures were carried out to groups in Benguet State University (BSU), Baguio City, San Jose City, Tarlac City, and Metro Manila, with the focus question: "What are your important considerations in purchasing fresh carrots and cabbage"?

For triadic sorting, three pieces of fresh carrots were presented to the participants. Each of the participants were asked to separate two carrots which have similarities, and a question was asked in which way the two carrots were alike and thereby different form the third one. The same procedure was applied to cabbage respondents. The relevant attributes and levels deduced from the results of the FGDs and Triadic Sorting are presented in Tables 3 and 4. Five Attributes with two or three levels were specified for carrots, these include the freshness, color, size, origin and price per kilo. For cabbage, five attributes with two and three levels were also identified by the respondents. These include freshness, shape, production method, origin and price. The prices used were based on the prevailing retail prices. For each product, the prices were specified to represent the range for low, medium, and high prices.

Table 3. Relevant attribute and attribute levels for carrots

ATTRIBUTES	LEVELS
Freshness	1-Smooth skin 2-Rough skin
Color	1-Light orange 2-Deep orange
Size	1-Big 2-Medium 3-Small
Origin	1-Outside Baguio and Benguet 2-Within Baguio and Benguet
Price	1-High- P45.00 2-Medium- P25.00 3-Low- P15.00

Full Factorial Design: (2x2x3x2x3) 72 descriptions
Orthogonal Design: 16 descriptions

The maximum number of product descriptions (Full Factorial Design) that can be generated from the specific set of attributes and levels was determined by the multiplication of the number of attribute levels across the set of attributes. The resulting full factorial design for carrots and cabbage were 72 and 48 product profiles, respectively. Clearly, one could not expect respondents to evaluate such a large number of alternative products.

This problem was resolved by using an orthogonal design that enables the conjoint models to be estimated with fewer than the maximum number of product descriptions, while ensuring that enough data is available for statistical analysis, resulting in a carefully controlled set of profiles for the respondent to consider. The random combination of attributes and attribute levels was withheld to obtain the product profiles or combination of levels of all the attributes.

The product descriptions to be evaluated by respondents were generated from the orthogonal design procedure "orthoplan" within SPSS (SPSS Version 15.0). The results were 16 product descriptions for carrots and 8 product descriptions for cabbage, which were presented in the respective survey questionnaires.

Table 4. Relevant attributes and attribute levels for cabbage

ATTRIBUTES	LEVELS
Freshness	1-Dark green color of leaves 2-Crisp/no wilted leaves
Shape	1-Flat head 2-Obloid/rounded
Production method	1-Conventional (with pesticide) 2-Organic or less pesticide
Origin	1-Within Baguio and Benguet 2-Outside Baguio and Benguet
Price	1-High- P35.00 2-Medium- P20.00 3-Low- P10.00

Full Factorial Design: (2x2x2x2x3) 48 descriptions
Orthogonal Design: 8 descriptions

The Survey Questionnaire

The data were collected by means of a structured questionnaire separated into three sections. In the first section, buying and consumption pattern was measured including a question relating to price sensitivity.

The second section was the conjoint part of the questionnaire where pictures of each profile for carrots and cabbage were presented to the respondents. The respondents were then asked to make an overall judgment of the differentiated products according to the product descriptions derived from the orthogonal model. Having established that instructions are clear to the respondents, they were asked to indicate their preferences for each product using a 9-point scale, where 1 represents "dislike extremely" and 9 represents "like extremely". They were also reminded that as they move on from one description to the next, they can always try to change their scores to indicate whether they like or dislike it more than the previous one.

The third section included socio-demographic characteristics such as place of residence, gender, age, education and employment.

Estimation Method

The relative importance of each attribute was estimated by measuring the utility range for each attribute. Utility range was computed by dividing the range of utility values for an attribute by the sum of ranges across all attributes then multiplying the resulting value by 100. The attribute with the widest range in utility values is considered to be the most important.

RESULTS AND DISCUSSION

A. CARROTS

Carrot Attributes Influencing Consumers Preferences

Table 5 and Figure 1 show that the consumers gave the highest importance value of 43.35% to price. The other attributes, which have the corresponding similar importance values of 19.93%, 15.13%, and 14.91% are origin, freshness, and size. Color had the least importance value of 6.69%.

The next step was to estimate the utilities that consumers attach to the levels of each attribute. The utility estimates would indicate how each factor level relates to preference. Positive values indicate that the attribute level is positively-related to preference,

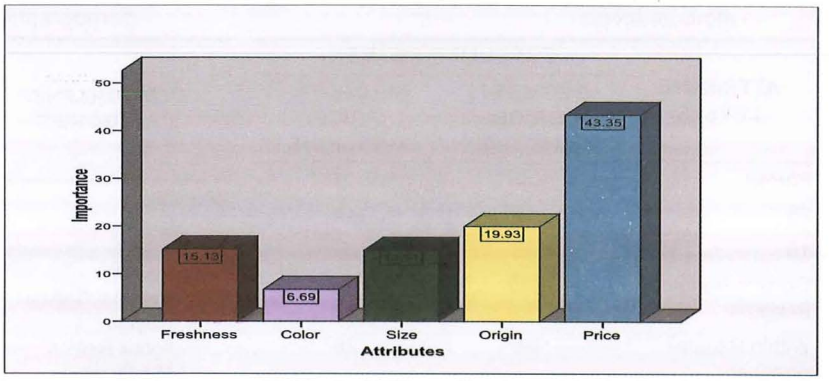

Fig.1. Graph of carrot attributes and importance values of consumers' preferences

Table 5. Carrot attributes and importance values influencing consumers' preferences

ATTRIBUTES	IMPORTANCE VALUE (%)
Price	43.35
Origin	19.93
Freshness	15.13
Size	14.91
Color	6.69

and negative utility values indicate that the factor level is not preferred. From the combinations of carrot descriptions considering the attributes and levels, the consumers preferred the following carrot attributes as shown in Table 6: lowest price of PhP15 per kilo, carrots originating from Baguio-Benguet, have smooth skin, of deep orange color, and are of big sizes.

The Pearson's R and the Kendall's tau were used to test validity or to assess whether the conjoint model fits the ratings of the respondents. Both tests have a theoretical maximum value of 1 for perfect agreement between the estimated utilities of the cards and the group's rankings or ratings. The resulting Pearson's R and Kendall's tau values of .991 and .967, respectively, indicated high agreement between the observed and estimated preferences.

Market segments of carrot consumers

Cluster analysis was used to classify the consumers according to the carrot attributes which they prefer. The resulting clusters would be considered as the market segments. As shown in Table 7, two clusters emerged from the analysis.

Table 6. Utility estimates of factor levels for carrot attributes

ATTRIBUTES	LEVEL	UTILITY ESTIMATE
Price	40	-.833
	25	.201
	15	.632
Origin	Outside Baguio-Benguet	-.337
	Within Baguio-Benguet	.337
Freshness	Smooth skin	.256
	Rough skin	-.256
Size	Big	.198
	Medium	.107
	Small	-.306
Color	Light orange	-.113
	Deep orange	.113

Correlations:
Pearson's R = .991; Sig. = .000
Kendall's tau = .967; Sig. = .000

Segment 1- "Origin-Sensitive"

Cluster 1 was labeled the "Origin-sensitive" group, consisting of 75% of the respondents, with the highest mean attribute utility value of .36 on the attribute level for origin of carrots as coming from Baguio-Benguet. This indicated that this market segment considered the origin of carrots, particularly, carrots coming from Baguio-Benguet, to be the number one carrot attribute taken into account when buying carrots. The other carrot attributes preferred by this group were: lowest price of PhP15 (value of .33), have smooth skin (value of .27), of big sizes (value of .18), and of deep orange color (.11).

Table 7. Market segments of carrot consumers by attribute levels

ATTRIBUTE LEVELS	CONSUMER SEGMENT	
	SEGMENT1 "ORIGIN-SENSITIVE"	SEGMENT2 "PRICE-CONSCIOUS"
PhP40	-.45	-1.97
25	.12	.44
15	.33	1.53
Outside Baguio-Benguet	-.36	-.26
Within Baguio-Benguet	.36	.26
Smooth skin	.27	.21
Rough Skin	-.27	-.21
Big	.18	.24
Medium	.15	-.03
Small	-.34	-.21
Light orange	-.11	-.13
Deep orange	.11	.13
Number of Valid cases in each Cluster	249 or 75%	84 or 25%

Table 8. Market segments of carrot consumers by demographic categories

DEMOGRAPHIC CATEGORIES	CLUSTER PERCENTAGE (%)	
	1 "ORIGIN-SENSITIVE"	2 "PRICE-CONSCIOUS"
Address		
Central Luzon	77.2	22.8
CAR	67.2	32.8
Visayas	71.7	28.3
National Capital Region	87.5	12.5
Ilocos Region	66.7	33.3
Mindanao	82.6	17.4
Gender		
Female	73.7	26.3
Male	77.2	22.8
Civil Status		
Married	74.9	25.1
Single	74.4	25.6
Age		
26 and below	80.0	20.0
27-36	70.5	29.5
37-46	79.5	20.5
47 and above	69.5	30.5
Educational Attainment		
College graduate	75.0	25.0
Non-college graduate	74.2	25.8
Occupation		
Farmer	50.0	50.0
Full time employee	73.1	26.9
Housewife	78.7	21.3
Self-employed	79.2	20.8
Student	73.5	26.5
Purchase frequency		
More than once a week	83.5	16.5
Once a week	75.6	24.4
Few times a month		
Less than few times a month	66.7	33.3
	63.4	25.2

Segment 2- "Price-Conscious"

The second cluster, labeled as the "Price-conscious" group, consisting of 25% of the respondents had the highest mean attribute utility value of 1.53, which indicated that they prefer carrots priced at PhP15 per kilo. The consumers in this group also prefer carrots to be originating from Baguio-Benguet (value of .26), of big sizes (value of .24), have smooth skin (value of .21), and of deep orange color (value of .13).

Table 8 shows the market segments of carrot consumers by demographic categories. Considering the address, gender, civil status, age, educational

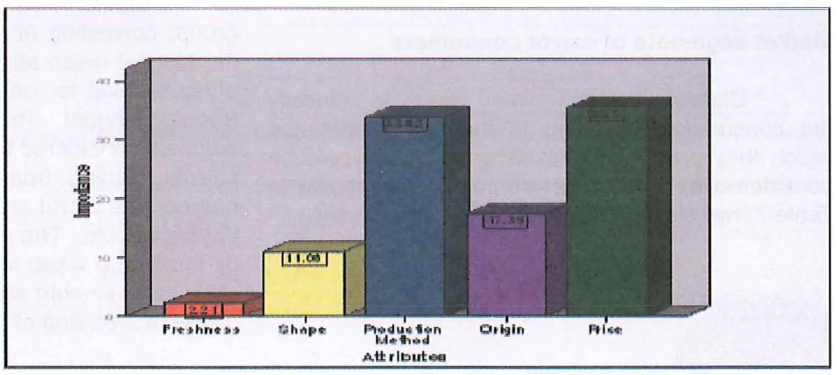

Fig. 2 Graph of cabbage attributes and importance values of consumers' preferences

attainment, occupation and purchase frequency of the respondents between clusters, a greater proportion of the consumers belonged to the Origin-sensitive group. The only exception is on the employment, particularly, for farmers where there were equal proportion who belonged to the Origin-sensitive group and the Price-conscious group.

B. CABBAGE

Cabbage Attributes Influencing Consumers' Preferences

Table 9 and Figure 2 show that like the carrot consumers, the cabbage consumers place greatest emphasis on price, assigning to it the highest importance value of 35.50%. Production method followed closely with the importance value of 33.82%. Other attributes are origin, shape and freshness with corresponding importance values of 17.39%, 11.08%, and 2.21%. Origin plays a significant role to the respondents but not as significant as production method and price.

Table 9. Cabbage attributes and importance values influencing consumers' preferences

ATTRIBUTES	IMPORTANCE VALUE (%)
Price	35.50
Production method	33.82
Origin	17.39
Shape	11.08
Freshness	2.21

Table 10 indicates that the most preferred cabbage attribute levels obtaining the highest preference ratings are: lowest price of P10.00 per kilogram (.634), organically grown (.663), cabbage originating from Baguio and Benguet (.341), with round head (.217), and crisp or no wilted leaves (.043). It was also noticed that the P20.00 per kilogram price was given a positive score of .124, indicating that the price was also preferred by the consumers but not as much as they preferred P10.00 per kilogram. Very little preference was shown for the attribute levels "crisp/no wilted leaves" over "dark green" under the attribute freshness.

The resulting values of Pearson's R and Kendall's tau were .990 and 1.000, respectively, indicating high agreement between the observed and estimated preferences.

Table 10. Utility estimates of factor levels for cabbage attributes

ATTRIBUTES	LEVEL	UTILITY ESTIMATE
Price (PhP)	35	-.757
	20	.124
	10	.634
Production method	Conventional	-.663
	Organic	.663
Origin	Within Baguio and Benguet	.341
	Outside Baguio and Benguet	-.341
Shape	Flat head	-.217
	Round head	.217
Freshness	Dark green	-.043
	Crisp/no wilted leaves	.043

Correlations:
Pearson's R = .990; Sig. = .000
Kendall's tau = 1.000; Sig. = .000

Market segments of cabbage consumers

The K-means clustering on the utilities of the attribute levels resulted to two clusters or segments (Table 11).

Segment 1- "Health-Conscious"

Consumers from segment 1 are very "health-conscious", representing 44.8% of the respondents. This segment gave the highest utility score of 1.19 to the attribute level organic, under the production method, indicating that they connect food much more with their well-being than the other segment do. This assents to a study done by Pearson (2001) where he mentioned that eating fresh fruits and vegetables is generally seen as being important to maintaining human health and the major health benefit of organic fresh vegetables is that they are nutritionally valuable and free of artificial chemicals. He also said that majority of household food buyers knows that, in relation to food, organic means grown without chemicals.

Other attribute levels favored by this segment are: price of P10.00 per kilo (.15), originated from Baguio and La Trinidad (.11), round head (.05) and dark green color (.05).

This segment showed very little preference on the shape and freshness of cabbage. The utility scores indicated that the consumers showed little preference on round head over flat head, likewise

Table 11. Market segments of cabbage consumers by attribute levels

ATTRIBUTE LEVELS	CONSUMER SEGMENT	
	Segment 1 "Health-Conscious"	Segment 2 "Price & Origin conscious"
35	-.25	-1.17
20	.10	.14
10	.15	1.03
Conventional	-1.19	-.23
Organic	1.19	.23
Within Baguio and Benguet	.11	.53
Outside Baguio and Benguet	-.11	-.53
Flat head	.05	-.44
Round head	-.05	.44
Dark green	.05	-.12
Crisp/no wilted leaves	-.05	.12
Number of Valid cases in each Cluster	158 or 44.8%	194 or 55.2%

with the dark green color of cabbage over crisp/no wilted leaves.

Segment 2- "Price and Origin Conscious"

The second segment is labeled the "Price and Origin Conscious" segment, consisting 55.2% of the cabbage respondents. This segment gave high importance to both price and origin, particularly cabbage with the lowest price of P10.00 per kilo (1.03), and cabbage originating from Baguio and La Trinidad (.53), Round head (.44), organically grown (.23), and crisp leaves are also preferred by this segment.

It was observed in this price-sensitive segment that this group does not give much importance to the production method as compared to the first segment. This was also concurred by the research done by Pearson (2001) where he mentioned that most of the conventionally produced vegetable buyers indicated that they would buy organic food products if these were available where they shop at a comparable price and quality.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The survey in the different regions of the country yielded a total of 342 respondents for carrots. There were 23.1% from Central Luzon, 17.8% from Cordillera Administrative Region, 17.5% from Visayas, 16.4% from the National Capital Region, 15.8% from Ilocos Region, and 9.4% from Mindanao.

Most of the respondents were female (69.3%), married (64.2%), 27 years old to 36 years old (26.9%), college graduates (74.0%), full-time employees (51.5%), and purchase carrots once a week (46.8%).

Based on the importance values, the consumers considered the price of carrots to be of highest importance in buying carrots. The other attributes of origin, freshness, and size had similar importance. However, compared to price, their importance were much lower. Color was the attribute considered by the consumers to be least important in buying carrots.

Like the carrot consumers, the cabbage consumers placed greatest emphasis on price. Production method followed closely while the other attributes of origin, shape and freshness were considered to be of lesser importance.

Considering the combinations of attributes and levels, the carrot consumers preferred the lowest price of PhP15 per kilo, originating from Baguio-Benguet, smooth skin, deep orange color, and big size.

The most preferred cabbage attribute levels obtaining the highest preference ratings are: lowest price of P10.00 per kilogram, organically grown, originating from Baguio and Benguet, with round head, and crisp or no wilted leaves.

Finally, for the market segmentation for carrots consumers, two clusters were identified: the "Price-conscious" group and the "Origin-sensitive" group. On the other hand, the market segmentation for cabbage consumers resulted to clusters identified as the "Health-conscious" group and the "Price and Origin Conscious" group.

Generally, consumers highly preferred the price of carrots to be the lowest price of PhP15 per kilo and must come from Baguio-Benguet. For cabbage

consumers, the preference was for organically-grown cabbages, with the lowest price of PhP10 per kilo and must also come from Baguio-Benguet.

Recommendations

1. With price as the most important consideration for carrot and cabbage consumers, R & D efforts should be focused on lowering the price of the vegetable by improving the production and marketing efficiency.

2. With the origin of carrots and cabbages as another important consideration for consumers, promotion strategy to advertise Baguio-Benguet produce such as prominent labeling and attractive packaging should be another focus.

LITERATURE CITED

AQUINO, C. 2004. The Philippine Vegetable Industry: Almost Comatose. Philippine Peasants Institute. http://www.ppi.org.ph/publications (Accessed in September 2005)

CLARK, J. 1998. TASTE AND FLAVOR: Their Importance in Food Choice and Acceptance. Proceedings of the Nutrition Society, 57, pp.639-643.

CONCEPCION S., M. Montiflor. 2004. Perceptions of Southern Mindanao Farmers on the Quality of Temperate Vegetables. Paper presented in the 47th Australian Agricultural and Resource Economics Society Conference, Fremantle, Western Australia, 12-14 February 2003.

DIGAL N., S. Concepcion. 2004. RECOVERING MARKETS: Securing Small Producer Participation in Restructured National and Regional Agri-food Systems. University of the Philippines in Mindanao.

GELLYNCK, X. 2002. Market Oriented Positioning of On-farm Processed Foods as a Condition for Successful Farm Diversification. Changing Environment and Competitiveness in the Food Industry.

MALHOTRA, N. 2004. Marketing Research: An Applied Orientation. 4th Edition. Prentice-Hall Inc.

PEARSON, D. (2001). How to Increase Organic Food Sales: Results from Research Based on Market Segmentation and Product Attributes. Agribusiness Review, Vol.9-2001. University of New England, Armidale, Australia. http: www.agrifood.info/review/2001/Pearson. html. (Accessed in March 2006)

Proceedings of the Planning Workshop on Vegetable Production, 27-29 July 2005, ATI, BSU Compound, La Trinidad, Benguet.