

South Korean Consumer Evaluation of Squash

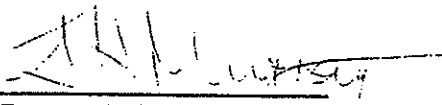
T. Phelps, S.H. Murray and A. Gunson
December 1994

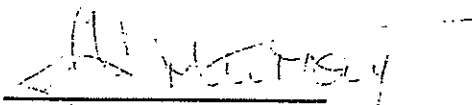
A Report for the New Zealand Buttercup
Squash Council

T. Phelps and S.H. Murray
MT ALBERT RESEARCH CENTRE
HortResearch
Private Bag 92 169
Auckland
Telephone: 0-9-849 3660
FAX: 0-9-815 4201

HortResearch Client Report No. 94/332

This report has been prepared by The Horticulture and Food Research Institute of New Zealand Ltd (HortResearch) which has its Head Office at Batchelar Research Centre, Private Bag 11 030, Palmerston North and has been approved by:


Research Scientist


Science Manager

Date: 22 Dec 94

Date: 22 Dec 94

CONTENTS

	Page
EXECUTIVE SUMMARY	1
1. BACKGROUND	3
2. OBJECTIVES	3
3. PROCEDURES	4
3.1 Selection of Consumers	4
3.2 Provision of Samples	4
3.3 Sample Preparation	4
3.4 Evaluation Procedures	5
3.5 Data Analysis	6
3.6 Explanation of Sensory Statistics	7
4. RESULTS	8
4.1 Sensory Results	8
4.2 Results of Focus Group Discussion held in Auckland	21
5. DISCUSSION	24
6. APPENDICES	26

EXECUTIVE SUMMARY

South Korean Consumer Evaluation of Squash

A Report for the New Zealand Buttercup Squash Council

T. Phelps and S.H. Murray

December 1994

Three varieties of Squash namely, Crown, Delica and Iron Helmet, were evaluated by 42 consumers in Seoul, South Korea, in November 1994. Sensory testing of the same varieties of squash was conducted in New Zealand concurrently with testing in Seoul. Following sensory assessment of the squash, a focus group discussion was held to investigate consumer perceptions and product purchase trends. This report contains a summary of the group discussion held in Auckland, New Zealand. Every component of the consumer evaluation took place in Korean, both in Seoul and Auckland.

The key findings are as follows:

- * No significant differences in preference attributable to age or gender were found between the three varieties of squash.
- * **Delica** squash was most liked for overall degree-of-liking and degree-of-liking of flavour. This variety was also found to be the sweetest. Consumers considered Delica to have "ideal" flavour strength, sweetness, firmness, density and chewiness (ease of chewing). The cooked appearance was disliked as the colour was strange and unlike the expected appearance of Korean varieties of squash. The "*messy/too many cracks/crumby*" appearance was also disliked. The green colour of this variety gave the impression of unripeness. The texture of Delica was disliked, as the sample lacked moisture, had a thick mouthfeel and was difficult to swallow. Approximately 25% of the consumers identified a sweet aftertaste present after consuming this variety. Very few of the consumers who participated were aware of the Delica variety of squash.
- * The aroma of **Iron Helmet** squash was its most liked attribute being described as "*sweet*", "*natural/characteristic pumpkin aroma*" and "*appetising/pleasant/delicious/ nice/good*". However, some consumers found this aroma too strong. The sweetness of this variety was weaker than "ideal", however, the sweet taste was liked by 38% of consumers. The flavour was considered "*too watery*". Consumers disliked the appearance commenting that it "*seems tough/appearance looks tough*" and "*stringy/stringy surface*". Twenty-one percent of consumers found a lingering sweet taste in their mouths after eating this variety.
- * **Crown** squash was most liked for its appearance with 30% of consumers commenting that they liked the "*colour/colour is pretty/beautiful/nice/good/impressive*". This variety was least liked for overall degree-of-liking and degree-of-liking of aroma and flavour. Crown squash was found to have the weakest flavour intensity and sweetness, being significantly weaker than "ideal" in both cases. Consumers described this variety as being "*tasteless*", "*insipid/plain*" and "*not sweet enough*". This variety had moderate stringiness which was considered "ideal" by South Korean consumers. Twelve percent of consumers identified an aftertaste which was described as "*bitter/lingering bitterness*".

Squash is perceived as a health aid in South Korean society. It is used particularly by woman after giving birth as it is believed to reduce swelling following pregnancy. South Koreans prepare squash in many different ways for eating and it is sometimes used as an ornament. Korean consumers have the impression of New Zealand being a clean and unpolluted country, however, the freshness of products imported from New Zealand is questioned due to the distance they have to be transported to Korea. Consumers remember a case poisoned mussels from New Zealand being sold in Korea in 1993, the memory of this appears to have tainted the image of New Zealand.

For further information contact: Tracey Phelps - Sensory Science Group, HortResearch, Private Bag 92169
Auckland, New Zealand. Telephone: (09) 815 4248 FAX: (09) 815 4244
Refer HortResearch Client Report No: 94/332

1. BACKGROUND

The Sensory Science Group at HortResearch was awarded funding from the Agricultural and Marketing Research and Development Trust (AGMARDT), to carry out research in 1994. The research was aimed at investigating the advantages and limitations of in-market testing compared with testing in New Zealand, as a means of establishing preferences for food products destined for export to South Korea.

Two product types were sought for use in this project, one fresh horticultural product and one processed product. Through consultation with Mr John Brakenridge of the Horticultural Export Authority (HEA), it was agreed that the HEA, on behalf of the New Zealand Buttercup Squash Council would fund a small portion of the research and supply three varieties of squash for evaluation in the South Korean marketplace. Wishing to optimise its position as a squash exporter, the New Zealand squash industry are interested in South Korea as an area to expand into with future export contracts. For this reason information gathered regarding how South Koreans view squash, particularly Delica squash, would be of great importance to the future planning of the industry.

2. OBJECTIVES

To conduct sensory testing of three varieties of squash, namely Crown, Iron Helmet and Delica, in Seoul, South Korea.

Primarily this research was undertaken to:

- * identify any preferences among the three varieties of squash;
- * determine whether significant differences in preference exist due to age and gender of consumers;
- * describe the sensory qualities of each of the varieties of squash;
- * gather information regarding product awareness, uses and purchase trends of squash in the South Korean marketplace.

Following the taste panels an informal discussion was held to elicit information regarding Delica squash. As part of this project taste panels were concurrently being conducted in New Zealand, using Korean consumers situated in Auckland. A discussion was held following this evaluation also; the comments gathered regarding the following points are included in this report. Staff from TRADENZ conducted the discussion group in Seoul, therefore a report outlining the information gathered from this session will be submitted to HEA by them. The discussions covered such points as product awareness, product uses and product purchase trends.

3. PROCEDURES

All sensory testing and organisation of the project in Korea, was conducted by the staff of *Korea Survey (Gallup) Polls Ltd.* in Seoul, South Korea.

3.1 Selection of Consumers

Forty-two South Korean consumers were selected on the following criteria:

- * consumers selected must not have been involved in any sensory evaluation work previously;
- * the group consisted of 21 males and 21 females;
- * nine consumers were aged 20-29 years, 10 were 30-39 years, 11 were 40-49 and 12 were 50-59 years old.

3.2 Provision of Samples

Transportation, by air, of each variety of squash to the New Zealand Embassy in Seoul was organised by Mr Ron Dunn of DM Palmer Ltd, (Importers and Exporters) New Zealand.

Delica squash was sourced in Lafoa, New Caledonia. Both Crown and Iron Helmet varieties were sourced within New Zealand, Southhead (Auckland) and Aoroa. Samples were transported from the New Zealand Embassy to Gallup for evaluation, beginning 1 November 1994.

The squash was stored at room temperature until the day of assessment.

3.3 Sample Preparation

Samples were cooked by a method of simple steaming. The surface of each whole squash was cleaned thoroughly prior to cooking, as samples were presented with their skin on. Each squash was cut into segments approximately 4-5cm wide and deseeded. Each segment was then divided into cubes approximately 3-4cm in length and 4-5 pieces were allowed per consumer. Cubes were placed skin down in a steamer over a saucepan of boiling water. Each variety was cooked separately to avoid flavour contamination among samples. Samples were steamed until tender (approximately 15 minutes). Ten minutes prior to the evaluation, samples were removed from the steamer and excess water was allowed to drain off. Samples were then placed directly onto coded plates ready for evaluation. Consumers received plastic coded dessert spoons with which to eat their samples. A glass of water was provided for cleansing the palate between samples.

3.4 Evaluation Procedures

A pilot study was conducted by the Sensory Science Group, HortResearch, Mt Albert Research Centre, New Zealand in July 1994. This study was carried out to ascertain attributes that were important to South Korean consumers in their consideration of squash. The information gathered from this study was used to formulate a final evaluation form and to ensure that sample preparation and presentation was carried out in a culturally sensitive manner.

Korea Survey (Gallup) Polls Ltd is not traditionally a Sensory Research facility as this company is primarily involved in market research. Gallup staff conduct many surveys by telephone interview. Telephones for such interviews are contained in small private booths (Plate 1). The sensory evaluation of the squash samples was carried out in these interview booths. The room in which the booths were contained was air-conditioned to a temperature of approximately 20°C and the room was fluorescently lit. Each session consisted of a group of eight consumers. Discussion during assessments was not allowed.

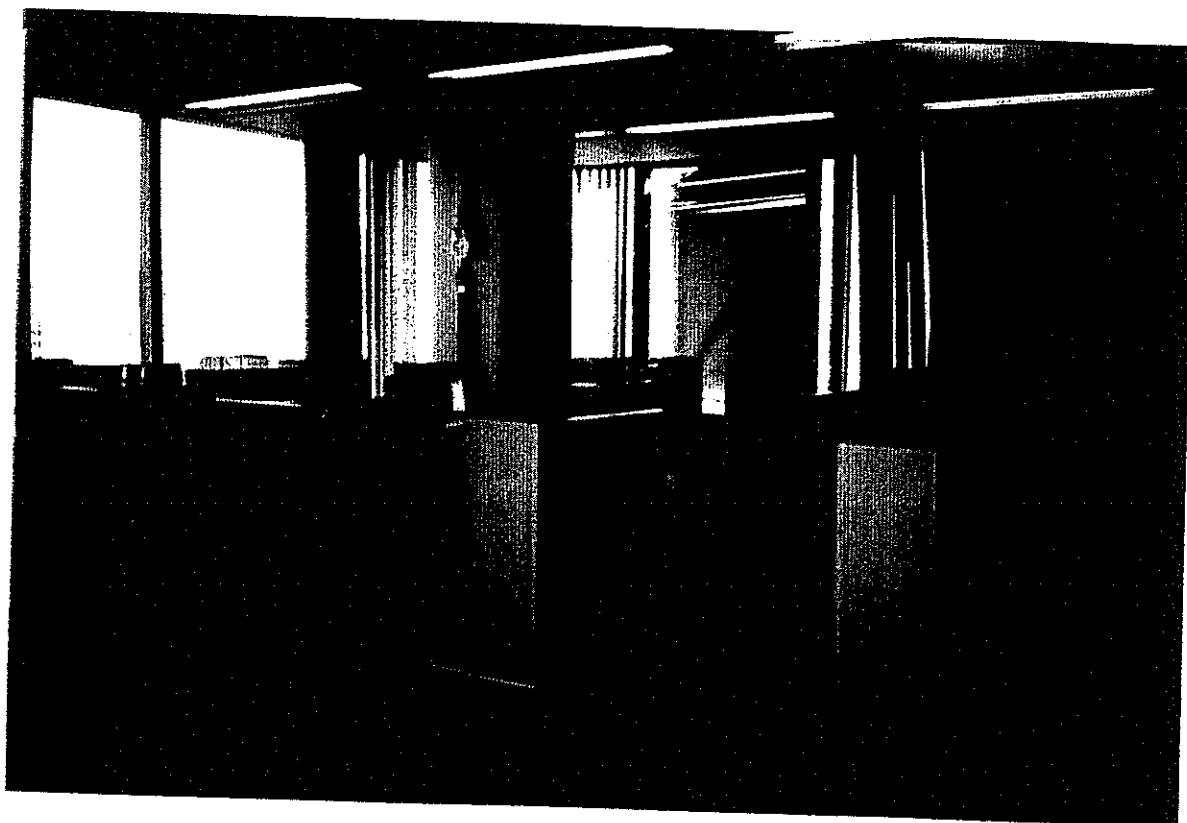


Plate 1. Korea Survey (Gallup) Polls Ltd - Evaluation Booths

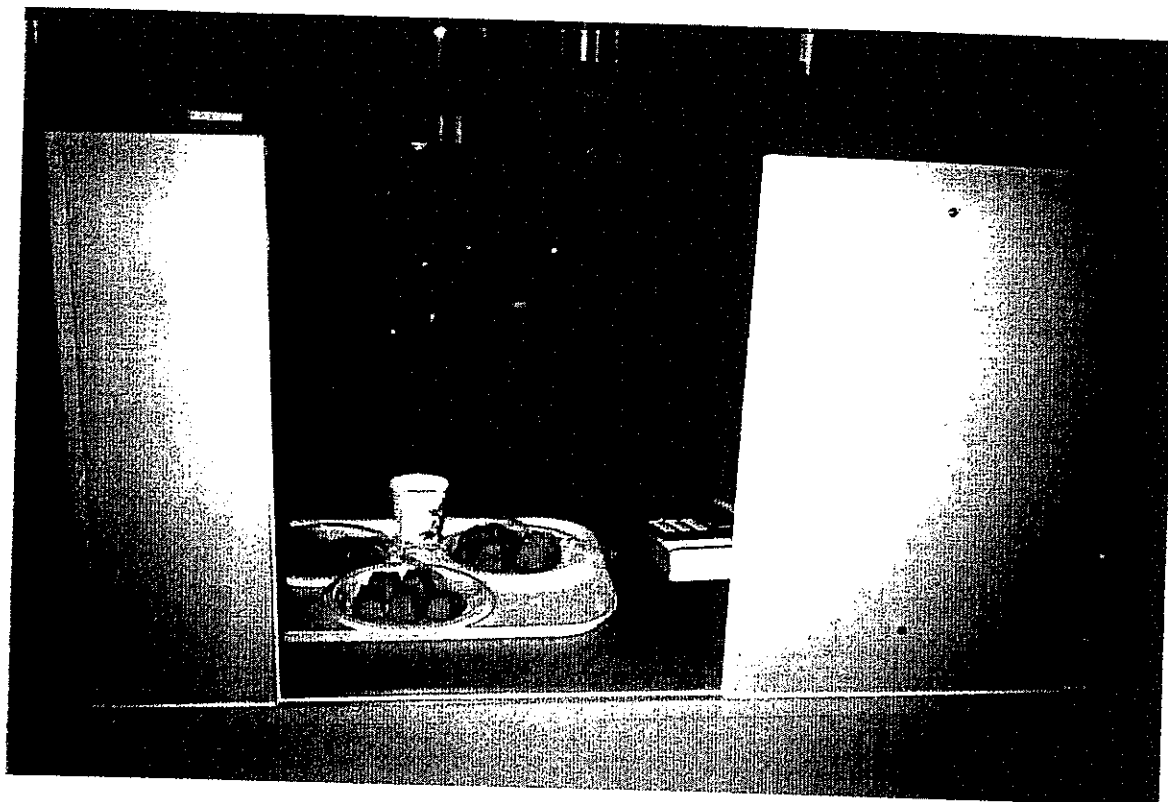


Plate 2. Korea Survey (Gallup) Polls Ltd - Sample Presentation

A balanced complete block design was used. All consumers evaluated each of the three varieties of squash.

Consumers were presented with each of the three samples and asked to indicate their degree-of-liking of the follow attributes: overall, appearance, aroma and flavour. Further to these questions consumers were asked to indicate their perception of the intensities and their personal "ideal" expectation score for the following attributes; colour, flavour, sweetness, firmness, moisture content, density, stringiness and chewiness. Finally consumers were asked whether an aftertaste was present after consuming each sample. Space was provided throughout the evaluation form for the inclusion of consumer comments regarding the samples.

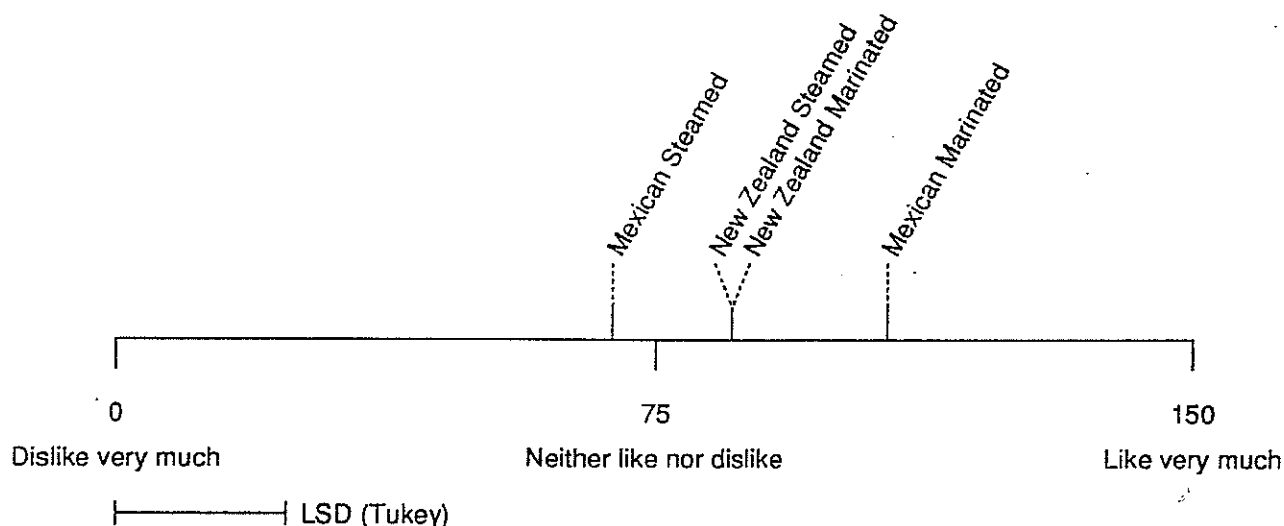
3.5 Data Analysis

Numerical data was analysed by the Residual Maximum Likelihood Method (REML), using the Genstat Statistical package. Least significant differences (LSD) were calculated from the standard error of difference.

Consumer comments were translated, collated and their frequency tallied.

3.6 Explanation of Sensory Statistics

Example of a line scale: Degree-of-liking of Aroma



We will use the above line scale in our explanation.

The line scale shows, for a particular attribute, eg. Aroma, the relative positions of the mean (average) scores of each of the varieties of Squash being tested on a scale of preference which is indicated underneath eg. from 0=Dislike Very Much to 150=Like Very Much.

To find out whether the difference between the samples is significant ("real") we ran a Tukey's test which determines the Least Significant Difference (LSD) ie. what is the smallest distance needed between two samples before they become significantly different from each other. This is shown as the line drawn under the line scale (see above).

Thus to see which of the above samples are different from the others, measure the LSD line and hold this against any two positions on the line scale. If the distance between them is greater than the LSD line, there is a "real" difference between the two samples. Conversely, if the distance between the two positions is less than the length of the LSD line, there is no "real" difference between the two varieties.

For the above example, the LSD = 22 (ie. 22mm), thus when you compare the four squash samples you will see that the Mexican steamed sample is significantly different from the Mexican marinated sample, whereas it is not significantly different from the two New Zealand samples.

There are many different tests of significance that can be used, but we have chosen Tukey's because we feel it is the most appropriate test for this piece of research. The samples are significantly different from each other at the 5% level. We can look at other levels but at this level this means that there is only a 5% or 1 in 20 chance that these results could be due to random choices by the consumers.

4. RESULTS

4.1 Sensory Results

Mean scores and ratio of ideal to actual scores for sensory attributes of squash as assessed by South Korean consumers are contained in tables in Appendices 1 and 2 respectively. Frequency tables for comments relating to these sensory attributes of squash are contained in Appendices 3 - 7. Attributes are listed in this results section in the order they appeared within the evaluation form.

No significant differences were found, for any attribute in this evaluation, that were attributable to age or gender.

Overall

South Korean consumers preferred Delica squash significantly more than both Iron Helmet and Crown varieties, when considering overall degree-of-liking (Figure 1). Consumer comments tended to suggest this was due to the "*sweet/sweetness*", "*soft/soft mouthfeel*" and "*taste similar to sweet potato*" qualities of this sample (Appendix 3). A high proportion of consumers also commented that this sample was "*delicious*". Ten percent of consumers liked the "*pretty colour/colour/nice colour/colour appeals to appetite*" of Delica squash. However, some consumers disliked the "*strange colour/the colour/not like Korean pumpkin/seems artificial*" appearance of this variety.

Iron Helmet squash was also liked for its "*sweet/sweetness*". However this variety of squash was disliked by consumers for being "*too watery*" and for its "*tasteless/no tastelow intensity/no special taste*".

Crown squash was highly liked for appearance attributes, as noted by the following consumer comments; "*pretty colour/colour/nice colour/colour appeals to appetite*" and "*neat appearance/looks very good/looks delicious/visible attractiveness/pretty*". Consumer comments however indicated a lack of flavour in this variety, as can be judged from the following comments; "*tasteless/no tastelow intensity/no special taste*", "*want it sweeter/not sweet enough/low sweetness*" and "*insipid/plain*".

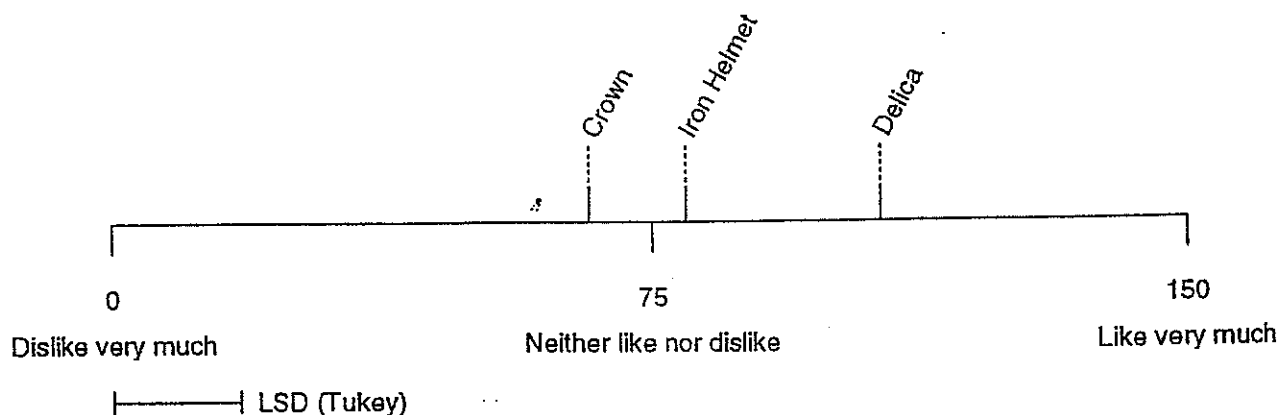


Figure 1. Mean scores for Overall degree-of-liking.

Appearance

Crown squash was found to be most liked for degree-of-liking of appearance being significantly more liked than Iron Helmet (Figure 2). Each of the three varieties, particularly Crown, were liked for their "*colour/colour is pretty/beautiful/nice/good/impressive*" (Appendix 4).

Approximately 10% of consumers liked the "*neat/very neat*", "*looks delicious*" and "*looks smooth/smooth surface*" appearance of Crown squash. A further 10% of consumers described Crown squash as "*looks solid*", a quality that was disliked.

The "*green colour/green skin colour/green skin looks fresh*" of Delica squash was liked by 14% of consumers. However, a similar number disliked this variety commenting "*looks unripe/green colour makes me think unripe*". The appearance of this sample was also disliked for being "*messy/too many cracks/looks crumbly*" and "*skin colour too dark*".

The appearance of Iron Helmet squash was disliked by 12% of consumers because this sample "*seemed tough/appearance looks tough*" and "*stringy/stringy surface*".

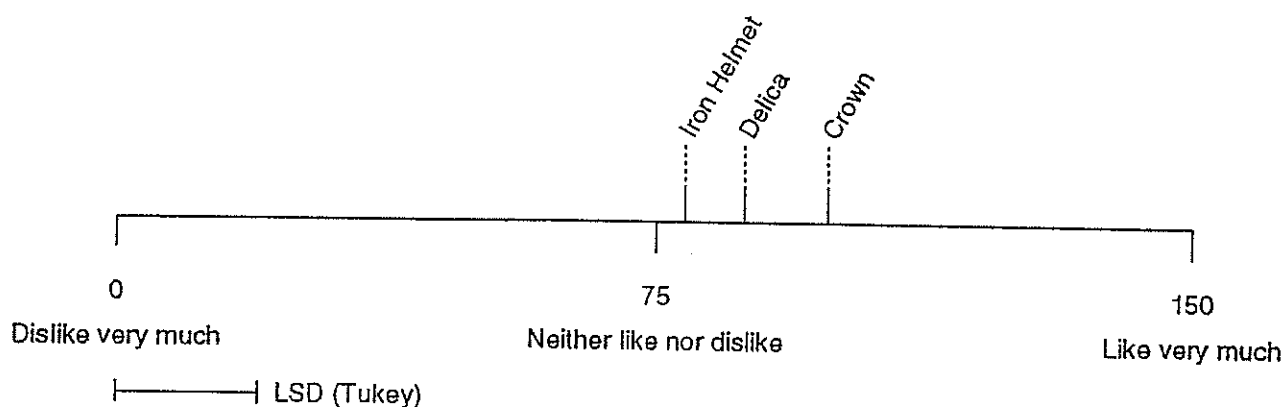


Figure 2. Mean scores for degree-of-liking of Appearance.

Colour Intensity

Each of the three varieties were found to be of similar, moderate, colour intensity (Figure 3). Delica squash however, was considered to be significantly lighter than the "ideal" colour intensity for squash (Figure 4). Iron Helmet and Crown varieties were scored closest to the "ideal".

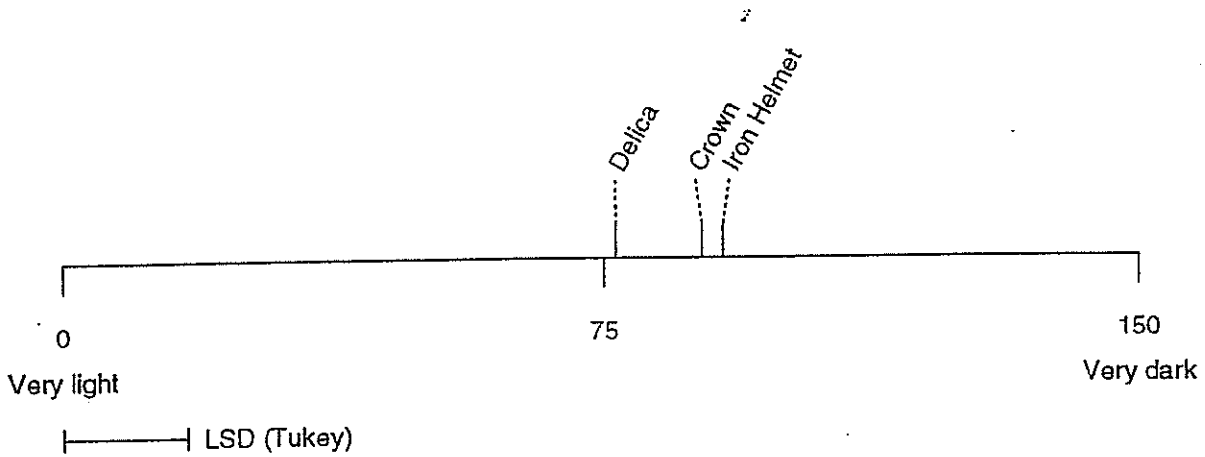


Figure 3. Mean scores for Colour Intensity.

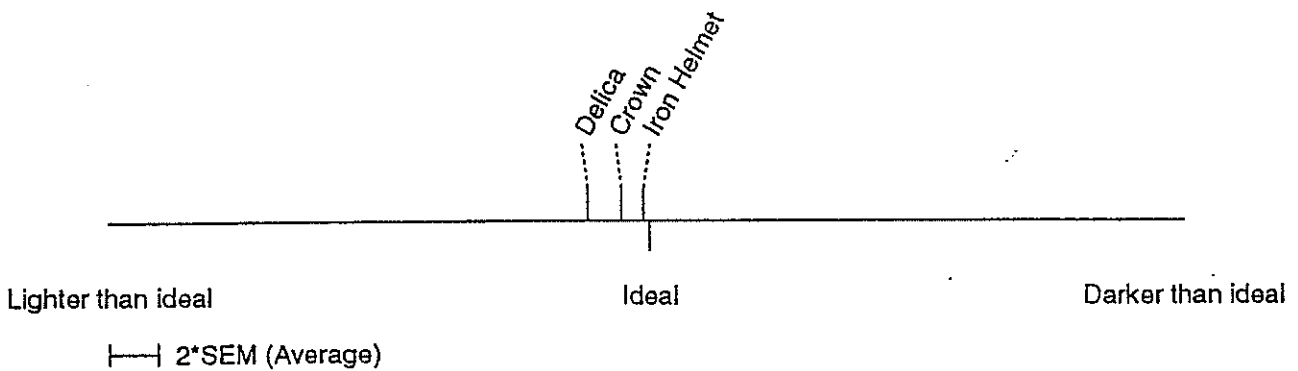


Figure 4. Closeness to "ideal" Colour Intensity.

Aroma

When considering degree-of-liking of aroma, South Korean consumers liked Delica and Iron Helmet significantly more than Crown squash (Figure 5).

Consumer comments indicate Delica was particularly liked for its "*light/soft/not too strong aroma*" (Appendix 5). The aroma of this variety was also liked for being "*sweet*" and "*savoury*".

Iron Helmet was found to have a pleasing "*sweet*" and "*natural/characteristic pumpkin aroma*". Ten percent of consumers liked the "*strong*" aroma of this variety, while 12% commented they disliked the "*strong smell/very strong/too strong/too pungent*" aroma.

Consumers comments were also divided over the aroma of the Crown squash. Fourteen percent of consumers disliked the "*strong smell/very strong/too strong/too pungent*", while a further 12% disagreed commenting they disliked the aroma of this sample for having "*no aroma/not much aroma*".

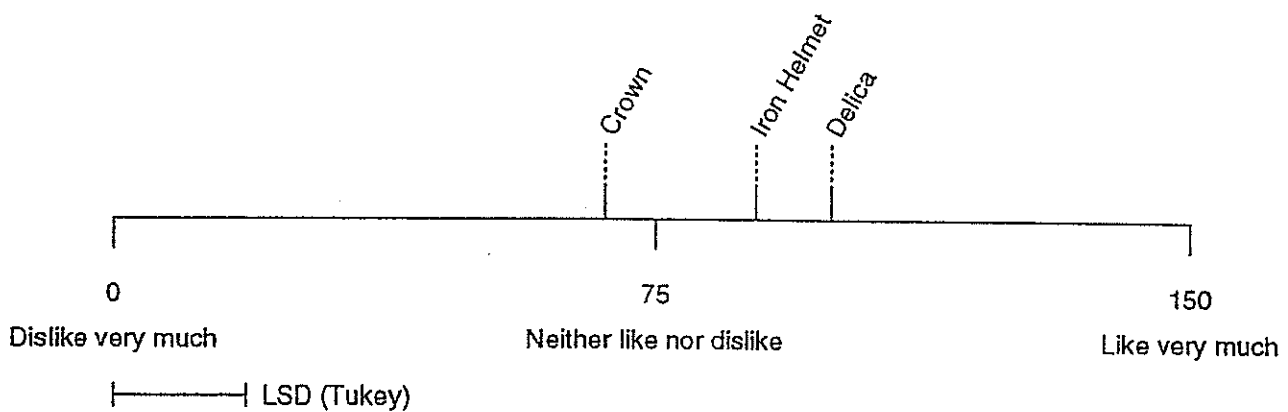


Figure 5. Mean scores for degree-of-liking of Aroma.

Flavour

Significant differences were found between each of the three varieties for degree-of-liking of flavour (Figure 6). Delica was most liked, significantly more so than Iron Helmet and Crown. Iron Helmet squash was liked significantly more than Crown for this attribute but was less liked than Delica. Crown squash had the least liked flavour, being significantly less liked than both Delica and Iron Helmet varieties.

Consumer comments supported the above findings very clearly. Approximately 40% of consumers liked the "*sweet/sweetness*" of Delica and Iron Helmet squash. Consumers also liked the "*light/soft*" flavour of these two varieties (Appendix 6). Delica being the most liked variety for this attribute was also described as having a "*delicious/good taste/taste/tasty/pleasant*" flavour and being "*similar to sweet potato/liked steamed sweet potato*", qualities which were liked by approximately 20% of consumers.

While the "*light/soft*" flavour of Crown squash was liked, consumers described this variety as being "*not sweet/poor sweetness*", "*tasteless/no characteristic taste/no special taste*", "*insipid*" and having a "*watery taste*".

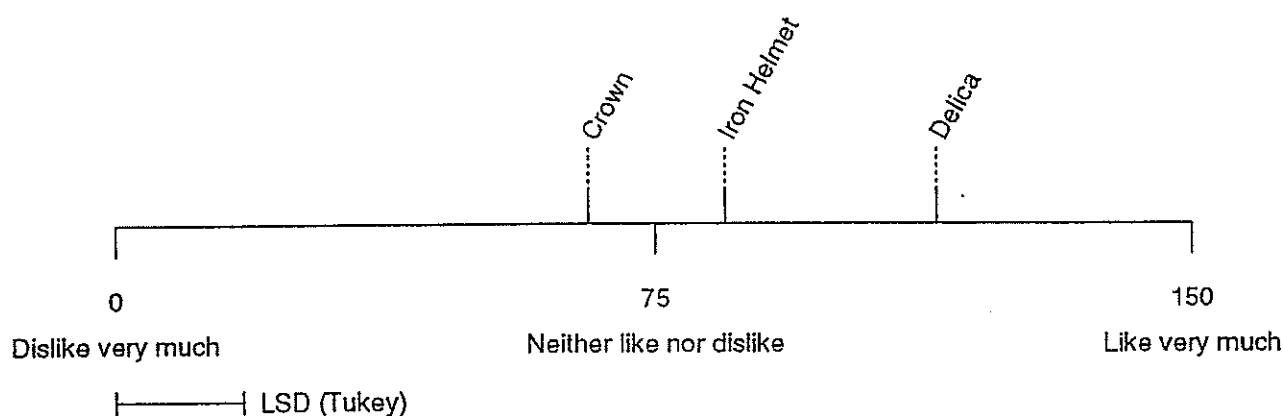


Figure 6. Mean scores for degree-of-liking of Flavour.

Flavour Intensity

Consumers rated Delica squash as having the strongest flavour intensity, being significantly stronger than the Crown variety (Figure 7). The stronger flavour of Delica was liked by consumers who rated this variety as close to "ideal" (Figure 8). Iron Helmet and Crown varieties were significantly weaker than the "ideal" flavour strength.

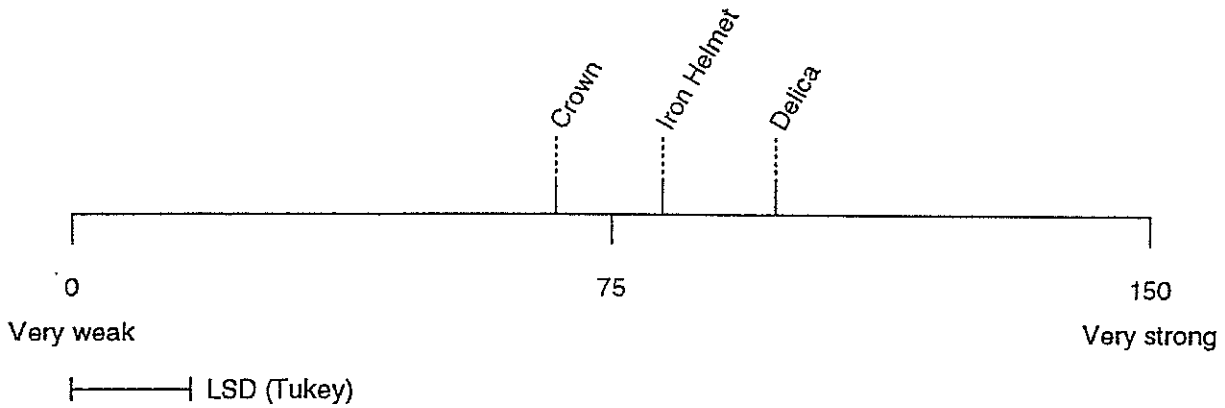


Figure 7. Mean scores for Flavour Intensity.

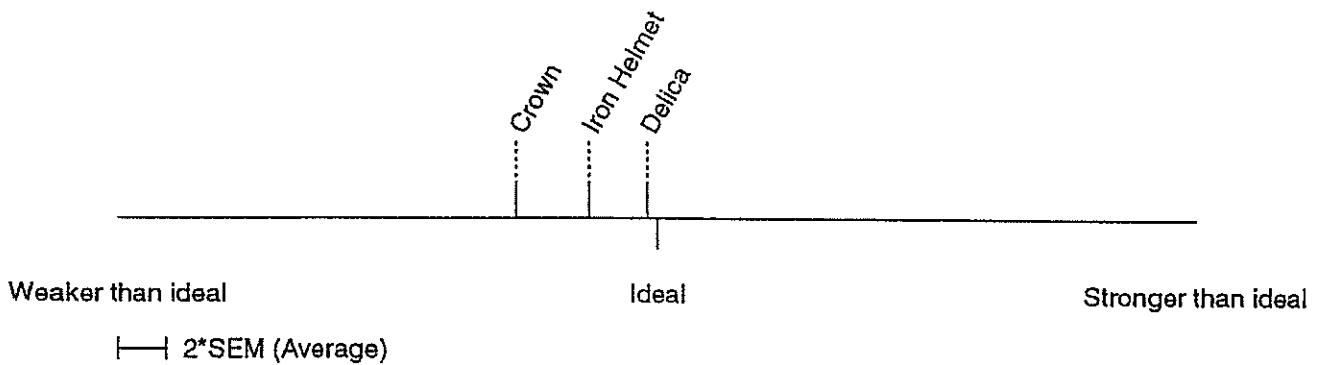


Figure 8. Closeness to "ideal" Flavour Intensity.

Sweetness

Consumer responses showed Delica squash to be the sweetest variety and closest to the "ideal" for this attribute (Figures 9 & 10). Delica was significantly sweeter than Iron Helmet and Crown squash. Both of these varieties were significantly less sweet than the "ideal". Crown was the least sweet variety being significantly less sweet than Delica and Iron Helmet varieties and subsequently most removed from the "ideal" sweetness.

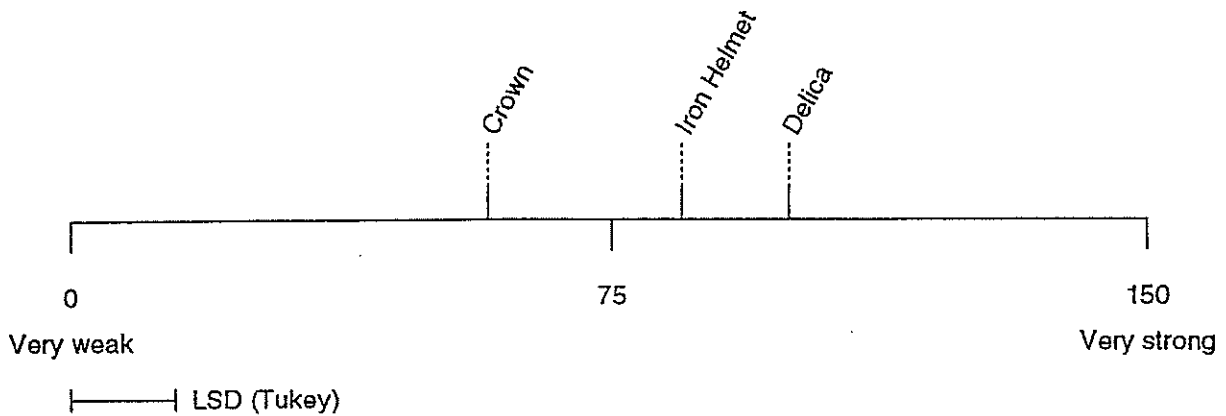


Figure 9. Mean scores for Sweetness.

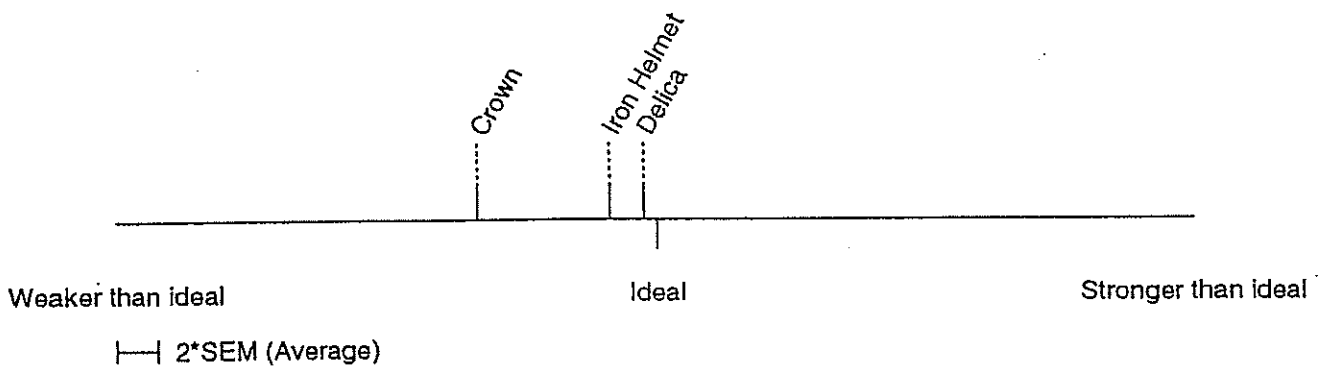


Figure 10. Closeness to "ideal" Sweetness.

Firmness

No significant differences were found for this attribute, all varieties were found to be of moderate firmness (Figure 11). Each variety was scored as not significantly different from "ideal" (Figure 12). It is therefore shown that the cooked squash in this trial were of optimum firmness as judged by South Korean consumers.

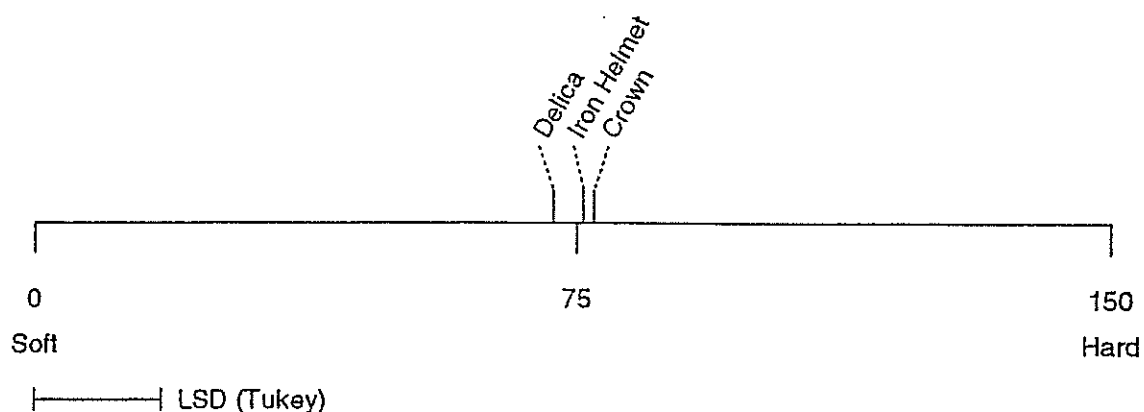


Figure 11. Mean scores for Firmness.

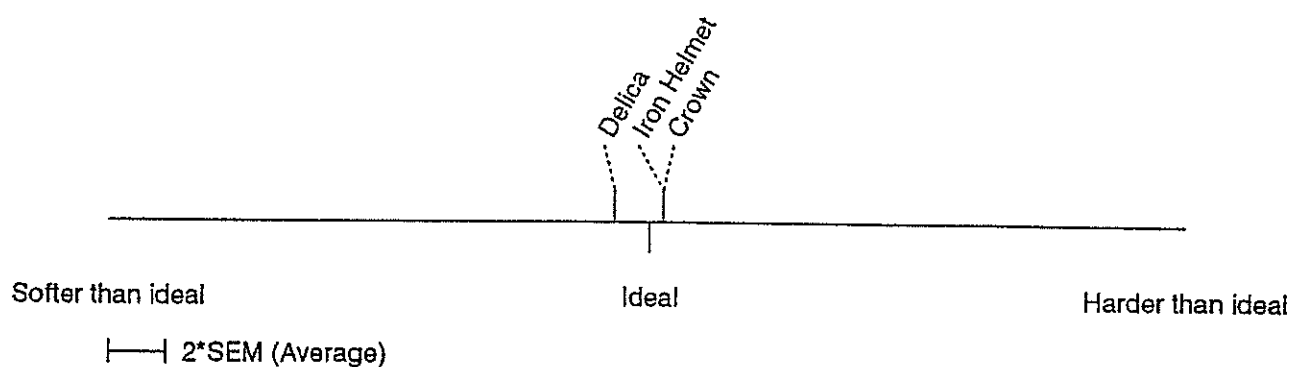


Figure 12. Closeness to "ideal" Firmness.

Moisture Content

Consumers considered Crown and Iron Helmet squash to have significantly higher moisture content than the Delica variety (Figure 13). Crown and Iron Helmet squash were found to have close to "ideal" moisture content, while Delica had a moisture content significantly less than "ideal" (Figure 14).

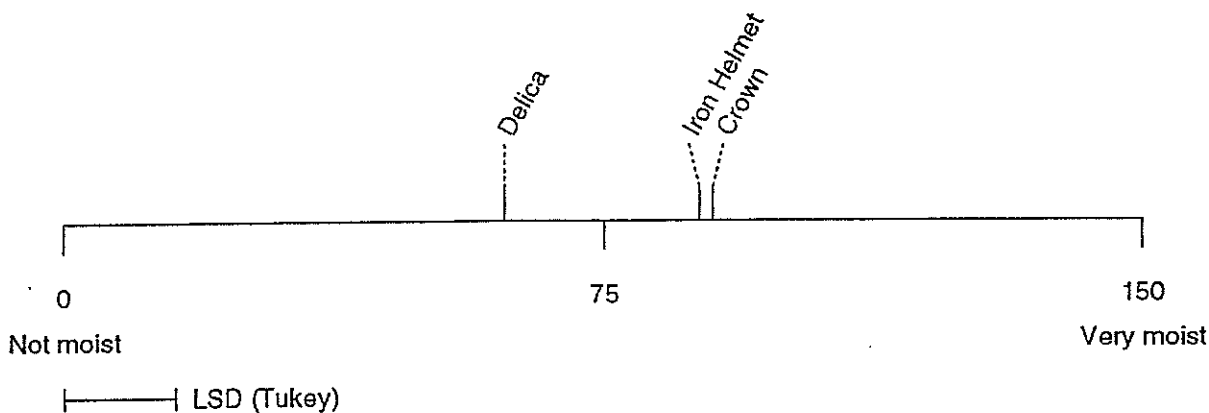


Figure 13. Mean scores for Moisture Content.

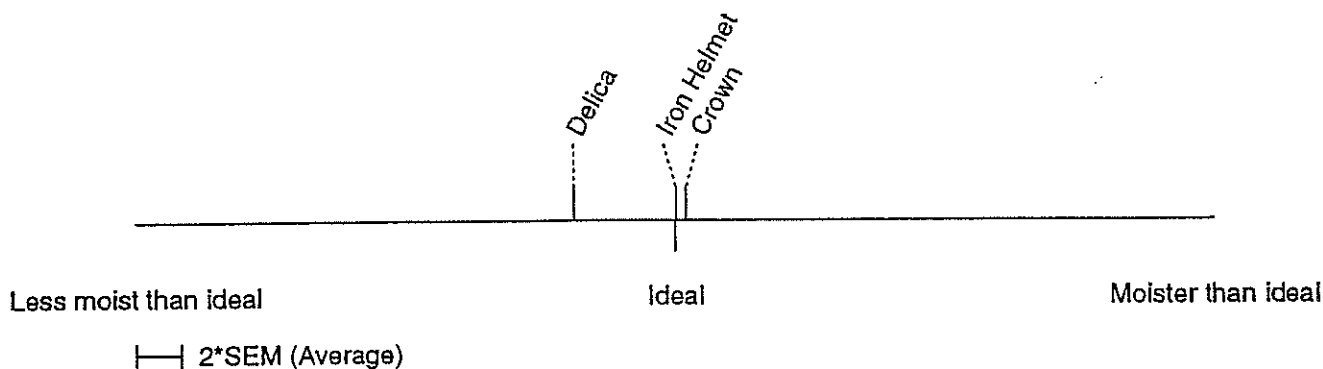


Figure 14. Closeness to "ideal" Moisture Content.

Density

As shown in Figure 15, Delica squash was found to be the most dense. Crown squash was rated significantly less dense than Delica while Iron Helmet was of a similar density to both Delica and Crown. Delica and Iron Helmet were considered to be close to "ideal" density for squash (Figure 16). The density of Crown squash was significantly less than the "ideal".

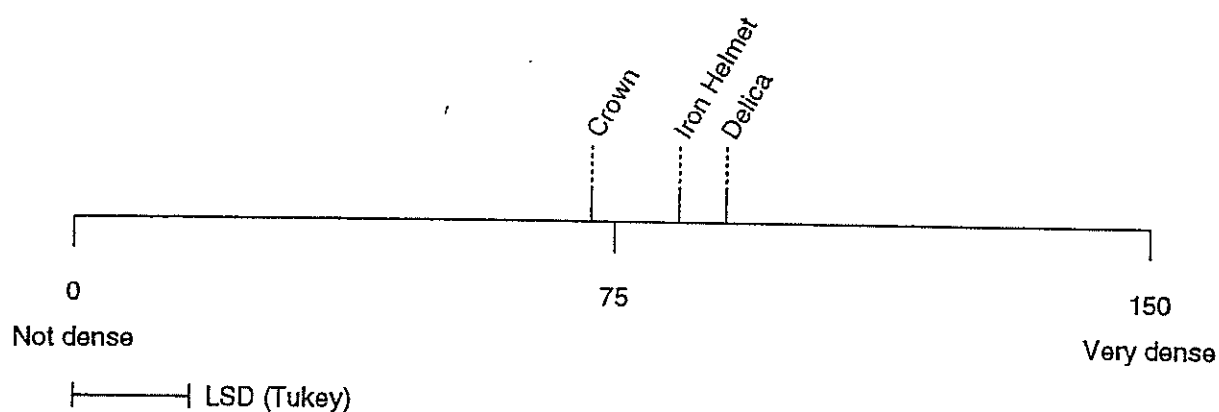


Figure 15. Mean scores for Density.

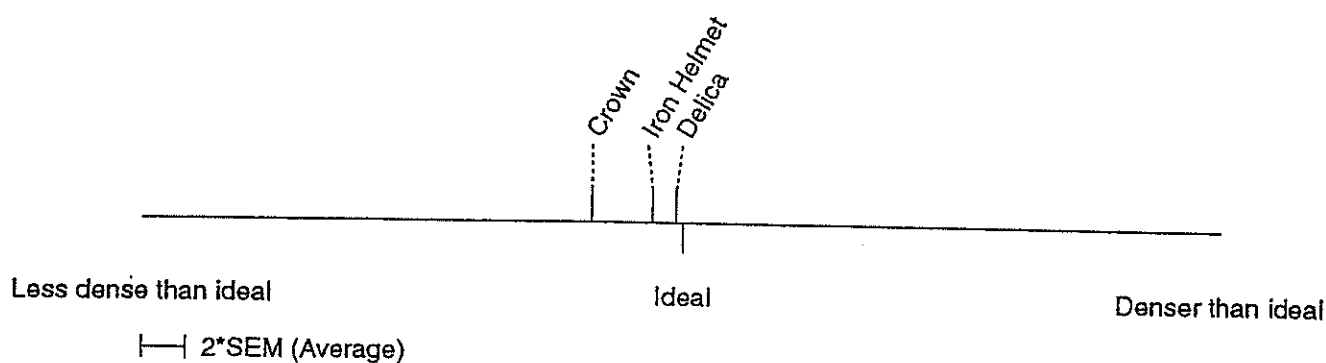


Figure 16. Closeness to "ideal" Density.

Stringiness

Iron Helmet was the most stringy, significantly more so than Crown and Delica (Figure 17). This variety was more stringy than "ideal" (Figure 18). Crown had moderate stringiness that was considered "ideal" by consumers. Crown was significantly less stringy than Iron Helmet yet more stringy than the Delica variety. Consumers found Delica to be the least stringy variety, significantly less than the other two varieties. However, this squash was scored significantly less than "ideal" for this attribute.

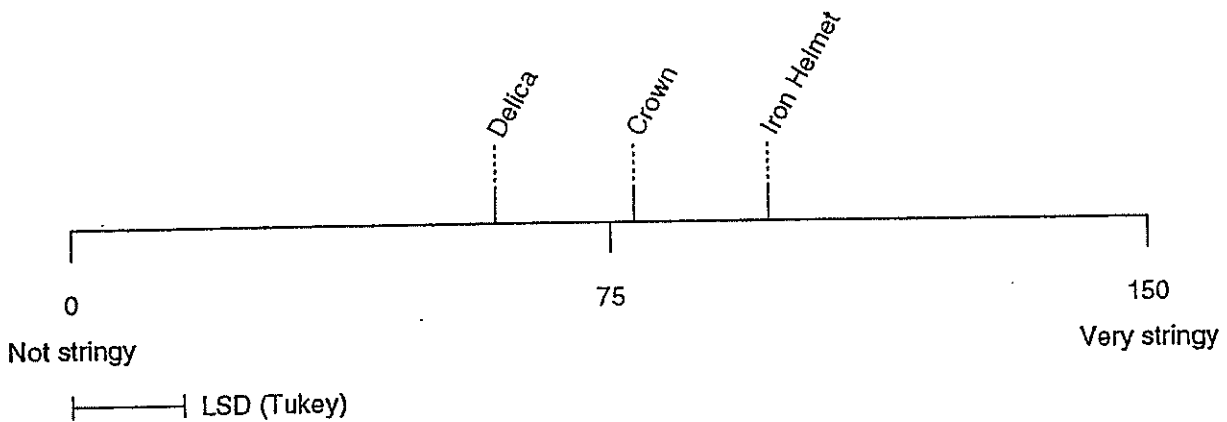


Figure 17. Mean scores for Stringiness.

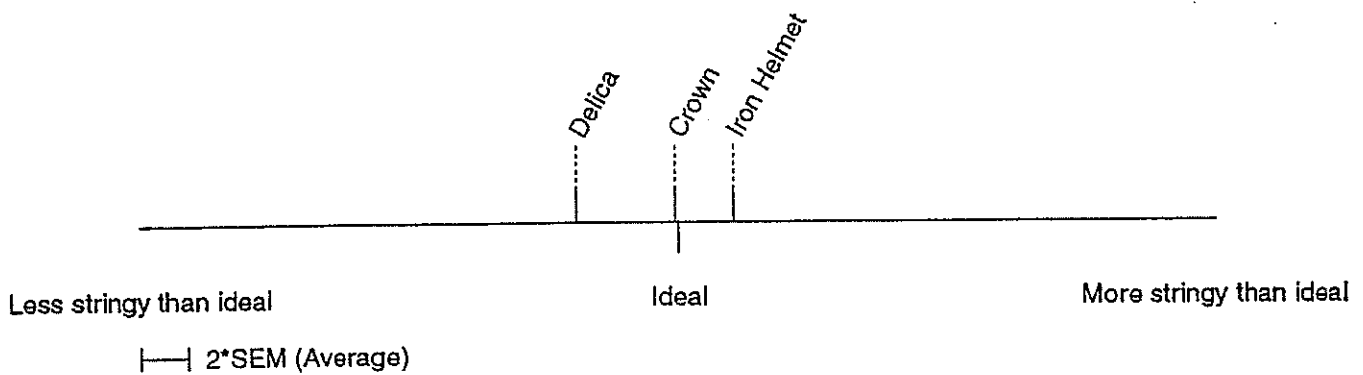


Figure 18. Closeness to "ideal" Stringiness.

Chewiness (Ease of chewing)

Consumers indicated Delica squash was significantly easier to chew, and closer to "ideal" chewiness than Iron Helmet and Crown varieties (Figures 19 & 20). Iron Helmet and Crown squash were considered significantly more difficult to chew than the "ideal".

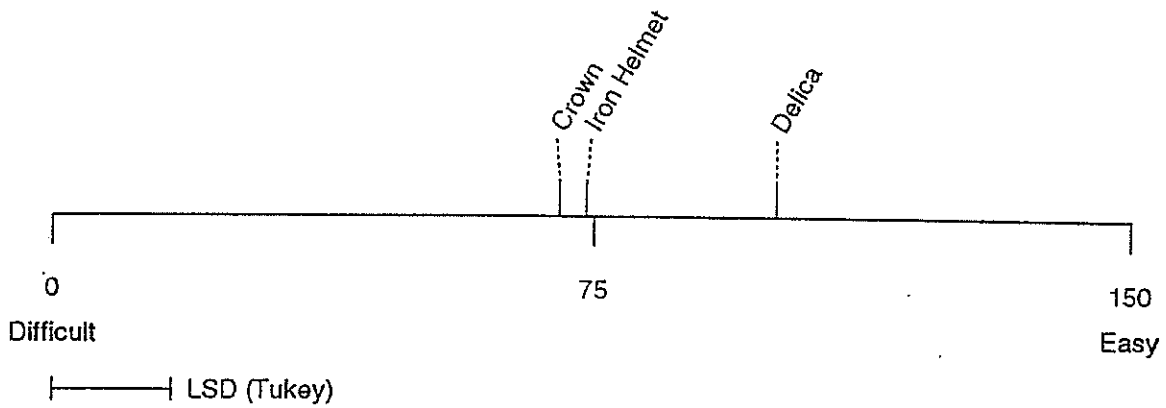


Figure 19. Mean scores for Chewiness.

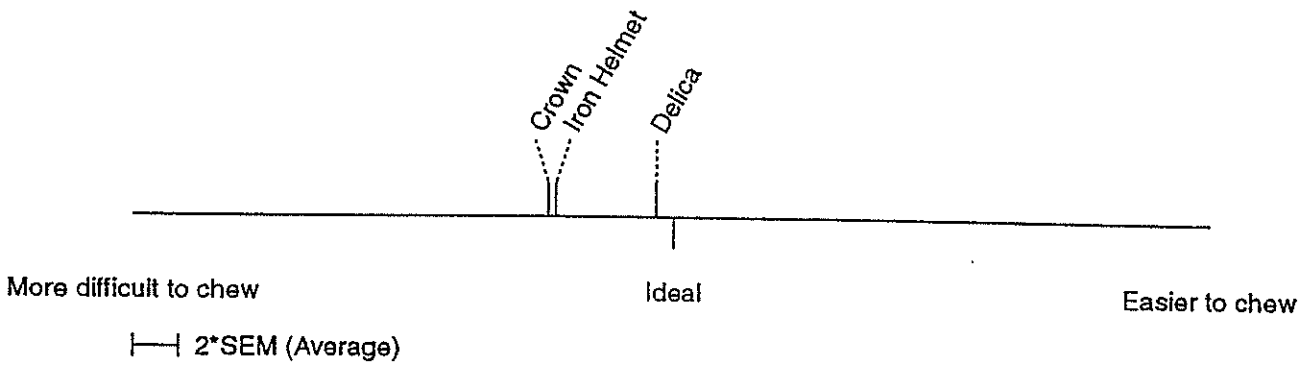


Figure 20. Closeness to "ideal" Chewiness.

Aftertaste

At the end of the evaluation consumers were asked to indicate if an aftertaste was present and if so to describe it. Seventy-nine percent of consumers found an aftertaste in Delica squash, 50% for Crown and 69% for Iron Helmet. Comments collected to describe these aftertastes are listed in Appendix 7.

Delica and Iron Helmet were found to have a "*sweet/too sweet*" aftertaste, Crown was more noted for its "*bitter/lingering bitterness*". Twelve percent of consumers described the aftertaste in the Delica variety as "*soft/light*".

4.2 Results of Focus Group Discussion held in Auckland

Thirty-nine South Korean consumers took part in the Sensory Evaluation of squash in Auckland (run concurrently with testing in Seoul) as part of this project. Following this assessment, a group discussion was held focusing on consumer perceptions of squash, particularly Delica. The discussion was conducted in Korean by a Korean interpreter. The discussion was based on a series of questions supplied by the New Zealand Buttercup Squash Council.

Product Awareness (Delica Squash)

A small number of South Korean consumers were aware of Delica squash, however the majority were not. Those who were aware had either seen Delica for sale in Korean supermarkets or street markets, or had become familiar with the product since arriving in New Zealand. One consumer, obviously familiar with this variety of squash, said "*we call it sweet pumpkin*". Those who had encountered the product in Korea said it was expensive.

Generally the feeling towards this product was that it was unfamiliar and different from Korean pumpkin. The expected/familiar product seems to be larger and more yellow in colour. The green colour of Delica was perceived as being fresh by a number of consumers, also as indicative of nutritional value especially iron content. A few thought the green colour indicated an unripe product. The following comment was made; "*it is difficult to buy it until you try it - if you sell this product with a taste meeting then it would sell sensationally*"; indicating a "try before you buy" idea may overcome any appearance biases.

When discussing the flavour of this variety, the sweet, savoury, chestnut, sweet potato-like taste was liked. Crumbly texture, low moisture content, thick mouthfeel, hard to swallow, were all negative comments relating to the texture of this sample.

Consumers indicated they would be interested in squash recipes, also they felt it was necessary to let people know whether the skin can be eaten, as generally they remove it before eating.

The orange colour of Delica squash suggested to some consumers that this product contained carotene - good for night blindness. One consumer found the orange colour to be indicative of iron. The combination of green and orange indicated to consumers that this vegetable contained plenty of vitamin A. One consumer said, "*deep green means energy*".

Product Uses

A great number of comments collected indicated squash is perceived as a medical aid in Korean society.

When consumers were asked "who uses squash" the following was noted:

- * woman after confinement (after giving birth) - good for swelling
- * patients
 - constipation
 - good for kidney function
 - good for urination
- * people with coughs, we add honey
- * people who like alcohol
- * housewives aged 30-50
- * children
- * elderly

The comment was made that "*people don't like to buy imported products for using as medicine, prefer Korean original pumpkin, they think it is more effective*".

Squash appears to be prepared for eating in many ways in Korea:

- * grill squash covered with flour
- * steamed
- * soup
- * pumpkin juice - double boiled and filtered juice - good for asthma
- * pumpkin rice cake
- * pumpkin drinks
- * pumpkin tea (dried and ground up)
- * pumpkin kimchi
- * boiled pumpkin for women in confinement
- * steamed pumpkin with glutinous rice and kidney beans
- * pumpkin candy
- * fried pumpkin

Sometimes used as an ornament.

New Zealand Imagery

Most consumers associate New Zealand with kiwifruit, and perceive New Zealand as being unpolluted and clean. New Zealand is also known for its deer velvet, honey, oranges, dairy products and meat. Imports from New Zealand were considered unfresh by some consumers because of the distance they have to be transported to South Korea. For this reason some people said Chinese agricultural products were more liked as they aren't transported so far. The cost was also expected to be high for products from New Zealand again because of the distance required to transport the squash for sale.

A point of interest which has arisen both in the pilot study and during this discussion session, is that of poisoned New Zealand mussels that were sold in Korea in 1993. Several comments referred to this incident "*poisoned New Zealand mussels damaged the image*" and "*they loose credibility because of the event of the poisoned mussels*". Obviously this event has affected the Korean view of New Zealand and New Zealand products.

Product Purchase

When questioned regarding place of purchase the following list was devised:

- * supermarket
- * department store
- * street market
- * health food store
- * agriculture and marine products market
- * pumpkin market
- * country market
- * mobile vegetable store
- * apartment market

If squash was made available to the South Korean market over the period February to May, consumers would be enthusiastic to purchase it if the price was reasonable. Squash can be purchased over this period in Korea, however, the prices are very high. Consumers were asked to give an indication of the prices they would pay for squash at this time of year: for a large pumpkin, 10000 Won (\$20); for a squash like Delica, a price in the range of 700-3000 Won (\$1.40-\$6) would be paid.

Consumers were asked what products squash would substitute in their shopping and cooking:

- * kidney beans
- * red beans
- * glutinous rice
- * ginseng
- * jujube
- * all kinds of vegetables
- * pine nuts
- * cinnamon
- * pear

5. DISCUSSION

Delica

Consumers rated Delica as most liked for overall degree-of-liking and degree-of-liking of flavour. This variety was the sweetest and easiest to chew. Consumers considered Delica to have "ideal" flavour strength, sweetness, firmness, density and chewiness. Delica was described as being "*sweet/sweetness*", as being/having "*soft/soft mouthfeel*", "*light/soft/not too strong aroma*", "*light/soft*" flavour and "*delicious/good taste/taste/tasty/pleasant*" flavour. This variety was found to have a "*sweet/too sweet*" aftertaste by 26% of consumers. Delica was found to be the least stringy variety, however, results showed Korean consumers prefer their squash to have moderate stringiness. Delica was considered less stringy than "ideal".

Comments gathered during the focus group discussion held in Auckland revealed the texture of this variety was not particularly liked by South Korean consumers. This sample was found to have poor moisture content and a thick mouthfeel which made it difficult to swallow. Delica had significantly less moisture content than "ideal".

The appearance of the cooked sample was disliked for having a "*strange colour/the colour/not like Korean pumpkin*", for being "*messy/too many cracks/crumblly*", "*don't like the green/too much green*" and "*looks unripe/green colour makes me think unripe*". Consumers found the colour intensity of this sample to be significantly lighter than "ideal".

The majority of consumers involved in the focus group discussion held in Auckland were not aware of the Delica variety of squash. The general feeling for this product was that they would buy it now they had tasted it, therefore it should be sold in a "try before you buy" type situation. Prior to tasting this variety, consumers did not like the green skin as it had connotations of being unripe.

The green and orange colours of Delica squash represented the presence of Carotene, Vitamin A and Iron to consumers.

Iron Helmet

Iron Helmet squash was moderately liked overall and for degree-of-liking of flavour, when compared to Delica and Crown varieties. This variety was found to have the darkest colour which was close to "ideal". The aroma of Iron Helmet squash was its most liked attribute, being described as "*sweet*", "*natural/characteristic pumpkin aroma*" and "*appetising/pleasant/delicious/nice/good*". Twelve percent of consumers however described this aroma as "*strong smell/very strong/too strong/too pungent*". Twenty-one percent of consumers identified a "*sweet/too sweet*" aftertaste in this variety of squash.

The following texture attributes associated with this sample, namely, firmness, moisture content and density, were each rated close to "ideal". Iron Helmet squash was found to be considerably more stringy and more difficult to chew than "ideal".

The "sweet/sweetness" taste of this sample was liked, however, consumers also found this variety to be "tasteless/no taste/low intensity/no special taste" and "too watery".

The colour of Iron Helmet squash was liked being described as "*colour is pretty/beautiful/nice/good/impressive*" by 14% of consumers but the appearance was disliked by a further 12% of consumers for appearing "tough" and for having a "*stringy/stringy surface*".

Crown

This variety of squash was most liked by South Korean consumers for its appearance. The specific appearance qualities that were liked were; "*colour/colour is pretty/beautiful/nice/good/impressive*" (31%), "*looks delicious/appetising*" (12%) and "*neat/very neat*" (12%). The colour intensity of Crown squash was scored close to "ideal". Crown squash was of moderate stringiness which was considered to be "ideal".

The flavour and sweetness of this variety were both weaker than "ideal", both being rated as weakest for these attributes when compared to Delica and Iron Helmet varieties. The moisture content and firmness were both "ideal" while the chewiness of this sample was considered more difficult than "ideal". This sample was found to have the least dense texture being scored significantly less dense than "ideal".

Crown squash was the least liked for overall degree-of-liking and degree-of-liking of flavour. The flavour was perceived as being "*not sweet/poor sweetness/less sweetness*" and "*tasteless/no characteristic taste/ no special taste*". A "*bitter/lingering bitterness*" aftertaste was described in this variety by 12% of consumers.

6. APPENDICES

Appendix 1. Mean Scores for Sensory Attributes of Squash as Evaluated by Korean Consumers.

Attributes	Treatment			Significance	Tukey's LSD
	Delica	Iron Helmet	Crown		
Overall ¹	107.6 ^a	79.8 ^b	66.2 ^b	*	17.71
Appearance ¹	87.4 ^{ab}	79.0 ^b	99.3 ^a	*	19.61
Colour ²	76.7	91.9	89.0	NS	17.03
Aroma ¹	100.0 ^a	89.2 ^a	68.0 ^b	*	18.41
Flavour ¹	114.6 ^a	84.8 ^b	65.7 ^c	*	17.60
Flavour Intensity ³	98.2 ^a	82.1 ^{ab}	67.2 ^b	*	16.41
Sweetness ³	100.2 ^a	84.9 ^b	57.8 ^c	*	14.41
Firmness ⁴	71.7	76.0	77.4	NS	17.73
Moisture Content ⁵	61.1 ^b	88.4 ^a	90.2 ^a	*	15.24
Density ⁶	90.7 ^a	84.0 ^{ab}	71.8 ^b	*	16.11
Stringiness ⁷	59.1 ^c	97.2 ^a	78.4 ^b	*	15.41
Chewiness ⁸	100.9 ^a	74.0 ^b	70.2 ^b	*	16.32

Number of tastings per sample = 42

* = Significant differences were found

NS = No significant differences were found

Means in the same row followed by the same letter are not significantly different at the 5% level

¹ Scores were registered on a line scale where 0=Dislike very much, 75=Neither like nor dislike and 150=Like very much

² Scores were registered on a line scale where 0=very light and 150=very dark

³ Scores were registered on a line scale where 0=very weak and 150=very strong

⁴ Scores were registered on a line scale where 0=soft and 150=hard

⁵ Scores were registered on a line scale where 0=not moist and 150=very moist

⁶ Scores were registered on a line scale where 0=not dense and 150=very dense

⁷ Scores were registered on a line scale where 0=not stringy and 150=very stringy

⁸ Scores were registered on a line scale where 0=difficult and 150=easy

Appendix 2. Ratio of Ideal Scores to Actual Scores for the Sensory Attributes of Squash.

Attributes	Treatment		
	Delica	Iron Helmet	Crown
Colour Intensity	0.794*	0.980	0.901
Flavour Intensity	0.963	0.776*	0.592*
Sweetness	0.950	0.839*	0.512*
Firmness	0.878	1.052	1.053
Moisture Content	0.688*	1.006	1.042
Density	0.976	0.894	0.713*
Stringiness	0.684*	1.227*	0.989
Chewiness	0.937	0.644*	0.628*

Ratios that are significantly different at the 5% level from the ideal score of 1.000 are marked *

Appendix 3. Frequency (%) of consumer comments about Overall qualities liked and disliked in Delica, Iron Helmet and Crown squash varieties.

Comments	Treatment		
	Delica	Iron Helmet	Crown
<u>Qualities Liked</u>			
sweet/sweetness	33	19	0
pretty colour/colour/nice colour/colour appeals to appetite	10	5	29
soft/soft mouthfeel	21	2	5
light taste/soft taste	10	7	7
delicious	19	0	0
neat appearance/looks very good/ looks delicious/visible attractiveness/pretty	0	7	12
savoury/savoury taste	7	2	7
taste is similar to sweet potato	14	0	0
mouthfeel/like the chewing feeling/ well chewed/comfortable to eat	5	7	0
nice aroma	5	7	0
<u>Qualities Disliked</u>			
tasteless/no taste/low intensity/no special taste	0	10	24
want it sweeter/not sweet enough/ low sweetness	2	5	17
strange colour/the colour/not like Korean pumpkin/seems artificial	14	2	5
too watery	0	12	5
insipid/plain	0	2	14
appearance/looks not pretty/doesn't look delicious	7	5	0
solid/high solidity	0	7	5
stringy/stringy chewing/can feel the stringy bits	0	7	5
too soft/squashy/too tender	0	7	5
don't like the green colour/too much green	10	0	0
nasty taste/taste	0	5	5

Number of Tastings per sample = 42

Appendix 4. Frequency (%) of consumer comments about Appearance qualities liked and disliked in Delica, Iron Helmet and Crown Squash Varieties.

Comment	Treatment		
	Delica	Iron Helmet	Crown
<u>Qualities Liked</u>			
colour/colour is pretty/beautiful/nice/good/ impressive	10	14	31
neat/very neat	2	0	12
looks delicious/appetising	7	2	12
looks smooth/smooth surface	0	5	10
green colour/green skin colour/ green skin colour looks fresh	14	0	0
looks soft	7	0	5
colour is soft/light	0	5	7
looks solid	2	7	2
<u>Qualities Disliked</u>			
seems tough/appearance looks tough	7	12	2
don't like colour/colour is bad/bad appearance	7	7	5
looks solid	0	7	10
seems overripe/looks spoilt/seems mouldy	0	7	5
stringy/stringy surface	0	12	0
looks unripe/green colour makes me think unripe	10	0	0
messy/too many cracks/looks crumbly	10	0	0
seems not delicious/does not appeal to appetite/impression not good	5	5	0
skin colour too dark	10	0	0

Number of tastings per sample = 42

Appendix 5. Frequency (%) of consumer comments about Aroma qualities liked or disliked in Delica, Iron Helmet and Crown squash.

Comment	Treatment		
	Delica	Iron Helmet	Crown
<u>Qualities Liked</u>			
light/soft/not too strong aroma	33	5	2
sweet	10	19	2
natural/ characteristic pumpkin aroma	2	14	7
appetising/pleasant/delicious/nice/good	2	12	7
savoury	19	2	0
strong	2	10	5
very weak/not much aroma	2	2	7
<u>Qualities Disliked</u>			
strong smell/very strong/too strong/too pungent	0	12	14
no aroma/not much aroma	7	2	12
unripe pumpkin smell/I can smell the green	7	0	5
strong pumpkin aroma	2	7	2

Number of Tastings per Sample = 42

Appendix 6. Frequency (%) of consumer comments about Flavour qualities liked and disliked in Delica, Iron Helmet and Crown squash.

Comment	Treatment		
	Delica	Iron Helmet	Crown
<u>Qualities Liked</u>			
sweet/sweetness	40	38	7
light/soft	21	10	14
delicious/good taste/ taste/tasty/pleasant	24	0	2
similar to sweet potato/like steamed sweet potato	17	0	0
<u>Qualities Disliked</u>			
not sweet/poor sweetness/ less sweetness	2	5	17
tasteless/no characteristic taste/no special taste	0	5	14
insipid	0	0	10
watery taste	0	0	10

Number of Tastings per Sample = 42

Appendix 7. Frequency (%) of terms to describe the aftertaste of Delica, Iron Helmet and Crown squash.

Aftertaste present	Treatment		
	Delica	Iron Helmet	Crown
sweet/too sweet	26	21	0
bitter/lingering bitterness	0	7	12
soft taste/light	12	2	2
savoury	7	0	5

Number of Tastings per sample = 42