

Marketing

of potato cultivars to consumers

HC Schönfeldt, CS Leighton, N Gibson (University of Pretoria)
L Morey (Agricultural Research Council)



Universal Testing Machine (Instron 4500) used to determine shear values of potato samples.

This article describes the first steps in the process of marketing cultivars to consumers. There is now sufficient scientific information on which the evaluation of cultivars can be based. The next steps will include the involvement of owners and licenceholders of popular cultivars to take part in the process. Samples of selected cultivars from various production regions will then be evaluated according to processes identified in this study. The characterisation of the cultivars will then be done according to selected applications such as boiling, crisping, roasting, mashing etc.

Introduction

In 2005 the Potato Industry Development Trust approved funding for two years for a project proposal that was recommended by the National Potato Research Committee aimed at the development and evaluation of techniques to characterise potato cultivars according to their suitability for various methods of preparation.

Following the finalisation of the project at the end of the 2006/2007 financial year, a system for the mapping of potato cultivars for consumer application was proposed. The next step is now to apply this proposed system to a variety of cultivars from various production regions with the view to develop a document explaining the best application of these cultivars to consumers. This information will be an integral part of the strategic marketing plan, approved by the Marketing Committee of Potatoes South Africa.

Consumers today want to know more about the foods they purchase, prepare and consume. They seek foods that are suitable for purpose and not necessarily price. Towards this end, scaling, rating or grading techniques are often used to describe the quality of foods. A simple system that can be understood by consumers is required to describe and map particular food products according to their intrinsic and extrinsic qualities. These attributes can be measured in various ways, but for each foodstuff, it should be determined exactly which attribute makes a meaningful contribution to total quality.

In this study, a combination of sensory properties, physical measurements and chemical analyses data was used to describe the intrinsic and extrinsic quality attributes of seven different potato cultivars. Ultimately such a mapping system should meet the consumer or processors' requirements.

Materials and methods

Prior to this study, a model for a flavour category/mapping system (Figure 1) was developed. In order to test the validity of the model, it was applied to sensory texture, physical



Preparation of samples for sensory analysis.

and chemical analyses data for seven different potato cultivars as described in Table 1.

Taste panel procedures

Ten experienced panelists were selected to participate in the profiling of the seven potato cultivars by applying quantitative descriptive analysis (QDA). The description of texture attributes are described in Table 1.

One half of a potato in the skin was served to the panel members for evaluation. Each portion was wrapped in aluminium foil, shiny side in, and coded with a three digit code. Samples were kept warm before being served to the panel on pre-heated porcelain side plates. Uniformity of each sample (volume served and serving temperature) of each replication of the different samples was ensured. Samples were randomised to exclude any bias due to the positioning effect.

Shear values and percentage softening

Raw and cooked potatoes were cored with a 12.5 mm diameter corer, parallel to the length of each potato. The cores were sheared perpendicular to the core using a shear device mounted on a Universal Testing Machine. Eight cores per sample were tested followed by the calculation determining the percentage softening of the samples during cooking.

Specific gravity

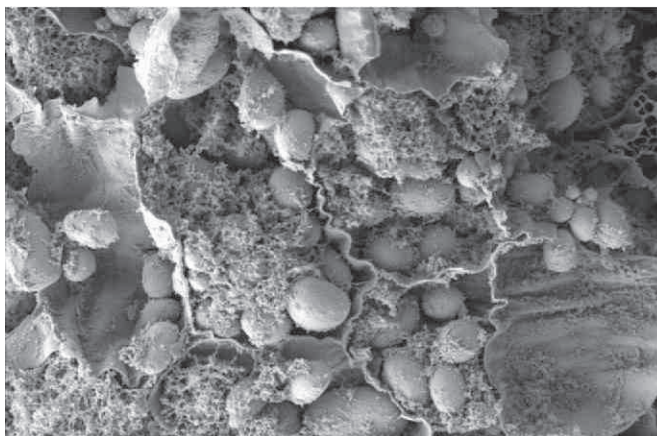
Two or three potatoes were selected as a sample batch and their dry weight as well as their weight under water was determined followed by the calculation of the specific gravity. This process was repeated ten times with different sample batches, for each cultivar.

Chemical analysis

Proximate composition was done by ARC-AIS an SANAS accredited laboratory. The dry matter, moisture, ash, protein, fat, total non-structured carbohydrates, starch and calcium percentages of the potato cultivars were determined. These were determined as a percentage of the total content of the potato tuber. The procedures were performed in duplicate on each cultivar.

Statistical analysis

Principal Component Analysis (PCA) was applied to the obtained sensory, physical and chemical data.



Electron microscope photo of raw potato tissue showing the starch grains

Table 1: Measurement and description of sensory, physical and chemical attributes used in this study

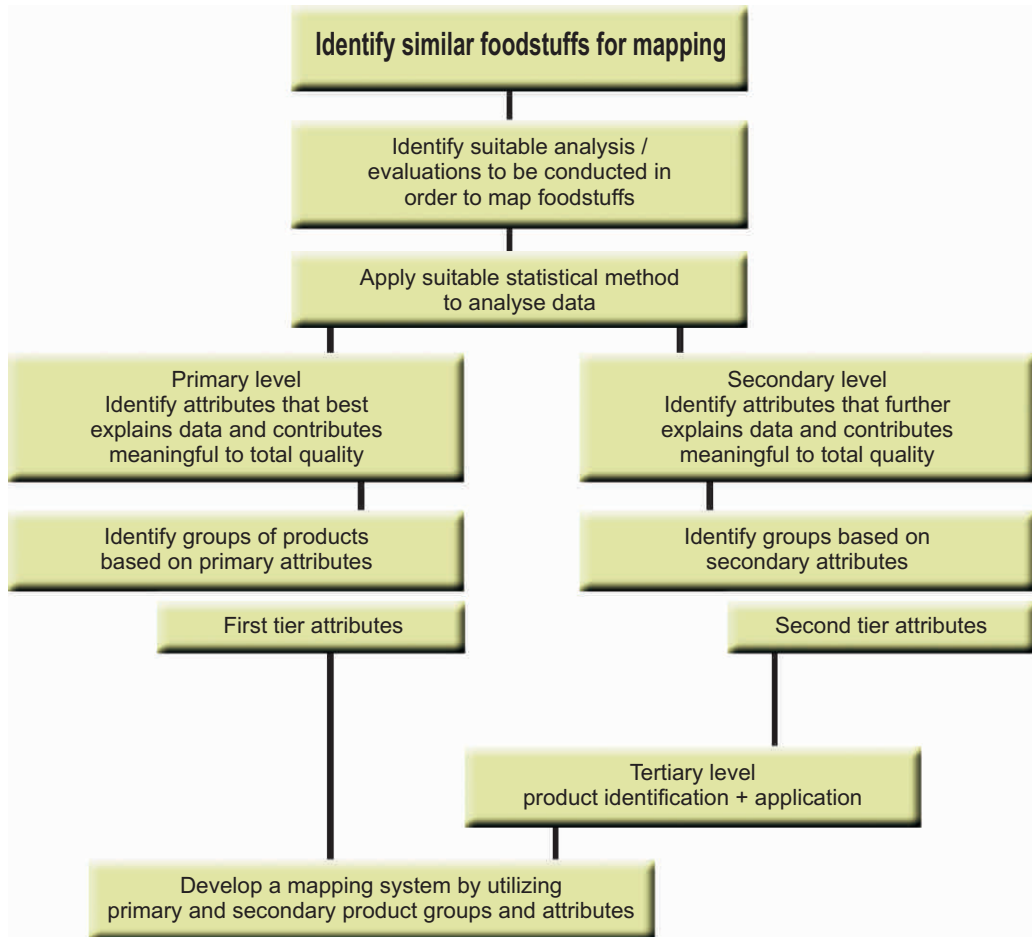
Measurement	Description	
Sensory texture attributes	Hardness with knife	Force required to shear / slice through potato with knife
	Fracturability – fingers	Degree of compression between fingers before the potato fracture i.e. low compression = high fracturability
	Hardness in the mouth	Force required to divide the potato in two parts by the front teeth
	Fracturability- mastication	Degree of compression before the potato is separated into parts Breaks easily = high fracturability; Hard to break = low fracturability
	Firmness, compactness	Degree of compression between molar teeth before item falls apart.
	Mealiness	Expresses how mealy / crumbly the potato feels in the mouth after chewing
	Adhesiveness on mastication	Force required to remove potato sticking to teeth and palate after chewing
Physical analysis Cooked potatoes were cooled to $\pm 18^{\circ}\text{C}$, then cored. Shear values were obtained using an Instron Universal Testing Machine.	% Softening	% softening of sample from raw to cooked state measured at 40-45 $^{\circ}\text{C}$
	Starch wash-out (SWO)	A measurement of a volume of solids that will settle to the bottom in water over a specific time period.
	Specific gravity (SG)	Determines the starch weight in potatoes.. A high SG is associated with a high dry matter and a more mealy potato.
Chemical analysis Conducted by a SANAS accredited laboratory	Dry matter content (%) (DM)	
	Moisture (%)	
	Starch content	
Scanning electron microscopy	Size and distribution of starch granules	Visual appraisal of amount of starch granules

Results and Discussion

Results are discussed by means of principle component analysis (PCA) graph such as indicated in Figure 2. All the data were used to group the cultivars as indicated on the graph. Dry matter content had the highest correlation coefficient. The percentage softening of the

potatoes from raw to cooked state (40 - 45 $^{\circ}\text{C}$), also appears to be a good method to explain the PCA. Although specific gravity (SG) is regarded as an accepted method to group potatoes, it did not explain the principle component analysis in terms of grouping, satisfactorily. Dry matter content appears to explain the principle component analysis the best for the grouping of

Figure 1: Concept model towards developing a mapping system



different potato cultivars and seems to make a meaningful contribution to total quality. At the primary level, chemical measurements such as dry matter content and starch content plus physical measurements such as specific gravity, starch wash-out (SWO) and percentage softening, grouped the cultivars together. At the secondary level, sensory texture attributes grouped the cultivars together (Table 2).

A third level can be applied for different purposes. Cooking methods is proposed but appearance attributes such as skin and flesh colour, flavour attributes and other cultivar usages i.e. processing method, could also be considered for this level.

Conclusion

The dry matter content showed most potential for grouping different potato cultivars as indicated in Figure 2. However, a combination of dry matter content, starch content, percentage softening and starch washout (SWO) appears to give a more reliable mapping. This proposed mapping system will now be tested on different potato cultivars from similar or different regions.

Figure 2: Grouping of cultivars according to dry matter (DM) content

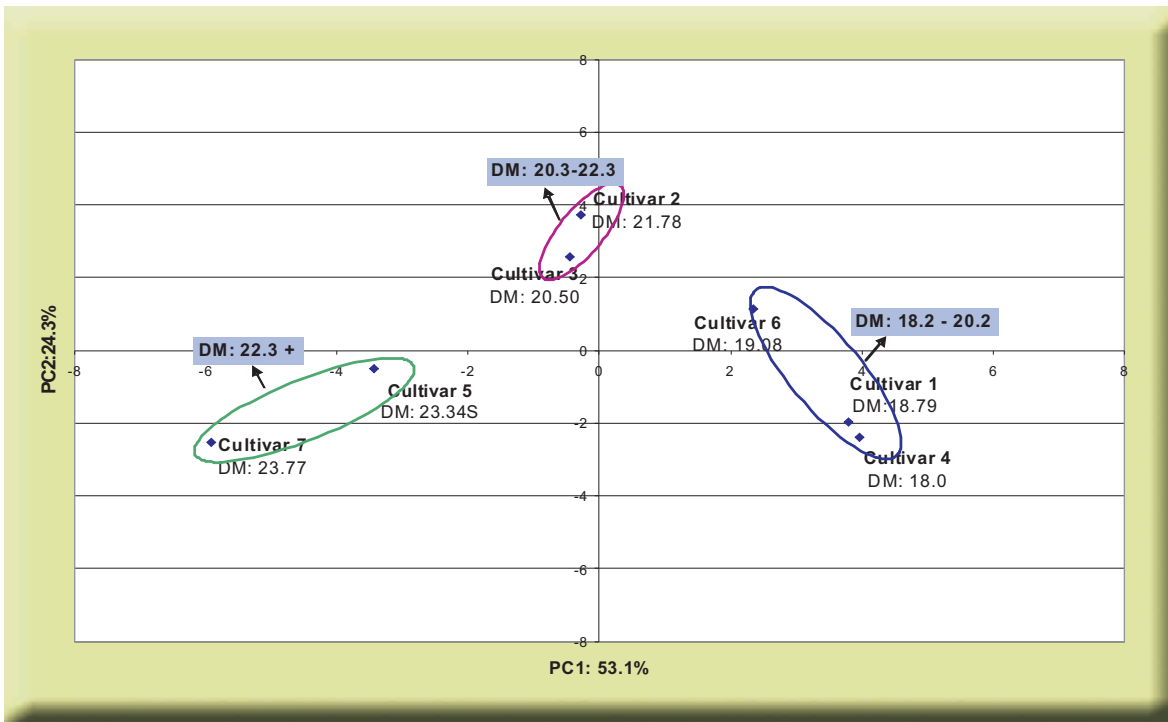


Table 2: Example of grouping / mapping potato cultivars using potato cultivars 4 and 7 as indicated in Figure 2, with data

Cultivar	Primary level	Secondary level	Tertiary level
Cultivar 7	DM (23.8 %) Softening (92.9%) Starch content (17.5%) SG (1.098) SWO (4.5 ml)	Hard with knife (3.83) Hard on mastication (3.41) Fracturability (4.62) Mealy / dry (3.25) Firm / compact (3.60)	Processing chips Slough when boiled
Cultivar 4	DM (18.0 %) Softening (86.8%) Starch content (12.8%) SG (1.071) SWO (2.9 ml)	Hard with knife (3.48) Hard on mastication (3.00) Fracturability (5.40) Mealy / dry (2.68) Firm / compact (3.53)	Boiling mashing Fair to good chip processing