

# Rapid classification methods of potatoes

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**T**he wonderful diversity of potatoes allows them to be celebrated in a variety of dishes that are well-loved by many cultures.

Potatoes are grown all over the world with country-specific cultivars being developed at a rapid pace that are explicitly cultivated according to regional conditions.

## Differences among cultivars

Cultivars differ in terms of physical, chemical and functional properties, processing potentials, as well as post-processing parameters which allow for varying culinary applications. These differences may be further influenced by agronomical conditions over the various production regions.

All of these factors have an effect on the textural properties of cooked potatoes. Heat (cooking, boiling, roasting, etc.) causes the gelatinisation of starch which results in the softening of the inner core of the potato. The way in which tubers react to heat is dependent on the dry matter (DM) to moisture ratio. Tubers with a higher DM content will have

a flourier texture, while tubers with a higher moisture content will have a waxier texture.

The non-homogeneity of this agricultural commodity complicates classification practices. These textural differences observed between cultivars can even be experienced at a batch-specific level and are therefore difficult to predict prior to cooking. The identification of textural properties has a significant impact on potato utilisation at various steps in the agricultural and processing chain.

Classification is important for, among others, producers, variety registration agencies, plant breeders, processors, bulk handlers, marketers and end users for fit-for-purpose usage. For this reason, a need was identified by Potatoes SA for a batch-specific classification method to class potatoes at farm and retail levels into the different textural groups within the South African agricultural and retail landscape.

Although the current classification system, based on specific gravity (SG) and consumer panel data, provided sound scientific data and a

methodology from which to work, it is both costly and time-consuming. Thus a new approach is required to be relevant in the current high-paced market conditions.

To answer this call from industry, a cost-effective, high-value methodology was developed which could differentiate between potato cooking types at retail level by means of an easily repeatable and reliable batch-specific cooking method. This easy-to-follow cooking method includes a visual guide which illustrates the internal textural properties of the tubers for classification into four different categories, such as waxy, waxy/floury, floury, and processing after cooking.

This boiling method was developed and tested in 2019 under controlled settings in a project titled, "Development of a rapid assessment method for potato classification". To ensure this method is viable in true market conditions, validation was necessary through market testing prior to release.

## Development of the test

The creation of the boiling test has gone through numerous developmental phases to reach the current stage. At commencement of the project, a wide variety of methods was tested and evaluated, starting with whole potatoes, halves, baking methodologies, fork tests, and a variety of boiling times and temperatures. The test was standardised and finally ready to be trialled on a large scale.

As the study was mostly conducted by researchers that were well versed in potato textural properties during its inception phases, this final phase proved to be essential for validation and gaining insight into true market conditions.

To achieve this, the guide was first piloted under second- and third-



Validation of the methods was done by repeating the test nine times over three days using eight different cultivars.

**Table 1: Cultivars chosen for large-scale testing of the boiling method.**

Cultivar	Textural class	Owner	SG	DM	Growth period
Foxy	Waxy	RSA Potato Seed Exchange	1.068	17.86	Short to medium (95-100)
7 Four 7	Waxy	GWK	1.066	17.35	Short (80-90)
Mondial	Waxy/floury	WesGrow	1.079	20.16	Short to medium (95-100)
Sifra	Waxy/floury	WesGrow	1.078	19.79	Short to medium (95-100)
Lanorma	Floury	GWK	1.083	21.05	Short (80-90)
Sound	Floury	First Potato Dynamics	1.081	20.43	Medium (90-110)
Alverstone Russet	Floury	WesGrow	1.087	21.77	Medium (90-110)
Belmonda	Floury	GWK	1.087	21.81	Medium (90-110)

year students at the Department of Consumer and Food Sciences at the University of Pretoria (UP) using two cultivars. This was done to familiarise project collaborators and to determine whether individuals who have no experience with potato classification were able to complete the boiling test with limited intervention from the project leaders. Results from the pilot study showed that the participants were able to complete the test. Feedback from the pilot study was used to update the guide.

Subsequently, the updated guide was tested at large scale using 18 (n=18) second-, third- and fourth-year students from the Department of Consumer and Food Sciences at UP. The validation was done by repeating the test nine times over three days using eight different cultivars (162

results per cultivar). Cultivar selection for this part of the study was based on cultivar textural class (SG and DM), cultivar owner (representative sample), availability and market share (Table 1).

The same methodology was followed as in the pilot study. Insight and feedback gained from this study were integrated into an updated draft guide for the third phase of the project.

**True market testing**

For the final stage of the project, the updated guide was tested under true market conditions at packhouse level where tubers are received, classed, and packed by minimally skilled workers. One of the largest commercial packhouses for fresh produce at retail level was identified to partake in this part of the study.

Ten workers were picked at random from various points in the packhouse to conduct the study. The workers were provided with the boiling test recipe (written and visual), the visual classification guide and evaluation sheet, and asked to perform the task without any further guidance or instructions. For this part of the test, five cultivars from varying textural classes were used.

The Mondial, Sifra and Apache cultivars were pulled from the packhouse floor on the day of evaluation. Cultivars Alverstone Russet and Belmonda, from a working group trial, were also included in the study to ensure a diversity of cultivars. The outcome of this test was evaluated by the researchers to determine whether adherence to the guide was achieved using only written and visual cues.

The three-phased validation process ensures that the final guide is standardised, easily understandable and reliable under varying conditions. This guide can be implemented at various points in the potato value chain. It is recommended that a short video is made to highlight some of the key points of the recipe that can be linked to the final guide via a QR code and uploaded to a platform such as YouTube. This will be aimed at producers who have to instruct their workers on how to utilise the guide, rather than at blue-collar workers.

Finally, it can be concluded that the development of this rapid boiling test for potato classification may hold significant value for an industry that works at a high pace with quick turnaround times and sensitive profit margins. This guide can, at farm level, provide timely information regarding the next step or outcome that should be followed. It can also provide processors with information that can improve product outcomes and increase return on investment.

Retail outlets will have applicable information to pass down to consumers regarding cooking applications to apply to specific potatoes and allow for an overall more enjoyable eating experience, thereby meeting consumer expectations. 🍅



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