Laboratory Standard Operating Procedure

Sample Preparation and Cooking Time for Texture Analysis of Boiled Yam

Biophysical Characterization of Quality Traits, WP2

Cotonou, Benin, 2020

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Ethics: The activities, which led to the production of this document, were assessed and approved by the CIRAD Ethics Committee (H2020 ethics self-assessment procedure). When relevant, samples were prepared according to good hygiene and manufacturing practices. When external participants were involved in an activity, they were priorly informed about the objective of the activity and explained that their participation was entirely voluntary, that they could stop the interview at any point and that their responses would be anonymous and securely stored by the research team for research purposes. Written consent (signature) was systematically sought from sensory panelists and from consumers participating in activities.

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ABSTRACT

Boiled yam preparation steps showed variations in the yam pieces size and the cooking operation; this presumably affect the sensory descriptors and texture analyses of final product. In this context, a robust methodology for boiled yam preparation and texture analyses was established. Five varieties were selected based on their contrasting quality characteristics. The optimum cooking time (OCT) for each variety and the ideal cooking time (ICT) defined as fixed duration from OCT of range of varieties were determined. Yam tuber was cut into three equal sections: proximal, central and distal. After peeling and washing, each usable/operational part (6/10) is divided following the length into two subsections (semi-cylinders). The semi-cylinders were steam-cooked up to minimum of 20 min (T20), and thereafter, softness was checked every 5 min using a fork by the panellists. The time when all panellists reported that the pieces are at least fairly soft is defined as OCT. The ICT was determined by calculating the average value of OCT. The latter is used to steam cook the samples evaluated by sensory profiling using quantitative descriptive analysis. In addition, these five varieties were tested at 45 °C by penetration test and texture profile analysis using conical probe P/40C and compression plate (P/75). For both texture methods, the yam pieces were steam-cooked during T20 and OCT. In total, sixty samples were analyzed by section for preliminary tests while forty five samples were used for validated method.

Keywords: Boiled yam, preparation, section sampling, optimum cooking time, ideal cooking time, penetration test, texture profile analysis

1 SCOPE AND APPLICATION

This SOP describes the preparation of samples for boiling tests in order to assess optimum cooking time (OCT) and ideal cooking time (ICT) prior to perform texture and sensory analyses of boiled yam. In comparison to water cooking mode, steam cooking is used to avoid disintegration of cooked yam.

2 GENERALITIES AND DEFINITIONS

Yam tubers are cut to the required dimensions and peeled, and then steam-cooked up to 20 minutes, before being evaluated for the change in texture each 5 minutes until optimum cooking time (as determined by probing the pieces with a fork). The resulting boiled yam pieces are evaluated by assessors in the point of view of texture, mainly the hardness (firmness).

T20: 20 minutes of cooking time (duration) of yam pieces. This cooking time was mainly used for preliminary essays in order to set-up the texture method and to determine the impact of the tuber section (proximal, central and distal) and the cooking time on the texture.

Optimum cooking time (OCT): Duration of steam-cooking necessary to obtain adequate yam piece texture acceptable for consumption. OCT is the time when all panellists assessed that the yam pieces are at least fairly soft. This cooking time was also used for preliminary essays in order to set-up the texture method.

Ideal cooking time (ICT): Fixed duration (determined from OCT of range of cultivars) used for both sensory and texture analyses. The ICT was chosen as the cooking time for optimized method and to generate final texture data.

3 PREREQUISITES

Setting up and managing a texture analyser.

4 APPARATUS

a. Texture analyser (the model used for the development of this SOP is a TA-XTPlus by Stable Microsystem).
b. Conical probe (P/40C) – Perpex
c. Compression plate (P/75) - Aluminium
d. Steam cooker with three trays was used with a degree of cooking varying from the low (first tray) to the top (thrid tray). The first tray was used in our experiment.
e. Punch with 2.2 cm long and 2.2 cm large.
f. Forks to assess optimum cooking time.
g. Chronometer
h. Meter/rule
i. Oven (45°C)
j. Thermometer

5 PRODUCT PREPARATION

5.1 Sampling and preparation of boiled yam

Setting samples in appropriate subsections

1. Select three tubers per genotype and measure their length (L) (15 to 40 cm depending on variety)
2. Cut yam tubers into three equal sections: proximal, central and distal (Photo 1)
3. After peeling and washing, cut the sections as follows:
    a. For the proximal and distal parts, 1/10 and 3/10 at the bottom side of section length is removed and discarded while for the central part, 2/10 from both ends of section is removed and discarded
    b. 6/10 of each section length (as representative of each part) is suitable to cook.
    c. Each usable/operational part (6/10) is divided following the length into two subsections (semi-cylinders).
    d.

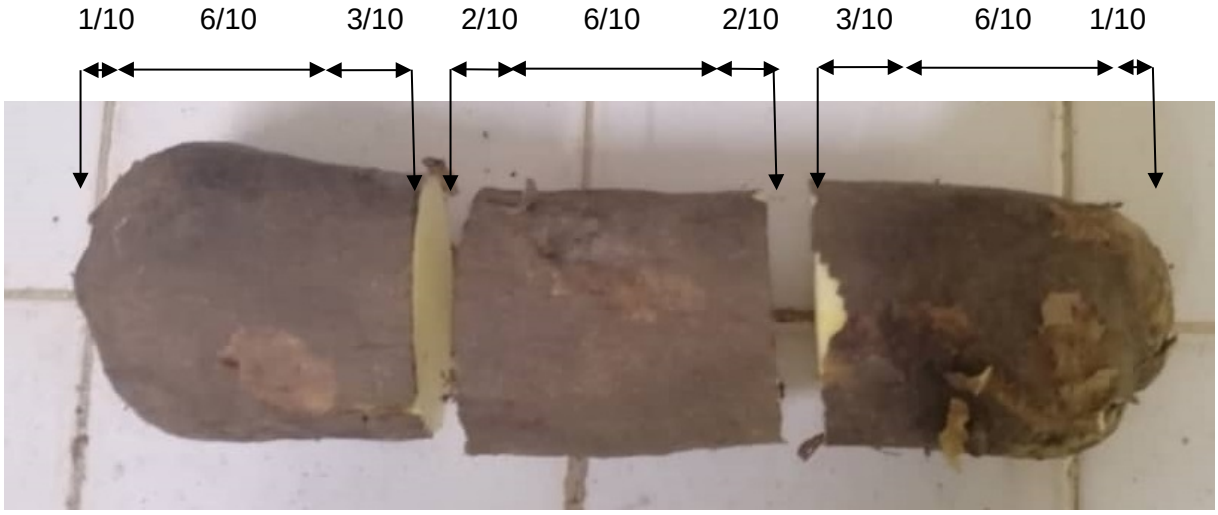


Photo 1: Yam tuber sections for preparation of samples for texture analysis

5.2 Determination of optimal cooking time (OCT)

To record optimum cooking time (duration), six yam semi-cylinders from one tuber per cultivar were steam-cooked up (photo 2) to minimum of 20 min, and thereafter, the softness (as indicator of cooking) is checked every 5 min using a fork. In addition, for each cultivar, softness is assessed by six trained assessors using a 1-3 scale points, where 1=not soft, 2=fairly soft and 3=very soft. Each assessor received one piece. The time when all panellists reported that the pieces are at least fairly soft is defined as OCT.

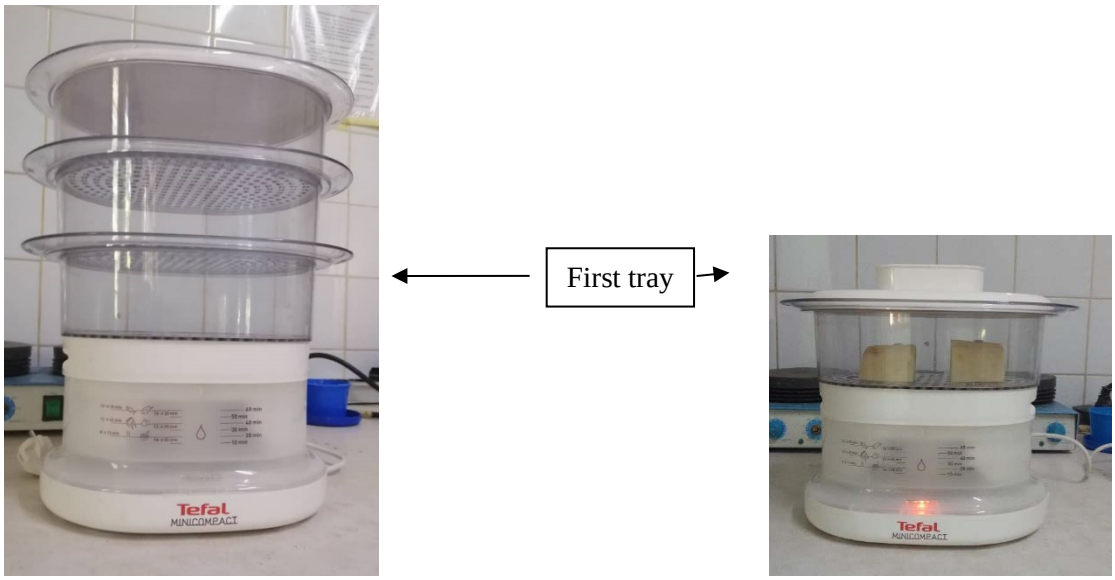


Photo 2 : Steam cooker for boiled yam

The ideal cooking time/duration was determined by calculating the average value of OCT from five yam cultivars (Table 1).

Tableau 1: Example of optimum cooking time of 5 yam cultivars

	Laboko	Deba*	Kpaina*	Ala	Kpété*
OCT (min)	**30**	**35**	**40**	**40**	**45**

*recently harvested

5.3 Yam cooking for texture analysis: preliminary measurements T20 and OCT

5.3.1 Penetrometry test

Preparation of sample for penetrometry test

Six yam semi-cylinders from a second tuber were obtained by cutting out the tuber as indicated previously (photo 3). From each section, one semi-cylinder piece was steam-cooked for 20 minutes (coded T20) and the other one for optimal cooking time (coded OCT). For penetrometry test, three to six yam tubers per genotype were used. In total, per section, three to six pieces for T20 and three to six pieces for OCT were evaluated by penetrometry test. Each piece was identified with a unique code.

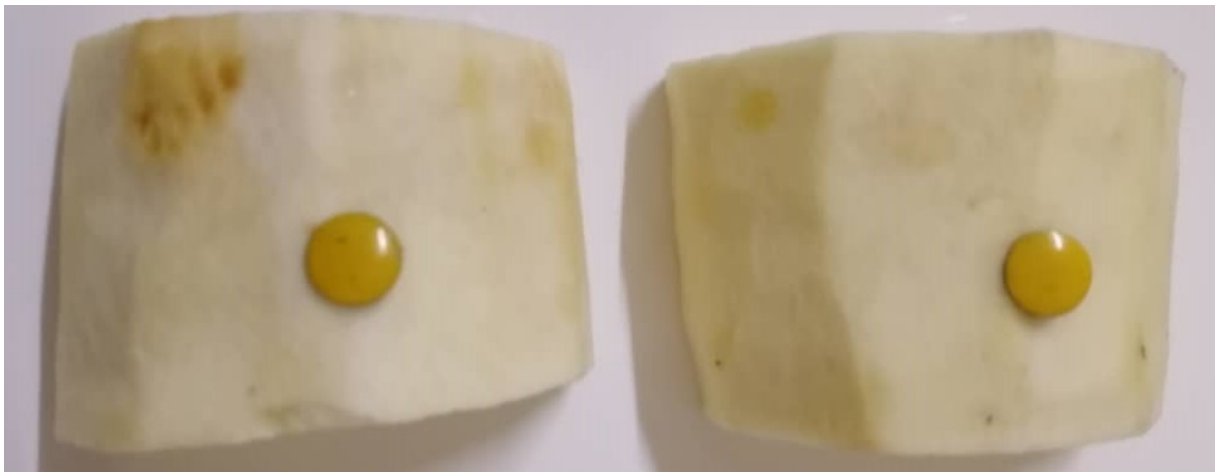


Photo 3: Half cylinder of boiled yam for penetrometry test

Cook separately the batch of pieces for 20 minutes, and then that for OCT. After cooking, remove the pieces and allow them to stabilize at 45 °C in an oven/incubator before performing the penetrometry test as indicated in the following SOP.

NB: The T20 was used in this study to determine the impact of tuber section on texture. For future experiments, this cooking duration (20 min) will not be considered anymore.

However, if this SOP is used, it is necessary to determine the range of OCT by assessors (or texture measurements, maximum force around 10 N) for the new studied genotypes in order to calculate the related ICT.

5.3.2 TPA test

Preparation of sample for texture profile analysis (TPA)

Six yam semi-cylinders from a third tuber were obtained by cutting out the tuber as indicated previously. From each half cylinder, a punch was used to obtain two cubic samples (Photo 4): one for T20 and the second for OCT. Thus, from one tuber and per section, two yam cubic (2.2 cm long and 2.2 cm large) pieces were obtained for T20 and two pieces for OCT. For texture profile analysis, three to six yam tubers per genotype were used. In total, per section, six to twelve pieces for T20 and six to twelve pieces for OCT were evaluated by TPA. Each piece is identified with a unique code.

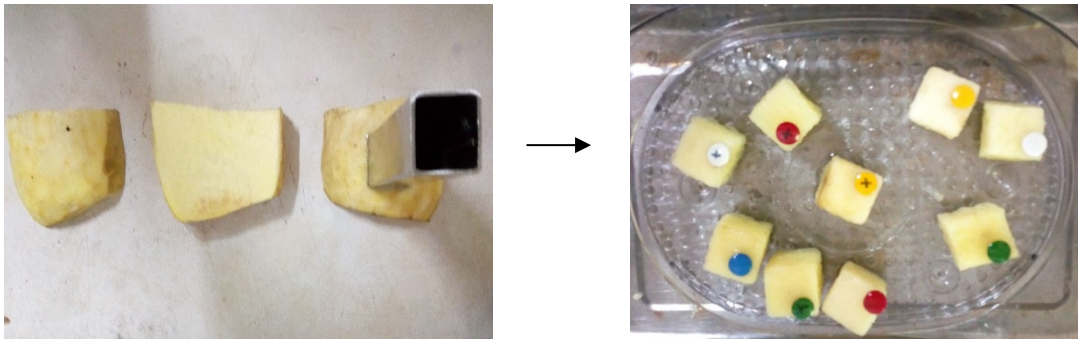


Photo 4: Cut yam pieces with punch for TPA

Cook separately the batch of pieces for 20 minutes, and then that for OCT. After cooking, remove the pieces and allow them to stabilize at 45°C in an oven/incubator before performing the penetrometry test as indicated in the related SOP.

NB: The T20 was used in this study to determine the impact of tuber section on texture. For future experiments, this cooking duration (20 min) will not be considered anymore.

However, if this SOP is used, it is necessary to determine the range of OCT by assessors (or texture measurements, maximum force around 10 N) for the new studied genotypes in order to calculate the related ICT.

5.4 Yam cooking for texture analysis: measurements for ICT

Based on preliminary texture measurements the ICT was determined and used in the following to assess the texture of steamed yam by using penetrometry and TPA measurements.

5.4.1 Penetrometry and TPA

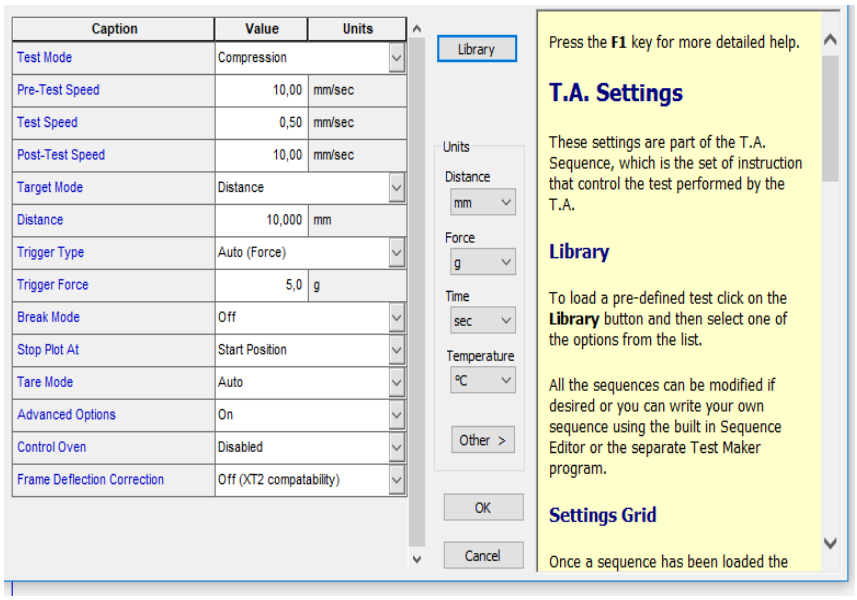
Six yam semi-cylinders from each tuber were obtained by cutting out the tuber as indicated previously. From each half cylinder, a punch was used to obtain two cubic samples (Photo 4). Thus, from one tuber and per section, two cubic yam pieces were obtained for ICT. Three to four yam tubers per genotype were used. In total, per section, six to eight pieces were evaluated at ICT: at least 3 pieces by penetrometry and 3 pieces by TPA. Each piece is identified with a unique code. The same cooking and sample preparation was used for sensory analyses.

6 TEXTURE MEASUREMENT

6.1 Penetrometry test

The penetrometry test was performed with conical probe P/40C and the settings are shown below and for each piece, two points of measure were carried out from both extremity (photo 5) depending of sample length.

Pre-Test Speed	10 mm/s
Test speed	0,5 mm/s
Trigger force	5 g
Target distance	10 mm
Temperature of test	45°C



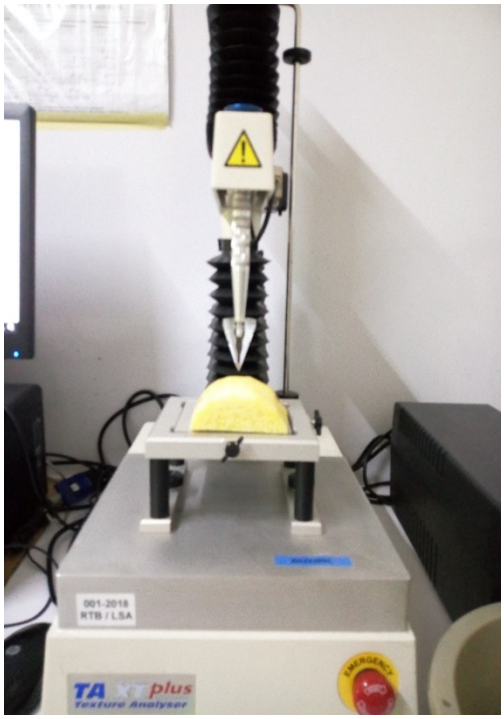
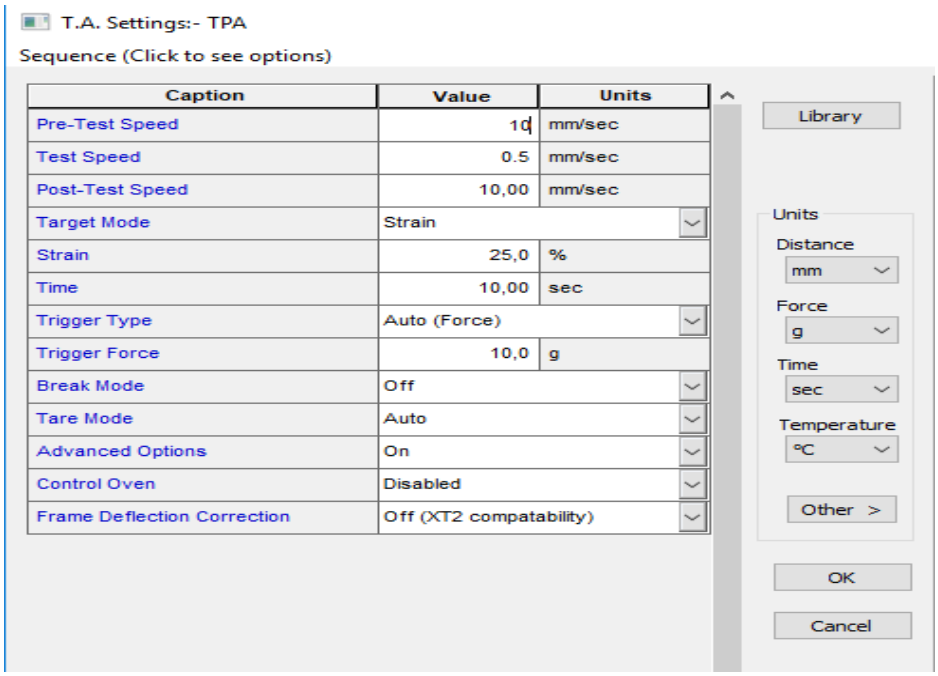


Photo 5 : Example of texture analysis by penetrometry for preliminary tests

6.2 TPA

The texture profile analysis was performed with compression plate (P/75) and the settings are shown below

Pre-Test Speed	10 mm/s
Test speed	0,5 mm/s
Trigger force	10 g
Strain	25%
Temperature of test	45°C



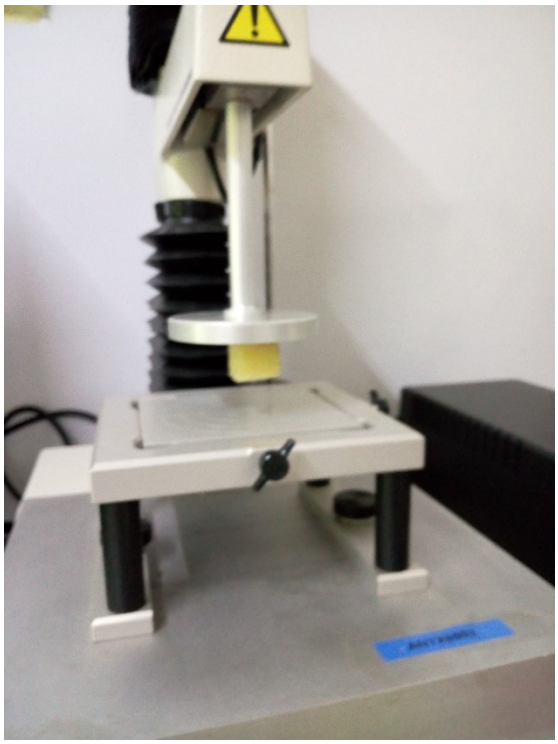


Photo 6 : Texture analysis by TPA

7 EXPRESSION OF RESULTS

The penetrometry results are expressed as hardness (N) and total work (N.sec).

The TPA results are expressed as hardness (N), springiness (mm), cohesiveness, gumminess (N) and chewiness (N) as presented in photo 7.

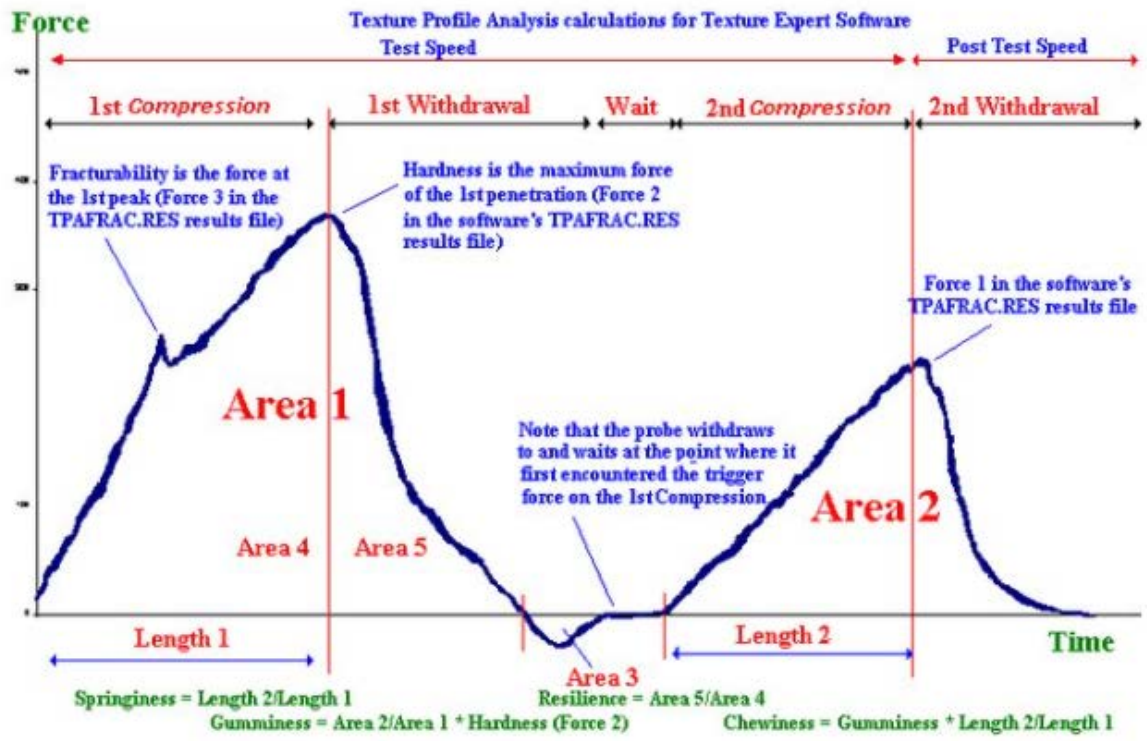


Photo 7: Calculation of TPA parameter.

8 CRITICAL POINTS AND NOTES ON THE PROCEDURE

Sample temperature and size /shape sample should be controlled.

9 TEST REPORT

The test report should include full information about the samples; harvest location, clone/genotype name.

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