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The Importance of Sorghum Grain Colour and Hardness, and Their Causes and Measurement

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THE IMPORTANCE OF SORGHUM GRAIN COLOUR AND HARDNESS, AND THEIR CAUSES AND MEASUREMENT

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THE IMPORTANCE OF DETERMINING COLOUR

- **Kernel colour determination is important because the information obtained helps in anticipating end-product colour quality.**
- **In Africa, white or light sorghums are more generally preferred for porridge making.**
- **Sorghum grain colour affects the colour of sorghum foods made with alkali like tortilla and alkaline tô.**
- **Red coloured sorghums are generally preferred for brewing traditional beer.**
- **For industrial production of lager beer white sorghums are generally selected.**

SORGHUM PLANT AND GLUME TYPE AND END-USE QUALITY

- White tan-plant sorghums with tan glumes and pericarp have essentially no coloured pigments.
- These sorghums produce grains that are evenly pale or essentially white.
- The grains are used in the production of baked products, tortillas, noodles, extruded snacks, grits and adjuncts for brewing lager beer.

COLOURED SORGHUMS AND END-USE QUALITY

- Sorghums that have red or purple plant colour have red and purple glumes, respectively.
- The red and purple colours are due to the presence of polyphenols.
- These polyphenolic compounds migrate from the glumes to the grains under unfavourable conditions such as humidity and rain.
- The grain is stained in the process affecting its end use quality and the resulting products.

PROCESSING COLOURED GRAINS

- To produce acceptable food products these coloured grains have to be chemically treated (alkaline or wood ash) or dehulled to remove the coloured compounds which are mostly concentrated in the pericarp.

- Grain colour is used in grain trade. In the USA for instance, one of the bases of sorghum classification is colour.
- In this classification, sorghum is divided into four classes, namely: Sorghum, Tannin sorghum, White sorghum and Mixed sorghum

DEFINITION OF COLOUR

- Sorghum kernel colour is the overall visual perception of the colour of the grain as viewed by the naked eye.

- Sorghum kernel colour is genetically controlled.

- Sorghum kernel colour is due to phenolic flavanoid pigments anthocyanins and flavan-4-ols which are located in the pericap.

- Sorghum kernel colour can be red, lemon, yellow, brown or white.

Figure 1. Sorghum in the field

SIMA WHITE TAN PLANT SORGHUM

MMSH625 RED NON TANNIN SORGHUM

MMSH1040 WHITE TAN PLANT SORGHUM

MMSH740 BROWN TANNIN SORGHUM

Figure 2. Some sorghums cultivars with different colours (white, red and brown)

Other factors affecting sorghum kernel colour include:-

- Pericarp thickness, presence or absence of pigmented testa and endosperm colour.

- Weathering as a result of the grain on the head in the field being exposed to sunshine, insect attack and mould.

GRAIN COLOUR ASSESSMENT METHODS

- By visual inspection and comparison against standard samples

- Scanning spectrophotometers using reflectance. Enables sample reflectance to be determined at a selected wavelength related to the colour under study.

- Tristimulus colorimeters which give three readings X (red value), Y (green value) and Z (blue value). These are easily combined to give the value a which indicates redness when it is positive. The value b which indicates yellowness when positive and the value L which indicates brightness from black (0) to 100.

THE IMPORTANCE OF SORGHUM KERNEL HARDNESS (ENDOSPERM TEXTURE)

- **Kernel hardness (endosperm texture) affects the processing properties of the grain and the resulting products.**

- **Grains with a high proportion of corneous endosperm tend to be more resistant to breakage during decortication (dehulling) and milling than grain with a high proportion of floury endosperm.**

- **During milling hard grains tend to yield proportionally cleaner endosperm of large particle size than soft grains. This is because the corneous endosperm is easily separated from intact starchy endosperm giving a higher yield.**

THE IMPORTANCE OF SORGHUM KERNEL HARDNESS (ENDOSPERM TEXTURE)

- Sorghum grains with corneous endosperm are preferred for stiff porridge and grits making.

- In the field, hard grains, are also more resistant to insect and mould damage than soft grains.

- Endosperm texture affects storage quality of the grain. Insects more easily attack soft floury endosperm sorghum than hard corneous sorghum.

SORGHUM KERNEL HARDNESS (ENDOSPERM TEXTURE) DEFINITION

- Sorghum kernel hardness (endosperm texture) is the proportion of corneous (vitreous or hard) fraction of the endosperm with respect to the floury or soft endosperm fraction.

- The proportions determine endosperm texture .

- Kernels with more corneous (vitreous or horny) than floury endosperm (chalky) are designated as hard or corneous.

- Kernels with more floury than corneous endosperm are termed soft.

- The relative proportions of the corneous and floury endosperm vary among sorghum types.

- This variation is mainly influenced by genetic factors. But it is also influenced by the environment.

- Kernel hardness can also be influenced by other factors such as moisture, proteins, lipids and endosperm cell wall material.

KERNEL HARDNESS ASSESSMENT METHODS

- Visual estimation of the proportions of the corneous (hard) and floury (soft) and intermediate endosperm.
- Kernel hardness using the Tangential Abrasive Dehulling Device (TADD).
- Kernel hardness: timed grinding using the Brabender microhardness tester (BHMT).
- Resistance to grinding on the Stenvert hardness tester (SHT).
- Density: estimating kernel hardness based on the density differences between the floury and vitreous part of the endosperm
- Percentage of floaters.
- Water absorption, lower water uptake is associated with kernel hardness.

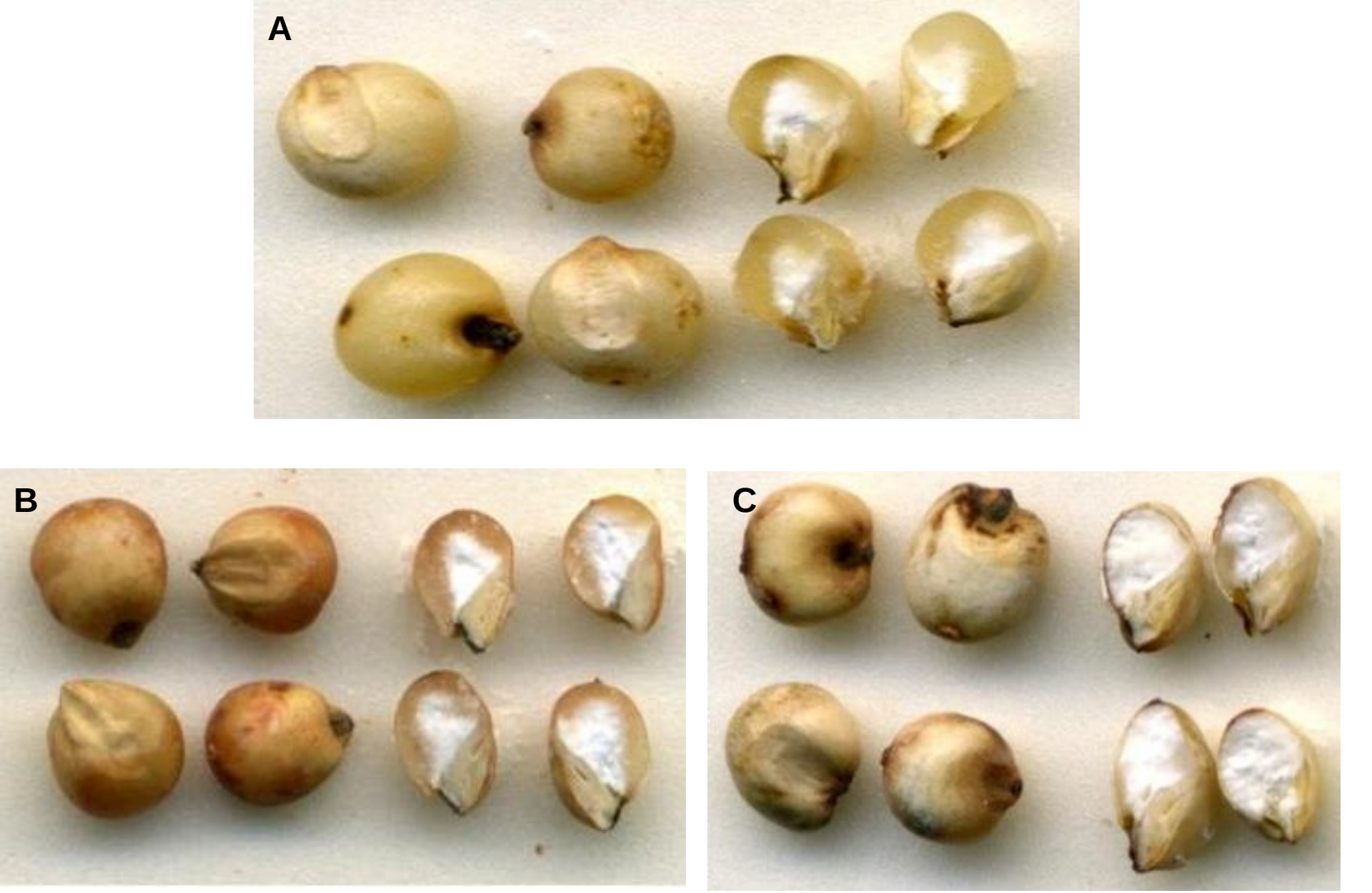

Figure 3: Endosperm texture A-Corneous (Hard), B-Intermediate, C-Soft (Floury)

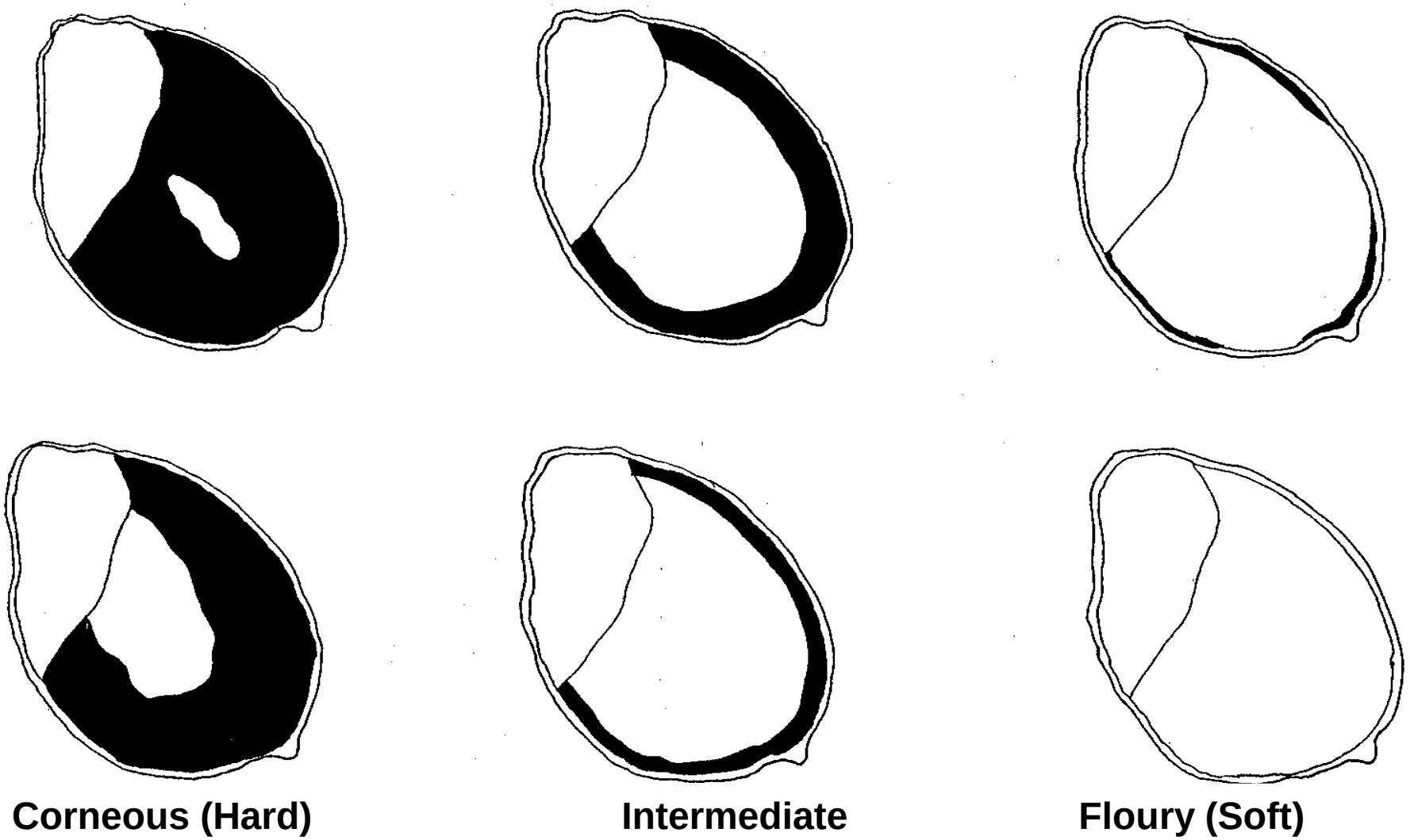

Figure 4: Illustration of sorghum kernel texture

THANK YOU