

FINAL REPORT

DETAILS

Project number	M102/01
Project title	Determine the malting and processing quality of sorghum cultivars and varieties
Project manager	C Chiremba
Co-workers(s)	Internal NC Phundulu, GD Moloto, MJ Sebidi
	External Seed industry, farmers
Project status	Complete
Duration	01/04/1999 to 31/03/2014
Funder(s)	ARC / Sorghum Trust

Final abstract

Seasonal malting-quality evaluation is a key aspect of quality control in order to maintain the viability of existing and candidate sorghum cultivars from the national cultivar trials. Sorghum milling is also becoming important in the sorghum industry. Hence cultivars are also evaluated for their hardness to determine milling potential. The objective of sorghum quality evaluation was to determine the malting and milling quality of grain so as to ascertain for what use it is best suited. Cultivar sets included entries and existing cultivars which were already commercially available or at various stages of the quality evaluation before final registration and release. Cultivars from six locations were evaluated for germinability, water uptake, malting loss, testa presence and Diastatic Power (DP). Milling and hardness properties were evaluated using the Tangential Abrasive Dehulling Device (TADD), one thousand kernel weight and kernel size fractions. Selection for malting cultivars was based on the mean of the reference samples or controls. Currently the reference cultivars for the GM class are PAN 8816 and NS 5655 and for the GH class PAN 8625 and NS 5511. Germinative energy for malting was 90%. There were no standards for sorghum hardness evaluation and the average hardness index or percentage kernel loss of the tested samples was used to screen cultivars. Only non-tannin cultivars were tested for hardness.

Keywords: sorghum, malting, diastatic power, milling, Tangential Abrasive Dehulling Device

Introduction

The project commenced in 1999 as a result of the need to supply high-quality malt to brewers as the use of low-malting cultivars resulted in substantial losses to the brewing industry. Sorghum quality evaluation on an annual basis is a quality control tool to ensure that new and existing cultivars comply with industry needs. Throughout Sub-Saharan Africa sorghum is largely used to produce opaque beers of which sorghum malt is a key ingredient as a source of hydrolytic enzymes, starch (the source of fermentable sugars), yeast nutrients, beer flavour and colouring substances (Taylor and Dewar, 2001). An estimated 200 000 tonnes of sorghum are commercially malted annually in southern Africa and some 3 million litres of sorghum beer are brewed each year (Taylor and Dewar, 2001). A small amount of the malt is used for production of the sorghum-malt breakfast cereal Maltabela. Agricultural departments and commercial breeders breed sorghum cultivars for malting purposes and it is only through malt quality evaluation that these cultivars can be adjudicated. The primary criterion is their potential to produce malt with high diastatic power (amylase activity). Other factors that define malt quality are free amino nitrogen content and grain cultivar type. In South Africa sorghum cultivars are divided into three types *viz.* condensed, tannin-free, non-malting sorghum (GL), condensed tannin-free malting sorghum (GM) and condensed-tannin sorghum (GH) (Department of Agriculture, Forestry and Fisheries, 2008). Therefore, there is a need to screen cultivars to meet the criteria for good quality malt production. Seasonal malting-quality evaluation is a key aspect of quality control in order to ensure and maintain the viability of existing and candidate sorghum cultivars from the national cultivar trials. The quality evaluation process is not only important to breeders and seed industries but is also a determinant in the end-use and acceptability of cultivars by industry. Information of the suitability of sorghum cultivars for malt and meal production ensures that products comply with the standards set by producers. The grading system for sorghum is based on the malt quality of sorghum cultivars. Identification of cultivars with good malting performance ensures that farmers make the correct cultivar choice and produce grain that complies with the set standards for sorghum processors, with the ultimate goal of satisfying consumers. Ensuring sorghum quality standards is important for optimising sorghum production and processing, making the sorghum industry competitive against other cereal crops.

Materials and Methods

Materials

Sorghum cultivars were received from different growing locations. Cultivars from Leeuwkraal, Weiveld, Platrand, Amersfort, Pederkop and Holmdene were evaluated for malting and milling quality from the 2012/13 planting season. Sample preparation involved cleaning the grain and storing at 4°C before analyses. Samples from at least five localities were evaluated based on acceptable germinative energy (at least 90% germination).

Methods

Sorghum grain was germinated for 72 h to determine its germinability as grain failing to germinate would not be suitable for malting. Grain samples were malted on a laboratory scale by steeping cleaned grain for 24 h at 25°C and then malting for five days also at 25°C. Sorghum Diastatic Power (DP) of the 5 day malts (after steeping) was measured according to South African Bureau of Standards Method 235 (SABS 1970), using peptone extracts and expressed as Sorghum Diastatic Units (SDU/g). Grain hardness was measured using the TADD by decorticating 50 g sorghum samples for 5 min (Gomez et al 1997). The thousand kernel weigh (TKW) was determined by weighing 1000 sound grain or malt kernels of a representative sample and kernel size by the number passing through 2.36 mm, 3.25 mm, 3.36 mm and 4.00 mm round hole sieves.

Results

Research results were published and presented annually in the form of technical reports, to the technical committee. For the 2013/14 season the average DPs of the GM and GH classes were 48 and 58 SDU/g malt respectively. None of the non-tannin sorghum entries qualified into the GM class. The entries had DPs of 34 to 37 SDU/ g malt compared to 48 SDU/g malt of the standards. Cultivar PAN 8932 (59 SDU/ g malt) qualified into the GH class. Germinative energy was generally high in three localities (at least 90%) except Platrand and Amersfoort. Water uptake was within acceptable range of 35-40%. Only non-tannin cultivars were evaluated for hardness as tannin cultivars are generally soft and have poor milling properties. Thousand kernel weight was at least 20 g for all localities and at least 70% of the kernels of most cultivars were >3.15 mm. The mean TADD hardness (percentage kernel removed) after abrading sorghum grain for 5 min was 61% and of the new cultivars, PAN 8933 had potential for milling.

Discussion

Although the project has ended, malting quality remains the single important criteria for sorghum quality in South Africa as there are no guidelines for sorghum milling. There is still a need to continue with the annual evaluation of cultivars for malt quality as breeders continuously release new cultivars and the ARC is the only institute in South Africa that has the capacity to carry out the analyses considering the already established facilities and expertise. Although the malting industry is declining, there is a market for malt in the sorghum lager beer industry in the region such as Swaziland and Zimbabwe where lager beer production has diversified to sorghum instead of barley malt. Sorghum hardness to determine cultivar suitability for milling has been a part of this project although extensive work is required to establish guidelines for milling criteria as there is an expansion in the sorghum milling industry.

Acknowledgements

The Sorghum Trust and Agricultural Research Council are acknowledged for funding the project.

Publications

Peer reviewed articles

CHIREMBA, C., SIWELA, M., ROONEY, L. W. & TAYLOR, J. R. N., 2012. Endosperm modification during sorghum malting in grains of differing hardness and malt quality. *Cereal Chem.* (In press)

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15 Annual Technical Reports: (1999 - 2014)

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