GRAIN TRADE AUSTRALIA

Section 2 – SORGHUM TRADING STANDARDS

2015/16 SEASON

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SECTION 1 INTRODUCTION

General

Since 1999 Grain Trade Australia has on an annual basis reviewed, produced and published on behalf of industry, the Sorghum Trading Standards (Standards) through its Standards Committee (Committee).

In order to provide a consistent message to both domestic industry and international buyers, Grain Trade Australia (GTA) encourages input into development of these Standards. Additionally, we urge industry to use the Standards contained within this Manual as applicable when buying and trading Australian sorghum.

Considerations to the Standards

This section of the Manual relating to sorghum has been produced following the annual Standards review by GTA. There are various sections of this Manual relating to Standards and associated procedures, and industry is encouraged to take account of all relevant sections when applying these Standards to sorghum bought and traded domestically or internationally.

The Grades referred to in this document are a combination of:

- Grades commonly introduced across the country on an annual basis and are generally the same in each State where sorghum is grown or traded

- Grades that may not be introduced every season or only introduced in a regional area. These grades may be created for various reasons including to meet the specific quality requirements of a customer, or to deal with specific quality issues with harvested grain in a localised area

Industry should note the list of Grades in this Manual is not exhaustive.

Variations to Standards

Whilst the information in this Manual is current at time of publication, you will need to monitor the GTA Member Updates, the GTA website (www.graintrade.org.au) and other applicable information to ensure that you are aware of the changes to the Standards and the impact on your own trading arrangements.

Varieties

Any commercially bred red, white or yellow varieties of grain sorghum may be grown and be acceptable within each sorghum grade. There is no list of varieties available within this document.

Timing of Standards Development

The Standards outlined in this Manual are applicable for the entire season of 2015/16. Standards apply to deliveries and grain traded from 1 August 2015 to 31 July 2016.

SECTION 2 DEFINITIONS

The following Defect definitions are to be read in conjunction with the images displayed in the GTA Visual Recognition Standards Guide for Grain Commodity Sampling and Assessment located on the GTA website at www.graintrade.org.au. The images in that document display the minimum and/or maximum coverage and attributes of the Defective Grain types as defined in these Standards.

As Is

In terms of sample assessment, the representative sample is as taken from the load tendered for delivery, without any interference to the sample. That is, there has been no cleaning or screening of the sample prior to analysis. The sample may also be referred to as a "dirty" sample.

Bin Burnt, Heat Damaged

Bin Burnt

Bin Burnt refers to those kernels that have become discoloured due to exposure to severe heat during storage or an incorrect artificial drying technique. Affected grains appear reddish brown, or in severe cases, blackened. Refer also to Maximum Temperature.

Heat Damaged

Heat Damaged refers to those kernels that have become discoloured due to exposure to severe heat during storage or an incorrect artificial drying technique. Affected grains appear reddish brown. Refer also to Maximum Temperature.

This definition is to be read in conjunction with the photo in the Visual Recognition Standards Guide which depicts the minimum affected standard for a grain to be classified as Bin Burnt or Heat Damaged.

Cereals

In the context of these Standards, cereals refer to wheat, barley, oats, cereal rye, triticale, sorghum, maize and rice.

Cereal Smut

Cereal Smuts include all smuts on all cereal grains. This includes but is not limited to:

Ball Smut

Are those infected by the spores of the fungus *Tilletia caries*. They have the appearance of pale, plump, slightly oversized grains. These grains are easily crushed between the fingers and contain a mass of black powder (spores) with a distinctive rotten egg smell. This may also be called Stinking Smut or Bunt.

Covered Smut

Covered smut is caused by various fungi of the *Ustilago spp*.

Loose Smut

Loose smut is the result of the fungus *Sporisorium sorghi* developing in the head during the growing phase. The tolerance applies to the number of blackened pieces of backbone in the sample.

A nil tolerance applies to all smuts in cereal kernels.

Chemicals not Approved for Sorghum

Refers to the following:

- Chemicals used on the growing crop in the State or Territory where the sorghum was grown in contravention of the label
- Chemicals used on stored sorghum in contravention of the label
- Chemicals not registered for use on sorghum
- Sorghum containing any artificial colouring, pickling compound or marker dye commonly used during crop spraying operations that has stained the sorghum
- Sorghum treated with or contaminated by Carbaryl, Organochloride chemicals, or diatomaceous earth
- Chemical residues in excess of Australian Commonwealth, State or Territory legal limits (see Maximum Residue Limit and National Residue Survey)

For further information on this topic, refer to the document "Australian Grains Industry Post Harvest Chemical Usage Recommendations and Outturn Tolerances 2015/16" - see GTA website http://www.graintrade.org.au/nwpgp.

Clean Seed Basis

For the purposes of assessment of various defective grains, clean seed includes all sorghum seed remaining above the screen following the 'Screening' process.

Contaminants

Contaminants are defined individually in these Standards and consist of the following:

- Cereal Ergot
- Cereal Smut
- Chemicals in excess of the MRL
- Chemicals not approved for Sorghum
- Foreign Material
- Foreign Seeds
- Insects - Large
- Insects - Small
- Objectionable Material
- Odour
- Pickling Compounds or Artificial Colouring
- Ryegrass Ergot
- Sand/Soil
- Sorghum Ergot
- Stones
- Stored Grain Insects and Pea Weevil - Live

Defective Grains

Defective grains refer to sorghum that has been damaged to some degree, as outlined in these Standards. They include the following:

- Bin Burnt, Heat Damaged
- Field Fungi
- Frost Damaged
- Insect Damaged

- Sappy
- Smut
- Sprouted
- Storage Mould

An individual kernel may only have one defect, being the defect type with the tightest tolerance in the standard.

Note that a tolerance for Total Defective grains applies, which includes all defective grain quality parameters where a tolerance applies in the Standard except for Sprouted, for which a separate tolerance exists.

Note also that Stained is not included as a Defective grain and unlimited Stained grains may occur in a sample. Refer to the definition of Stained.

Ergot

Ergot contaminates cereal and ryegrass kernels and is caused by infection of the fungus *Claviceps purpurea*.

Sorghum Ergot

Sorghum Ergot, *Claviceps africana,* occurs during flowering and results in the accumulation of a grey/white fungal mass, often found in empty seed glumes. Another ergot, *Cerebella spp.* is not a true ergot as such, but it is a fungus that often grows on the *Claviceps africana*, producing a large black mass. Note that there may be separate tolerances for Sorghum Ergot and Cereal Ergot. A good point of reference for further details can be found at: http://www.dpi.qld.gov.au/26_17273.htm or http://www.dpi.qld.gov.au/26_17274.htm

Ryegrass Ergot

Ryegrass ergot is *Claviceps purpurea* infection of ryegrass kernels. Tolerances are defined in terms of overall length in cm when pieces found in the sample are aligned end on end.

Cereal Ergot

Cereal ergot is *Claviceps purpurea* infection of any cereal kernels. Tolerances are defined in terms of the total number of pieces or whole affected kernels of any cereal found in the sample, except Sorghum Ergot.

Field Fungi

Field Fungi refers to kernels affected by the growth of fungi on the seed coat. It is usually caused by prolonged exposure to wet and damp conditions during or after maturation. The fungal growth can vary in colour from white, to grey, to black. It does not refer to the more serious Storage Moulds.

This definition is to be read in conjunction with the photo in the Visual Recognition Standards Guide which depicts the minimum affected standard for a grain to be classified as Field Fungi.

Foreign Material

Foreign Material includes:

Trash
Trash may consist of whiteheads, chaff, backbone, seedpods (less than 5mm in diameter and not listed elsewhere in the Standards) and other light material which remain above the 2.00mm screen after a sample of grain is subjected to the screening process.

Chaff
Chaff is defined as the protective material surrounding the mature seed prior to thrashing or harvesting. Backbone is the material to which seeds are attached to the plant stem.

Other Material
Includes all material not already categorised specifically in the other definitions within the Standard. It excludes contaminants for which tolerances have been stated in these Standards.

Foreign Seeds

Foreign Seeds are defined as seeds of any plant, other than the species of crop being tendered for delivery. Foreign Seeds are classified into two broad groups; those with specific tolerances listed in the Standards, and those without. The latter are termed "Small Foreign Seeds".

Seeds with specific tolerances have been categorised into several groups. These are:

Type 1#

Colocynth *(Citrullus colocynthis)*
Double Gees / Spiny Emex / Three Cornered Jack *(Emex australis*)
Jute *(Corchorus olitorius*)
Long Head Poppy *(Papaver dubium*)
Mexican Poppy *(Argemone mexicana*)
Opium Poppy *(Papaver somniferum*)
Poppy (Field) *(Papaver rhoeas)*
Poppy (Horned) *(Glaucium flavum)*
Wild Poppy *(Papaver hybridum)*
Parthenium Weed *(Parthenium hysterophorus*)*
New Zealand Spinach *(Tetragonia tetragonoides)*

* Parthenium Weed is a NIL tolerance in NSW/VIC/SA/WA
# Individual tolerances applies to all seeds in this category

Type 2

Castor Oil Plant *(Ricinus communis)*
Coriander *(Coriandrum sativum*)
Crow Garlic/Wild Garlic *(Allium vineale*)
Darling Pea *(Swainsona spp*)
Peanut seeds and pods *(Arachis hypogaea)*
Ragweed *(Ambrosia sp)*
Rattlepods *(Crotalaria sp)*
Starburr *(Acanthospermum hispidum*)
St. Johns Wort *(Hypericum perforatum)*

Type 3a

Bathurst Burr *(Xanthium spinosum*)
Bellvine (*Ipomoea plebeia*)
Branched Broomrape *(Orobanche ramosa*)
Bulls Head / Caltrop / Cats Head *(Tribulus terrestris*)
Cape Tulip *(Homeria spp)*
Cottonseed *(Gossypium spp*)
Dodder *(Cuscuta spp*)
Noogoora Burr *(Xanthium pungens*)
Thornapple *(Datura spp)*

Type 3b

Vetch (Commercial) *(Vicia spp)*

Vetch (Tare) *(Vicia sativa*)

Type 3c

Heliotrope (Blue) *(Heliotropium amplexicaule*)
Heliotrope (Common) *(Heliotropium europaeum)*

Note included in this Type are tolerances for seeds or pods

Type 4

Bindweed (Field) *(Convolvulus arvensis*)
Cutleaf Mignonette seeds or pods *(Reseda lutea)*
Darnel (Drake Seed) *(Lolium temulentum*)
Hexham Scent / King Island Melilot *(Melilotus indicus)* only acceptable if no tainting odour is present
Hoary Cress *(Cardaria draba*)
Mintweed *(Salvia reflexa*)
Nightshades *(Solanum spp)*
Paddy Melon *(Cucumis myriocarpus)*
Skeleton Weed *(Chondrilla juncea*)
Variegated Thistle *(Silybum marianum)*

Type 5

Knapweed (Creeping/Russian) *(Acroptilon repens)*
Sesbania Pea *(Sesbania cannabina)*
Paterson's Curse / Salvation Jane *(Echium plantagineum)*

Type 6

Saffron Thistle *(Carthamus lanatus)*

Type 7a

Broad Beans (*Vicia faba*)
Chickpeas *(Cicer arietinum)*
Colombus Grass *(Sorghum almum*)
Corn (Maize)(*Zea mays*)
Cowpea *(Vigna unguiculata)*
Faba Beans *(Vicia faba*)
Johnson Grass *(Sorghum halepense*)
Lentils *(Lens culinaris*)
Lupin *(Lupinus spp*)
Peas (Field) *(Pisum sativum*)
Safflower *(Carthamus tinctorius)*
Soybean *(Glycine max*)
Sunflower *(Helianthus annuus)*

And any other seeds or pods greater than 5mm in diameter

Type 7b

Barley (2 row) *(Hordeum distichon*)
Barley (6 row) *(Hordeum vulgare)*
Bindweed (Australian) *(Convolvulus erubescens)*
Bindweed (Black) *(Polygonum convolvulus*)
Durum *(Triticum durum*)
Red / Spring Feed Wheats (Various)
Oats (Black or Wild) *(Avena fatua*)
Oats (Sand) *(Avena strigosa*)

Oats (Common) *(Avena sativa)*
Rice *(Oryza sativa*)
Rye (Cereal) *(Secale cereale*)
Sorghum (Forage) *(Sorghum bicolor)*
Triticale *(Triticosecale spp)*
Turnip Weed *(Rapistrum rugosum)*

Type 7b includes any other Foreign Seeds not specified in Types 1 - 7a or elsewhere in Small Foreign Seeds.

All Foreign Seed Pods not listed and that are not greater than 5mm in diameter (Type 7a) are included as Foreign Material, whether whole pods or part thereof.

Frost Damaged

Refers to grain damaged as a result of frost during the maturation phase. The definition does not include grain pinched as a result of dry conditions or disease during maturation.

Grade

Grade refers to the classification given to the sorghum after it has been sampled and tested, and has been classified according to these Standards.

The following lists the GTA sorghum grades as outlined in this booklet:

CSG1 – grade = Sorghum No.1
CSG2 – grade = Sorghum No.2

Hit and Miss

In relation to screen slots, refers to the sequence of slots on the screen when viewing along a row facing the direction of the slots. That is, the screen is made of a series of slots and "no slots" in sequence equidistant.

Honeydew

Honeydew is a sticky exudates produced by the sorghum plant in response to any predator attack, including Ergot. Honeydew oozes out of the flowers and drips onto leaves of the sorghum plant. It causes seeds to stick together and can make crops difficult to harvest and prevent harvested grain from running through equipment.

Honeydew is acceptable if the grain is able to flow freely.

Insect Damaged

These are grains eaten in part by Stored Grain Insects and any field pests of grains including *Heliothis spp*. Any visible insect damage to the grain is to be classified as defective.

This definition is to be read in conjunction with the photo in the Visual Recognition Standards Guide which depicts the minimum affected standard for a grain to be classified as Insect Damaged.

Insects – Large and Small

These are insect contaminants of grain that do not cause damage to stored grains. There are separate tolerances for Large and Small Insects. They include but are not restricted to:

Large Insects	Small Insects
Desiantha Weevil (*Desiantha spp*)	Aphids
Grasshoppers, Locusts	Minute Mould Beetle (Corticaria spp)
Ladybirds	Mites (Acarina spp)
Pea Weevil (*Bruchus pisorum*) (dead only)	Stored Grain Insects (dead only)

Large Insects	Small Insects
Sitona Weevil (*Sitona spp*)	
Wood Bugs	

Tolerances apply to either Live or Dead whole Insects. Note for Live Pea Weevil and Live Stored Grain Insects, a nil tolerance applies – refer to Stored Grain Insects.

For all Insects pieces are included in Foreign Material.

Load

A load is a bulk unit tendered for delivery.

Maximum Residue Limits – MRLs

MRLs are the maximum amount of a chemical residue or its metabolite that is legally permitted on or in agricultural commodity. The Australian Pesticides and Veterinary Medicines Authority (APVMA) sets MRLs. These MRLs are set at levels which are not likely to be exceeded if the agricultural or veterinary chemicals are used in accordance with approved label instructions and can be found at on the ComLaw website at the following address http://www.comlaw.gov.au/Details/F2014C00821.

Australian MRLs may differ significantly from those prescribed by foreign countries and the International Codex Alimentarius Commission. Consequently grain exporters must be aware of MRLs of importing countries and which countries accept Codex MRLs. Foreign country MRLs may be accessed directly from foreign government websites, the NRS grains database at http://www.daff.gov.au/ag-farm-food/food/nrs/databases. Industry should always confirm the accuracy of these MRL listings through their own means.

Moisture

This is the amount of water present in the sample as determined by the appropriate analytical method.

N/A

In these Standards means not applicable. That is, no minimum or maximum tolerance exists. The quality parameter may exist at unlimited levels in the sample.

National Residue Survey

The National Residue Survey (NRS) gathers information and supplies chemical residue results on domestic and export grain commodities. The NRS results show Australian grain is of a high quality with respect to residues and contaminants. All grain exporters, container packers, bulk export terminal operators, Bulk Handling Companies and processors are encouraged to actively participate in the NRS grains residue monitoring program. Contravention of an overseas MRL may cause the rejection of cargoes resulting in severe financial cost being incurred and potentially jeopardising Australian grain into that market. Information about the NRS is located at http://www.daff.gov.au/agriculture-food/nrs.

Nil

Nil in these Standards means a level of zero in a half litre sample representative of the entire load (or parcel of grain being assessed) and/or not detected in the load or in/on the delivery vessel at any stage of the receival process.

Objectionable Material

Objectionable Material refers to objectionable foreign matter that may or may not be otherwise stated in these Standards which has the ability to degrade the hygiene of sorghum, become a food safety issue of concern or has a commercially unacceptable odour. This includes but is not limited to the following:

Animal Material

This refers to meat meal, bone meal, poultry offal, meal or any other animal proteins. Animal Material also includes carcasses of dead animals such as rats and mice.

Stick

A Stick is defined as ligneous material greater than 1cm in length and 0.5cm in diameter. Note that crop stubble greater than 3cm in length and 1cm in diameter is defined as a Stick. Smaller material is included in Foreign Material.

Tainting Agents

A Tainting Agent is any contaminant that imparts a smell or taint to sorghum. It includes but is not limited to plant parts and seeds of *Eucalyptus spp*.

Water

The addition of water to grain prior to delivery is a prohibited practice.

Other

This refers to any other commercially unacceptable contaminant such as animal excreta, glass, concrete, fertiliser or metal.

Odour

A commercially unacceptable Odour is defined as a sour, musty or other objectionable odour emanating from the sorghum which is not natural or normally associated with sorghum. Odour may be caused by various means which may or may not be physically discernible in the sample being assessed.

Pea Weevil

Pea Weevil refers to all life stages of insects of the species *Bruchus pisorum*.

Note that a separate tolerance applies to Live and Dead Pea Weevils:

Live

- A nil tolerance applies to all live Pea Weevils

Dead

- Dead Pea Weevil are included in the definition for Insects – Large
- Pieces of Pea Weevils are classified as Foreign Material

As Pea Weevils are commonly found inside field pea seeds, it is recommended that any field peas present in a load of grain should be broken and assessed for the presence of this insect.

Pickling Compounds or Artificial Colouring

Pickling Compounds are those chemicals added to grain as a seed treatment or as a seed dressing prior to sowing. This includes grains that may be affected by marker dye commonly used during crop spraying operations that has stained the sorghum. They are usually associated with a colouring agent.

Grains contaminated in this way may be identified by an unnatural surface colour and/or a colour that rubs off. Any grains that are artificially coloured regardless of intensity are defective.

Sand/Soil

Sand or Soil is generally regarded as unconsolidated mineral or organic material and may also consist of clumps of earth and grains of sand.

> **Sand**
> A grain of Sand is defined as a particle of unconsolidated (loose), rounded to angular rock fragment or mineral grain larger than 0.06mm that falls below the 2.00mm screen during the screening process. Smaller material is classified under Foreign Material.
>
> **Soil**
> Soil is defined as unconsolidated minerals (i.e., sand, silt and clay) mixed with organic matter. The definition of Soil also includes clods of dirt. There is no size limit for Soil.

Sand and Soil is to be determined as a % by weight in the entire half litre sample.

Refer also to Stones.

Sappy

Sappy grains are those that have been harvested before maturity. Sappy grains are generally soft when pressed. Any level of sappiness is classified as defective.

Screenings

This is the total material passing through a 2.00mm screen after a sample of grain is subjected to the screening process. It includes Small Foreign Seeds.

Small Foreign Seeds

These are all small foreign seeds which have fallen below the screen during the screening process, except those specifically mentioned in the Foreign Seeds definition.

Sorghum

This refers to red, white or yellow varieties of grain sorghum. Note that Forage Sorghum is a Type 7(b) Foreign Seed Contaminant.

Sprouted

Sprouted grains are those in which the shoot is visibly extending from any part of the germ.

Grains that have had the germ knocked off or scalloped out due to header damage or grains with pin holes are not included in this definition.

This definition is to be read in conjunction with the photo in the Visual Recognition Standards Guide which depicts the minimum affected standard for a grain to be classified as Sprouted.

Note that Sprouted is not included in the definition or tolerance for Total Defective.

Stained

Stained grains are not defective, nor are they included in the definition or tolerance for Total Defective. Unlimited Stained grains may occur in a sample.

Stained refers to kernels that exhibit a dark discolouration on the seed coat. It is caused by either exposure to wet and damp conditions during growth and maturation phases or a stress related biochemical reaction. The discolouration can vary from dark brown to black in colour and generally is not able to be rubbed off. It does not refer to Field Fungi or Storage Moulds for which tolerances exist in the Standards.

For reference, a photo of a Stained grain is included in the Field Fungi section of the Visual Recognition Standards Guide.

Standards

Standards means all the test parameters listed in this Manual. Loads presented for delivery or samples to be assessed under these Standards must be analysed for all the parameters listed in the Standards, unless otherwise specified in individual Storage and Handling Agreements.

Stone

A Stone or gravel is defined as a lump or mass of hard consolidated mineral matter that is retained above the 2.00mm screen during the screening process. Material falling through the 2.00mm screen is defined as Sand.

Note a maximum weight of 4.0g applies to the total weight of all Stones per 2.5L retained above the 2.00mm screen.

Storage Mould

Storage Mould refers to kernels that have become affected by the development of fungi or bacteria due to an increase in grain moisture levels during storage. Affected grains appear discoloured and visibly affected by mould.

This definition is to be read in conjunction with the photo in the Visual Recognition Standards Guide which depicts the minimum affected standard for a grain to be classified as Storage Mould.

Stored Grain Insects

These are insects which cause damage to stored grain and the tolerance applies to all life stages of the insect.

These include:

Common Name	Scientific Name
Bean Weevil	*Acanthoscelides obtectus*
Flour mite	*Acarus siro*
Murky meal caterpillar	*Aglossa caprealis*
Foreign grain beetle	*Ahasverus advena*
Lesser mealworm	*Alphitobius diaperinus*
Black fungus beetle	*Alphitobius laevigatus*
Pea and bean beetle – Southern cowpea weevil	*Callosobruchus chinensis*
Pea and Bean Weevil – Cowpea weevil	*Callosobruchus maculatus*
Cowpea weevil	*Callosobruchus phaseoli*
Dried fruit beetle	*Carpophilus dimidiatus*
Dried fruit beetle	*Carpophilus hemipterus*
Dried fruit beetle	*Carpophilus ligneus*
Dried fruit beetle	*Carpophilus obsoletus*
Rice Moth	*Corcyra cephalonica*
Flat Grain Beetle	*Cryptolestes spp*
Mould beetles	*Cryptophagus spp*
White-shouldered house moth	*Endrosis sarcitrella*
Tropical Warehouse Moth	*Ephestia cautella*
Cacao moth/warehouse moth	*Ephestia elutella*
Mediterranean flour moth	*Ephestia kuehniella*
Spider beetle	*Gibbium psylloides*
Broad-horned flour beetle	*Gnatocerus cornutus*

Common Name	Scientific Name
Tobacco beetle/cigarette beetle	*Lasioderma serricorne*
Long-headed flour beetle	*Latheticus oryzae*
Spider beetle black	*Mezium affine*
Spider beetle	*Mezium americanum*
Mottled grain moth	*Nemapogon granella*
Brown-dotted clothes moth	*Niditinea fuscipunctella*
Merchant grain beetle	*Oryzaephilus mercator*
Saw Tooth Grain Beetle	*Oryzaephilus surinamensis*
Small-eyed flour beetle	*Palorus ratzeburgi*
Depressed flour beetle	*Palorus subdepressus*
Indian Meal Moth	*Plodia interpunctella*
Psocids/Book lice	*Psocoptera sp*
White-marked spider beetle	*Ptinus fur*
Australian spider beetle	*Ptinus tectus*
Meal moth	*Pyralis farinalis*
Lesser Grain Borer	*Rhyzopertha dominica*
Granary Weevil	*Sitophilus granarius*
Rice Weevil	*Sitophilus oryzae*
Maize Weevil	*Sitophilus zeamais*
Angoumois Grain Moth	*Sitrotroga cerealella*
Yellow mealworm	*Tenebrio molitor*
Dark mealworm	*Tenebrio obscurus*
Cadelle	*Tenebroides mauritanicus*
Large pale clothes moth	*Tinea pallescentella*
Case-making clothes moth	*Tinea pellionella*
Webbing clothes moth	*Tineola bisselliella*
Rust-red Flour Beetle	*Tribolium castaneum*
Confused Flour Beetle	*Tribolium confusum*
Warehouse Beetle	*Trogoderma variable*
Hairy Fungus Beetle	*Typhaea stercorea*

Note that a separate tolerance exists for dead and live Stored Grain Insects.

Live

- A nil tolerance applies to all live Stored Grain Insects

Dead

- Dead Stored Grain Insects are included in the definition for Insects – Small
- Pieces of Stored Grain Insects are classified as Foreign Material

Temperature - Maximum

The maximum temperature of grain tendered for delivery when sourced direct from a grain dryer is 35^{O}C for all Grades.

Test Weight

Test Weight is a measure of the density of grain.

Visual Recognition Standards Guide

The Visual Recognition Standards Guide (VRSG) for Sorghum contains a range of photographs and illustrations to supplement the sorghum Standards as outlined in this booklet. The most recent VRSG for Sorghum was released in August 2015.

The Defective Grain definitions listed in this Standards Booklet are to be read in conjunction with the images displayed in the VRSG. The images in that document display the minimum and/or maximum coverage and attributes of the Defective Grain types as defined in these Standards.

SECTION 3 GRAIN QUALITY STANDARDS

The following tables represent the grades of sorghum as defined in this Manual.

To fully understand and accurately implement the sorghum Quality Standards, reference should be made to other relevant sections in this Sorghum Manual including:

- Definitions
- Varietal Master List
- Methods & Procedures
- Reference materials such as the Visual Recognition Standards Guide

Other sections of the GTA Standards Manual should also be perused for general guidance on activities associated with implementation of these Standards.

As stated previously, the following Standards are applicable at the time of publishing of this Manual. Variations and new Grades may exist and industry is encouraged to keep updated with changes via reviewing the GTA website and other relevant industry information sources.

Commodity:	**SORGHUM No.1**	**Standard Reference No.**	**CSG-1**
Effective:	**1 August 2015**	**Season:**	**2015/16**
PARAMETER	**SPECIFICATION**	**COMMENT / VARIATION**	
Description	n/a	Grain Sorghum of Red, White or Yellow varieties only	
Moisture Max (%)	13.5		
Test Weight Min (kg/hl)	71.0		
Foreign Material Max (% by wt)	2.0	All matter other than already specified in this Standard	
Screenings Max (% by wt)	11.0	All matter passing through a 2.0mm slotted screen – 40 shakes in the direction of the slots	
DEFECTIVE GRAINS Max (% by count, 300 grain sample, unless otherwise stated)			
Total Defective, of which	5.0	Includes Field Fungi, Sappy, Frost Damaged, Insect Damaged, Heat Damaged/Bin Burnt and Storage Mould	
Field Fungi	3.0		
Bin Burnt, Heat Damaged (% by weight per half litre)	0.5		
Storage Mould (% by weight per half litre)	0.05		
Sprouted	3.0	Not included in Total Defective	
FOREIGN SEED CONTAMINANTS Max – (count of seeds in total per half litre unless otherwise stated)			
Type 1 (Individual seed basis)	8	Colocynth, Double Gees/Spiny Emex/Three Cornered Jack, Jute, Long Headed Poppy, Mexican Poppy, Field Poppy, Horned Poppy, Wild Poppy, New Zealand Spinach, Parthenium Weed (Qld only)	
Type 2 (entire load)	Nil	Castor Oil Plant, Coriander, Crow Garlic/Wild Garlic, Darling Pea, Opium Poppy, Peanut seeds and pods, Ragweed, Rattlepods, Starburr, St. John's Wort	
Type 3 (a)	2	Bathurst Burr, Bellvine, Branched Broomrape, Bulls Head/Caltrop/Cats Head, Cape Tulip, Cottonseed, Dodder, Noogoora Burr, Thornapple/False Castor Oil	
Type 3 (b)	4	Vetch (Blue/Tare) and Vetch (Commercial)	
Type 3 (c)	8	Heliotrope (Blue), Heliotrope (Common)	
Type 4(a)	20	Bindweed (Field), Cutleaf Mignonette seeds or pods, Damel, Hexham Scent/King Island Melilot (Hexham Scent is only acceptable if no tainting odour is present), Hoary Cress, Mintweed, Nightshades, Paddy Melon, Skeleton Weed, Variegated Thistle	
Type 5	40	Knapweed (Creeping/Russian), Patterson's Curse/Salvation Jane, Sesbania pea	
Type 6	10	Saffron Thistle	
Type 7 (a)	50	Broad Beans, Chickpeas, Corn (Maize), Cowpea, Faba Beans, Johnson Grass or Colombus Grass, Lentils, Lupin, Peas (Field), Safflower, Soybean, Sunflower and any other seeds or pods greater than 5mm in diameter	
Type 7 (b)	400	Barley, Bindweed (Australian), Bindweed (Black), Wheat, Durum, Oats (Black), Oats (Sand), Oats (Wild), Oats (Common), Rice, Rye (Cereal), Sorghum (Forage), Triticale, Turnip Weed and any other weed seeds not specified in Types 1-7(a) or SFS	
Small Foreign Seeds (% by weight)	1.6	All foreign seeds not specified in Types 1-7(b) that fall below the 2.0mm screen during the Screenings process	
OTHER CONTAMINANTS Max - (count per half litre, unless otherwise stated)			
Cereal Smut (entire load)	Nil	Ball and Gall Smut or any other smut species	
Cereal Ergot (entire load)	Nil	Pieces or whole affected kernels of all cereal ergots except Sorghum Ergot	
Sorghum Ergot (% by weight)	0.3	*Claviceps africana* and *Cerebella sclerotes*	
Ryegrass Ergot (entire load)	Nil		
Stored Grain insects & Pea Weevils – Live (entire load)	Nil	All life stages	
Insects – Large	3	Dead or alive	
Insects – Small	10	Dead or alive	
Sand/Soil (% by weight)	0.06		
Stones (g per 2.5L)	4.0	Maximum total weight of all Stones retained above the 2.0mm screen per 2.5L	
Objectionable Material (entire load)	Nil	Sticks, glass, concrete, pickled grain, artificial colouring or any other commercially unacceptable contaminant	
Odour (entire load)	Nil	Grain which has any commercially foreign odour due to tainting agents or improper storage causing mould, souring or musty odours	
Maximum Temperature (^{0}c)	35	Grain temperature ex grain dryer	
Chemicals Not Approved for Sorghum (entire load)	Nil	Residues of any chemical compound not approved for grain sorghum, used in contravention of the labelled instructions or chemicals in excess of the MRL	

Commodity:	**SORGHUM No.2**	**Standard Reference No.**	**CSG-2**
Effective:	**1 August 2015**	**Season:**	**2015/16**
PARAMETER	**SPECIFICATION**	**COMMENT / VARIATION**	
Description	n/a	Grain Sorghum of Red, White or Yellow varieties only	
Moisture Max (%)	13.5		
Test Weight Min (kg/hl)	62.0		
Foreign Material Max (% by wt)	4.0	All matter other than already specified in this Standard	
Screenings Max (% by wt)	25.0	All matter passing through a 2.0mm slotted screen – 40 shakes in the direction of the slots	
DEFECTIVE GRAINS Max (% by count, 300 grain sample, unless otherwise stated)			
Total Defective of which	25.0	Includes Field Fungi, Sappy, Frost Damaged, Insect Damaged, Bin Burnt/Heat Damaged and Storage Mould	
Field Fungi	10.0		
Bin Burnt, Heat Damaged (% by weight per half litre)	1.0		
Storage Mould (% by weight per half litre)	0.1		
Sprouted	10.0	Not included in Total Defective	
FOREIGN SEED CONTAMINANTS Max – (count of seeds in total per half litre unless otherwise stated)			
Type 1 (Individual seed basis)	8	Colocynth, Double Gees/Spiny Emex/Three Cornered Jack, Jute, Long Headed Poppy, Mexican Poppy, Field Poppy, Horned Poppy, Wild Poppy, New Zealand Spinach, Parthenium Weed (Qld only)	
Type 2 (entire load)	Nil	Castor Oil Plant, Coriander, Crow Garlic/Wild Garlic, Darling Pea, Opium Poppy, Peanut seeds and pods, Ragweed, Rattlepods, Starburr, St. John's Wort	
Type 3 (a)	2	Bathurst Burr, Bellvine, Branched Broomrape, Bulls Head/Caltrop/Cats Head, Cape Tulip, Cottonseed, Dodder, Noogoora Burr, Thornapple/False Castor Oil	
Type 3 (b)	4	Vetch (Blue/Tare) and Vetch (Commercial)	
Type 3 (c)	8	Heliotrope (Blue), Heliotrope (Common)	
Type 4(a)	20	Bindweed (Field), Cutleaf Mignonette seeds or pods, Damel, Hexham Scent/King Island Melilot (Hexham Scent is only acceptable if no tainting odour is present), Hoary Cress, Mintweed, Nightshades, Paddy Melon, Skeleton Weed, Variegated Thistle	
Type 5	40	Knapweed (Creeping/Russian), Patterson's Curse/Salvation Jane, Sesbania pea	
Type 6	10	Saffron Thistle	
Type 7 (a)	50	Broad Beans, Chickpeas, Corn (Maize), Cowpea, Faba Beans, Johnson Grass or Colombus Grass, Lentils, Lupin, Peas (Field), Safflower, Soybean, Sunflower and any other seeds or pods greater than 5mm in diameter	
Type 7 (b)	400	Barley, Bindweed (Australian), Bindweed (Black), Wheat, Durum, Oats (Black), Oats (Sand), Oats (Wild), Oats (Common), Rice, Rye (Cereal), Sorghum (Forage), Triticale, Turnip Weed and any other weed seeds not specified in Types 1-7(a) or SFS	
Small Foreign Seeds (% by weight)	1.6	All foreign seeds not specified in Types 1-7(b) that fall below the 2.0mm screen during the Screenings process	
OTHER CONTAMINANTS Max - (count per half litre, unless otherwise stated)			
Cereal Smut (entire load)	Nil	Ball and Gall Smut or any other smut species	
Cereal Ergot (entire load)	Nil	Pieces or whole affected kernels of all cereal ergots except Sorghum Ergot	
Sorghum Ergot (% by weight)	0.3	*Claviceps africana* and *Cerebella sclerotes*	
Ryegrass Ergot (entire load)	Nil		
Stored Grain insects & Pea Weevils – Dead	10	All life stages	
Insects – Large	3	Dead or alive	
Insects – Small	10	Dead or alive	
Sand/Soil (% by weight)	0.06		
Stones (g per 2.5L)	4.0	Maximum total weight of all Stones retained above the 2.0mm screen per 2.5L	
Objectionable Material (entire load)	Nil	Sticks, glass, concrete, pickled grain, artificial colouring or any other commercially unacceptable contaminant	
Odour (entire load)	Nil	Grain which has any commercially foreign odour due to tainting agents or improper storage causing mould, souring or musty odours	
Maximum Temperature (^{0}c)	35	Grain temperature ex grain dryer	
Chemicals Not Approved for Sorghum (entire load)	Nil	Residues of any chemical compound not approved for grain sorghum, used in contravention of the labelled instructions or chemicals in excess of the MRL	

SECTION 4 VARIETAL LISTS

There are no varietal restrictions regarding sorghum other than Grain Sorghum can be of the following varieties only:

- Red; or
- White; or
- Yellow

SECTION 5 METHODS & PROCEDURES

5.1 Introduction

The following section details methods and procedures to be used for the assessment of various quality parameters as outlined in this Manual.

The methods outlined are either Reference Methods or Field Assessment Methods. Field Assessment Methods are included as a guide to industry where Reference Methods may not be able to be implemented. Note that Field Assessment Methods must equate to the Reference Method for the applicable test method.

In all instances of disputes, test results produced by trade-certified equipment take precedence over non-trade certified equipment and methods. Where the dispute involves only non trade-certified equipment or test methods, the reference method takes precedence over the field assessment method. Depending on the test to be conducted, variations may exist due to equipment used.

Procedures outlined are a guide for industry. Industry is free to develop their own Operational Procedures for each test and activity based on their own circumstances. At all times industry use of apparatus outlined in this Standard must comply with the manufacturers' recommendations for occupational health and safety and training.

5.2 Sampling

5.2.1 Definitions

This is the standard procedure used to draw a sample of the commodity from a bulk unit tendered for delivery to enable tests to be conducted on the commodity for the purposes of determining its quality.

- A primary sample is an individual probed sample taken from the lot presented for sampling
- A composite sample is the combined primary samples taken from the lot to be sampled, and is representative of the entire lot
- A sub sample is the sample taken from the mixed composite sample for the purposes of conducting quality tests, and is representative of the entire lot

5.2.2 Scope

Sorghum is traded on the basis of quality tests conducted on lots of sorghum presented for sale or delivery to end users. Obtaining representative samples is critical to ensuring test results reflect the true quality of these lots.

This procedure is applicable to all cereal grains, pulses and oilseeds.

5.2.3 Apparatus

- Manual sampling probe (double tube compartment probe, one inside the other, equipped with spiralled ports that open sequentially from bottom to top).
- Vacuum or pneumatic probe (an alternative to the manual sampling probe and consisting of a hand held or remotely controlled probe which retrieves grain through the use of a vacuum or other air movement system).
- Mixing bucket (including other associated equipment such as mini-auger suitable for mixing sample, optional).
- Sample dividing apparatus (optional).

5.2.4 Reagents

Not Applicable.

5.2.5 Procedure

Sample Collection guidelines for collecting a representative sample

- The surface of the grain should be fully exposed prior to sampling to allow for effective visual inspection. At this point, the load should be scanned for any defects or contaminants.
- The probe to be used should be of a sufficient length in order to obtain a sample from as close as possible to the bottom of truck.
- A primary sample must be drawn for assessment by thrusting the sampling probe as vertically and as deep as possible into the load.
- At least one probe must be taken from the front, middle and rear of each bulk unit.

- If more than one unit is delivered, samples must be drawn from each bulk unit as described above.

- If the bulk units are of visibly different quality, or if required at the Receival Agents discretion, different samples and grade classification may be undertaken for each separate bulk unit.

- If the declared varietal composition or paddock where the grain was grown is different for each unit tendered for delivery, or more than one variety is commingled in each delivery unit, then a separate assessment of each unit must be conducted.

- Each primary (probed) sample must consist of at least one litre of grain.

- A composite sample from each load tendered for delivery shall consist of the following minimum quantities and number of probes:

Load Size	Sample Size (minimum)
10 tonnes or less	3 litres
Over 10 tonnes up to 20 tonnes	4 litres
Over 20 tonnes up to 30 tonnes	5 litres
Over 30 tonnes up to 40 tonnes	6 litres
Over 40 tonnes up to 50 tonnes	7 litres
Over 50 tonnes up to 60 tonnes	8 litres
Over 60 tonnes up to 70 tonnes	9 litres
Over 70 tonnes up to 80 tonnes	10 litres

Note – in the above table the sample size reflects the number of probe samples. For example, 4 litres equates to 4 probe samples.

Sample Mixing

- The primary samples in each probe must be collected together and thoroughly mixed in a suitable container using a mechanical device where appropriate, to form the composite sample.

- Sub samples should be drawn from the composite sample either by hand or through the use of a suitable sample dividing apparatus.

Sample Analysis

- The sub sample should then be analysed for all of the quality parameters specified in these Standards or in the Receival Agent's agreement with the buyer concerned if different from these Standards.

- Results should be entered on the Receival Agents sample receipt.

5.2.6 References

Sampling of Wheat and other Grains - AACC Method 64-70A

5.3 Moisture Assessment of Cereals – Fan Forced Oven Reference Method

5.3.1 Definitions

This is the fan forced reference method specified in National Measurement Institute legislation to be used to determine the moisture content of grain samples as loss in weight when subjected to heating.

5.3.2 Scope

This is applicable to all cereals when being tested for moisture content under laboratory conditions.

5.3.3 Apparatus

- Laboratory Mill
- Forced Draft Oven capable of being maintained at 130^{o}C +/- 1^{o}C
- Aluminium moisture dishes, 50 – 55 by 15 – 20mm with tight fitting covers
- Desiccator
- Electronic balance capable of weighing up to 100g to 4 decimal places

5.3.4 Reagents

Not applicable

5.3.5 Procedure

- Grind a 30-40g whole grain sample in a suitable mill (Perten 3303, Tecator, Cemotec or similar). Sample to be "as is".
- Mix thoroughly and transfer 2 to 3g portions to each of 2 or more tared moisture dishes
- Cover and weight the dishes immediately
- Subtract tare weights and record weight of sample
- Clean mill between samples
- Uncover the dishes and place them in pre heated oven (130^{o}C) and place covers under the dishes. Evenly distribute the dishes within the oven
- Close oven door and allow temperature to stabilise and then heat for exactly 60 minutes
- Remove the dishes, quickly replace the lids and place in the desiccator
- Weigh the dishes after they reach room temperature
- Determine loss in weight as moisture as per the following equation:

$$\% \text{ Moisture} = \frac{Wtp - (Wdry - Wdish)}{Wtp} \times 100$$

Where

Wtp is the weight of the test portion before oven drying
Wdry is the weight of the dish, lid and test portion after oven drying

Wdish is the weight of the empty oven moisture dish and lid

Report result to the nearest 0.1%.

If duplicates differ by more than 0.2%, repeat the determination, otherwise, report the average of the duplicates.

5.3.6 References

- Moisture – Air Oven Methods – AACC Method 44-15A
- NMI M 8 Pattern Approval Specifications for Protein Measuring Instruments for Grain
- NMI V10 Uniform Test Procedures for the Verification, Certification and In Service Inspection of Protein Instruments for Grain

5.4 Moisture Assessment of Cereals – Brabender Oven Reference Method

5.4.1 Definitions

This is the Brabender Oven reference method used to determine the moisture content of grain samples as loss in weight when subjected to heating.

5.4.2 Scope

This is applicable to all cereals when being tested for moisture content.

5.4.3 Apparatus

- Mill - A low moisture loss mill must be used as significant levels of heat can be generated. The mill of choice is the Falling Number 3303 mill (a Wiley - using a 20 mesh screen). The Falling Number Mill 3303 is used with the setting – Wheat – 0.
- Electronic balance – accuracy = 0.001g (or better)
- Aluminium dishes - these dishes must be kept clean and weigh 11.500 + 0.005g
- Vial with well sealing screw to lid. Currently a small yellow top polyethylene container with polypropylene lid is used. Samples must be prepared and used within 24hrs.

5.4.4 Reagents

Not Applicable

5.4.5 Procedure

- Grind approx 50g of sample in accordance with relevant mill manual. Mix sample well and replace into original sample vial tightly sealing the lid. Sample must be prepared and used on the same day or prepared on the evening before.
- Make sure the dishes are clean and are resting on a clean surface (wipe with tissue). Tare the first dish and also subsequent dishes used but note the weight before taring if weight varies from 11.500 or tare varies by +/- 0.010g from tare. Recheck weight of dish to ensure within 11.500 +/- 0.005g. Dishes must also be checked before and after the season to ensure they are correct.
- Weigh out accurately 10.000 +/- 0.001g of the ground sample into an Aluminium dish. Then shake dish to obtain an even layer of sample.
- Take the weighed samples and place into the oven which has been previously switched on and heated to 130 °C. Place the dishes in the oven noting the number of the dish and its position number (1 through 9). There are ten positions in the oven (the tenth place is taken up by an empty dish for calibration purposes).
- When the oven has been loaded note the time or set a countdown timer to 60 mins once the required temperature is reached. Usually for 130°C the oven takes 10 - 15 minutes to reach the required temperature.
- When one hour has elapsed, standardise the instrument by selecting the empty dish and placing 9g in weights in the small platform between the 3 prongs on the balance and adjust the scale to 10.0 with the standard swinging freely. Moisture can then be read off for each sample in turn.
- Read the samples in the dishes consecutively recording results in the relevant worksheet.

NOTE:

- When switching the oven on make sure that the Brabender oven is level (use bubble level).
- All results are a direct reading of % w/w water.
- The minimum heating time must be adhered to (1 hour) but heating over the hour will not affect the results (up to 2 hours).
- If only a few grams of sample are available see the manufacturers hand book for the technique to be adopted.
- The weight of Aluminium dishes is to be checked at 6 monthly intervals to ensure they are within 11.500 +/-0.005g. If they are underweight they are to be discarded and replacements purchased. Do not add weight to the dish i.e. solder etc as this will breakdown over time or fall off. If they are overweight they may be cleaned with warm water and neutral detergent. Under no circumstances use abrasive or corrosive chemicals as this will lead to the dish being underweight.

5.4.6 References

- Moisture – Air Oven Methods – AACC Method 44-15A
- NMI M 8 Pattern Approval Specifications for Protein Measuring Instruments for Grain
- NMI V10 Uniform Test Procedures for the Verification, Certification and In Service Inspection of Protein Instruments for Grain

5.5 Moisture Assessment of Cereals – NIR

5.5.1 Definitions

This describes the NIR method for determination of moisture in cereal grains.

5.5.2 Scope

This procedure is applicable to all cereal grains.

5.5.3 Reagents

Not applicable.

5.5.4 Apparatus

NIR instrument approved for use for trade purposes under the conditions currently being developed by the National Measurement Institute.

5.5.5 Method

Sample to be "as is".

Individual manufacturer instructions and procedures should be followed for operation and maintenance of NIR instruments used to determine grain moisture.

Report result to the nearest 0.1%.

5.5.6 References

- NMI M 8 Pattern Approval Specifications for Protein Measuring Instruments for Grain
- NMI V10 Uniform Test Procedures for the Verification, Certification and In Service Inspection of Protein Instruments for Grain

5.6 Protein Assessment of Cereals – Dumas Reference Method

5.6.1 Definitions

This is the Dumas reference method used to determine the crude protein content of cereal grains. Samples are incinerated in an oxygen rich atmosphere to produce oxides of nitrogen which are catalytically reduced to molecular nitrogen. Interfering combustion products are removed by selective absorption. Nitrogen concentration is then measured by a thermal conductivity detector calibrated against a standard of known nitrogen content. Protein is then calculated from nitrogen content using a known factor for each product.

5.6.2 Scope

This method is applicable to all cereal grains.

5.6.3 Apparatus

- Combustion nitrogen analyser consisting of a furnace capable of maintaining minimum operating temperature of 950^{o}C for pyrolysis of the sample in pure oxygen, an isolating system capable of isolating liberated nitrogen gas from other combustion products for subsequent measurement by thermal conductivity detector, a device for converting NO_x products to nitrogen or measuring NO_2, and a detector system capable of interpreting detector response as percent N.

- Grinder or mill that produces ground material with particle size ≤ 0.8mm and with minimal heat generation.

- Analytical balance accurate to at least 0.0005g.

5.6.4 Reagents

- Gases – carrier gas (usually helium), pure (99.9%) oxygen, compressed air (used to drive component parts of the analyser)

- Reference calibration standard – TRIS - high purity (hydroxymethyl) aminomethane or Nicotinic Acid

5.6.5 Procedure

- Follow procedures to set up the analyser and operating gas systems as specified by the manufacturer. Perform the necessary adjustments for gas flows and pressures, combustion temperatures and times and start up equilibrium times to ensure optimal analysis conditions for the type of sample to be analysed.

- Calibrate the instrument by following the manufacturer's guidelines using the appropriate calibration standard. The calibration should be cross checked against a second high purity standard – Nicotinic Acid or EDTA. Blanks, as stipulated by the manufacturer, should be run prior to analysis to establish the baseline. These should include consideration of an atmospheric blanks factor or a sample blank similar to samples under test.

- Grind an amount of sample sufficient to represent the original material, and to perform a number of nitrogen determinations as required. Sample to be "as is".

- Weigh accurately to 0.001g an amount of ground sample, as recommended by the manufacturer, into the appropriate sample capsule and place the sample into the instrument for analysis.

- If presenting the sample to the instrument in a pellet form, adjustments may be required to burn temperatures, times and blanks to compensate for the absence of a sample capsule.
- Blank and standard control/check samples should be repeated periodically (as a guide every 10 samples) during each analytical run to monitor any drift. Standard drift corrections and recalculation of samples should be made after analysis if the drift exceeds specification.

- Calculation of nitrogen content is usually performed automatically by the instrument data processing system or associated software.

- Results should be expressed as percent (5) nitrogen to two decimal places. For conversion to protein content "as is" multiply wheat nitrogen by 5.7% and all other cereals by 6.25 unless otherwise stated. Convert protein content to an 11% moisture basis for wheat for the nitrogen/protein values where necessary. Report result to the nearest 0.1%.

- Analysis should be repeated if the difference between duplicate test results exceed the respective repeatability values (r) shown in the following table:

Grain	Mean % N	Repeatability		Reproducibility	
		r	RSD_r %	R	RSD_r %
Barley	1.85	0.06	1.22	0.11	2.09
Barley malt	1.49	0.04	0.99	0.08	1.97
Sorghum	1.47	0.05	1.15	0.07	1.69
Wheat durum	2.09	0.04	0.64	0.08	1.32
Wheat*	1.97	0.03	0.61	0.09	1.69
Wheat APH	2.54	0.03	0.46	0.08	1.15
Wheat flour	2.03	0.03	0.46	0.09	1.56

* Wheat other than the type specified in the above table

- Suitable fineness of grind gives a relative standard deviation (RSD) of ≤ 2.0% for ten successive determinations of nitrogen in ground test material. A larger RSD indicates the need for a finer grind or a larger analytical test weight, assuming that the instrument has been properly set up.

- For each batch the accuracy of the system is demonstrated by making ten successive determinations of nitrogen in nicotinic acid or tryptophan (different materials from calibration standard). Means of determinations must be ≤ ± 0.15 of respective theoretical values with standard deviation ≤ 0.15. Failure to achieve these values indicates the need for recalibration or optimisation of instrument settings.

- Accuracy checks should be carried out (1) On instrument installation and reinstallation following repairs and service; (2) When a new batch of working reference material is used; (3) After experiencing problems in instrument set up.

5.6.6 References

- Crude Protein Reference Method - AACC Method 46-30

- Dumas Total Nitrogen Determination – CCD Method 02-03, RACI

- Dumas Combustion – Total Nitrogen Determination (Reference Method) Annex A - National Measurement Institute Document M8

- Sweeney, R.A. (1989). JAOAC 72: 770.

- NMI M 8 Pattern Approval Specifications for Protein Measuring Instruments for Grain
- NMI V10 Uniform Test Procedures for the Verification, Certification and In Service Inspection of Protein Instruments for Grain

5.7 Protein Assessment of Cereals – NIR

5.7.1 Definition

This describes the NIR method for determination of protein in cereal grains.

5.7.2 Scope

This procedure is applicable to all cereal grains.

5.7.3 Reagents

Not applicable.

5.7.4 Apparatus

NIR instrument approved by the National Measurement Institute for use for trade purposes under the conditions stipulated in NMI V10 (Uniform Test Procedures for the Verification, Certification and In Service Inspection of Protein Instruments for Grain), and NMI M8 (Pattern Approval Specifications for Protein Measuring Instruments for Grain).

5.7.5 Method

Sample to be "as is".

Individual manufacturer instructions and procedures should be followed for operation and maintenance of NIR instruments used to determine grain protein.

Report result to the nearest 0.1%.

5.7.6 References

- NMI M 8 Pattern Approval Specifications for Protein Measuring Instruments for Grain
- NMI V10 Uniform Test Procedures for the Verification, Certification and In Service Inspection of Protein Instruments for Grain

5.8 Test Weight Assessment - Schopper Chondrometer Reference Method

5.8.1 Definitions

The Schopper Chondrometer is used for the measurement of Grain Density (Density is also known as “Bushel Weight”, “Test Weight” or “Hectolitre Weight”).

5.8.2 Scope

This method is applicable to all cereal grains.

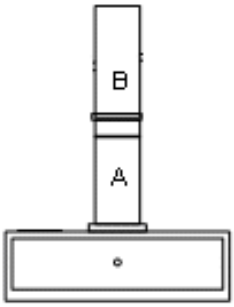
5.8.3 Apparatus

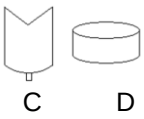
- 1L Schopper Calibrated Chondrometer
- 2 decimal place balance
- Plastic bowl

5.8.4 Reagents

Not applicable

5.8.5 Procedure





- Secure bottom half of cylinder A to base plate on the chondrometer box.
- Ensure the sliding divider C is in the slot on cylinder A.
- Place weight D on top of sliding divider.
- Secure top half of cylinder B to the bottom half A.
- Ensure the slider is closed and pour grain in the cylinder at a constant rate until full to the top.
- Pull the sliding divider out and the weight will move down, drawing the grain down with it (you will hear it moving down).
- Once the weight D is at the bottom, replace the sliding divider back in the slot.
- Carefully tip the cylinder upside down and tip out all the grain remaining above the divider. Make sure to catch the weight D as it drops down.
- Place a plastic container on the electric balance and tare to read zero.
- Remove the blade from the chondrometer and tip the measured litre of grain into the plastic container and weigh.

- The weight is in grams and needs to be multiplied by 0.1 (divided by 10) to obtain a density in kg/hl.
- Always undertake analysis in duplicate and average results.
- Report the result to one (1) decimal place.

5.8.6 References

Test Weight Per Bushel - AACC Method 55-10

National Measurement Institute General Certificate of Approval No 4/10/0

5.9 Test Weight Assessment – Franklin Mark 11 Chondrometer Reference Method

5.9.1 Definitions

This is the Franklin Mark 11 Chondrometer reference method to determine the density of cereal grains (otherwise known as the Test Weight) expressed as kilograms per hectolitre.

5.9.2 Scope

This method is applicable to all cereal grains.

5.9.3 Apparatus

- Franklin Mark II Drop Weight Trade Certified chondrometer
- Pre filling Cup

5.9.4 Reagents

Not applicable.

5.9.5 Procedure

- Assemble the instrument together and place the calibration weight onto the top of the measuring cylinder.
- Place the measuring cylinder with weight on the hook at the end of the measuring beam.
- Calibrate the instrument by moving the sliding weight to the position corresponding to 40kg/hl on the measuring beam. The beam should balance equidistantly between the top and bottom of the square space at the other end of the beam.
- If the beam is not balanced, turn the calibration screw at the other end of the beam until the correct setting is achieved.
- Remove the calibration weight. The instrument is then calibrated.
- Insert the cutter bar into the bottom measuring cylinder, and place the drop weight on top of the cutter bar.
- Fit the top filling cylinder onto the measuring cylinder.
- Fill the pre filling cup with grain. Sample to be “as is”.
- Steadily pour the grain from the pre filling cup with one hand into the top filling cylinder until it is full whilst holding both cylinders together.
- Withdraw the cutter bar in a single swift motion.
- Re-insert the cutter in the slit and push it through the grain with a single firm stroke.
- Remove the top filling cylinder from the measuring cylinder and discard the grain remaining above the cutter, while holding the cutter in place.
- Remove the cutter and suspend the measuring container from the measuring beam of the chondrometer.
- Adjust the sliding weight on the beam until the instrument is balanced.

- Read the test weight of the graduated balance beam at the point indicated by the sliding weight and record the result in kilograms per hectolitre.
- Report the result to one (1) decimal place.

5.9.6 References

Test Weight Per Bushel - AACC Method 55-10

ISO7971-2

National Measurement Institute General Certificate of Approval No 4/10/0

5.10 Test Weight Assessment – Kern 222 Chondrometer Reference Method

5.10.1 Definitions

This is the Kern 222 Trade Certified Chondrometer reference method to determine the density of cereal grains (otherwise known as the test weight) expressed as kilograms per hectolitre.

5.10.2 Scope

This method is applicable to all cereal grains.

5.10.3 Apparatus

- Kern 222 Trade Certified Chondrometer with valid Regulation 13 certificate.
- Electronic balance 0.01g resolution.

5.10.4 Reagents

Not applicable

5.10.5 Procedure

- Assemble the measuring container with the grain cutter inserted in the slit. Place the brass piston on top of the cutter blade. Connect the filling hopper securely on the top of the measuring container.
- Fill the pre-filling cup with grain. Grain sample to be “as is”.
- Empty the pre-filling cup out onto a large sample tray and manually remove any foreign material e.g. whiteheads, straw, barley, lupins, sticks stones etc.
- Pour the remaining grain from the sample tray back into the pre-filling cup. Ensure that the pre filler cup is filled up to or above the internal filling line/groove.
- Steadily pour the grain from the pre-filling cup into the filling hopper until the filling hopper is full.
- Grasp the measuring container firmly with one hand and with the other hand withdraw the cutter in a single swift motion.
- Re-insert the grain cutter in the slit and push it through the grain with a single firm stroke.
- Remove the filling hopper from the measuring container and discard the grain remaining above the cutter, while holding the cutter in place.
- Remove the cutter and return the base bucket to an upright position and then withdraw the cutter.
- Place the Steel Bowl onto the balance and press the T (Tare) button, ensure Zeros are displayed.
- Pour the grain from the bucket into the steel bowl.
- The weight in grams will appear on the display of the balance. This figure is referred to as the weight in grams per litre.
- All numerical results are to be written down to two decimal places.

5.10.6 References

ISO Method 7971-2

National Measurement Institute General Certificate of Approval No 4/10/0

5.11 Screenings Assessment – Reference Method

5.11.1 Definitions

This is the reference method used to determine the percentage by weight of Screenings, including Small Foreign Seeds.

5.11.2 Scope

This method is applicable to sorghum.

5.11.3 Apparatus

Agtator Shaking Device

Wheat Screen 2.00mm with the following specifications:

- 300mm diameter discs x 0.9mm stainless steel, perforated with 12.7mm x 2.00mm slots, hit and miss on ends with 4.77mm end bar and 2.0mm side bar.
- Slot width as assessed by an Engineers Pin Gauge is to be 2.00 mm ± 0.01 mm. Pin Gauge, being 2.01mm and 1.99, needs to have a valid Regulation 13 certificate.
- Compliance testing shall be undertaken by randomly selecting 74 slots and measuring using the above Gauge. 0 to 25 slots is an acceptable failure rate. Refer to separate procedure.

Analytical balance accurate to at least 0.01g

5.11.4 Reagents

Not applicable.

5.11.5 Procedure

- Obtain a certified half litre sample of grain. Sample to be "as is".
- Place the wheat screen on top of the Agtator platform with the slots aligned toward the front of the Agtator. Ensure the wheat screen is clean, smooth, dry and free of grain residues in the slots.
- Ensure the Agtator is set to perform 40 to and fro movements over a period of approximately 68 seconds.
- Pour the half litre of grain in one movement onto the screen surface. No additional movement or spreading of the sample over the screen is to occur.
- Turn on the Agtator and allow it to run until the 40 movements have been completed.
- Gently remove the screen and pan from the Agtator and detach the screen from the pan.
- Calculate Screenings percentage - Weigh the contents of the pan on an appropriate top pan balance and calculate the percentage as follows:

$$\text{Screenings by wt (\%)} = \frac{\text{Screenings Weight}}{\text{Total Weight}} \times 100$$

- Small Foreign Seeds (SFS) are assessed in the bottom tray (catchpan). These may need to be physically removed from all non-SFS material in the bottom tray. Alternatively, to assist in separating SFS from non-SFS material in the bottom tray, a mesh screen may be used. Place the sample over the mesh screen over a white tray and gently shake. SFS tend to remain on top of the mesh screen. Physical hand separation of SFS may still be required using this method.

- Calculate Small Foreign Seeds percentage - Separate any Small Foreign Seeds (SFS) as listed in the Definitions Section of these Standards from the Screenings fraction and weigh these separately.

  $$\text{SFS by wt (\%)} = \frac{\text{SFS Weight}}{\text{Total Weight}} \times 100$$

- Report all results to the nearest 0.1%.

5.11.6 References

No go gauge with Regulation 13 certificate.

5.12 Defective Grains Assessment – Reference Method

5.12.1 Definitions

This describes the method of assessment of deliveries of sorghum for the various types of defective grains described in these sorghum Standards. These are defined as:

Count per 300 grains	% by Weight per half litre sample	Count per entire load
Field Fungi	Bin Burnt, Heat Damaged	All Smuts
Frost Damaged	Storage Mould	
Insect Damaged		
Sappy		
Sprouted		
Total Defective		

5.12.2 Scope

This method is applicable for all deliveries of sorghum.

5.12.3 Apparatus

Wheat Screen 2.00mm with the following specifications:

- 300mm diameter discs x 0.9mm stainless steel, perforated with 12.7mm x 2.00mm slots, hit and miss on ends with 4.77mm end bar and 2.0mm side bar.
- Slot width as assessed by an Engineers Pin Gauge is to be 2.00 mm ± 0.01 mm. Pin Gauge, being 2.01mm and 1.99, needs to have a valid Regulation 13 certificate.
- Compliance testing shall be undertaken by randomly selecting 74 slots and measuring using the above Gauge. 0 to 25 slots is an acceptable failure rate. Refer to separate procedure.

Visual Recognition Standards, with the following photographic standards being recognised by GTA:

- Visual Recognition Standards Guide for Grain Commodity Sampling and Assessment – Issued August 2015, GTA

A 300 grain tray or mechanism capable of holding 300 grains. Alternatively a 100 grain tray.

Analytical balance.

5.12.4 Reagents

Not applicable

5.12.5 Method

- Sample to be “as is”.
- For Defective grains with tolerances based on a % by count in a 300 grain sample, assessment is made on the half litre sample on grain remaining above the 2.00 mm screen after the Screenings assessment has been conducted.

- For nil tolerance defects, the tolerance (rejection of the load) can apply if the defect is detected at any stage of the delivery or testing process, including in the truckload before sampling, in the probe sample, in the half litre sample or during discharge into the receival hopper after assessment.

- Following sieving, the grain remaining on the top screen should be examined under conditions of good lighting for a period of at least 30 seconds but no more than 60 seconds. If defective grains are found, the level of defect shall be determined using a 300 grain tray. Alternatively three samples of 100 grains may be analysed using a 100 grain tray. Instruments of magnification may be used to assist the determination of the level of visually defective grains present in the sample.

- If defective grains which have a tolerance based on % by count in a 300 grain sample are detected, a small sub sample should be drawn from across the top of the screen, and placed on the open 300 grain tray. Surplus grain should be removed from the tray ensuring all 300 holes are filled. The lid should then be slid shut, inverted, and the 300 grains emptied onto the bottom inspection tray.

- Each grain should be examined to determine if it is classified as defective. An individual kernel may only have one defect, being the defect type with the tightest tolerance in the standard.

- For those defective grains with a tolerance based on the % by weight in the entire half litre sample, the entire sample should be reviewed for those defects. Remove these defects and weight separately.

  $$\% \text{ for each defect} = \frac{\text{Weight of each defect type X 100}}{\text{Total Weight of half litre}}$$

- The individual defects percentage or Total Defective grains percentage can be assessed with the assistance of the GTA Approved photographic standards (Visual Recognition Standards Guide) or Approved objective measurement instruments where appropriate.

- Report all applicable results to the nearest 0.1%.

5.12.6 References

Visual Recognition Standards Guide for Grain Commodity Sampling and Assessment – Issued August 2015, GTA

5.13 Contaminants Assessment – Reference Method

5.13.1 Definitions

This describes the method of assessment of deliveries of sorghum for the various types of Contaminants described in these sorghum Standards. The various contaminant types and their assessment methods are described in this method as follows:

Count per half litre	% by weight in half litre	Weight in grams per 2.5 litres	Count per entire load
All Weed Seeds except Type 2, includes Foreign Seed Pods where specified	Foreign Material*	Stones (total above the 2.0mm screen)	Chemicals Not Approved for Sorghum or in Excess of the MRL
Honeydew	Sorghum Ergot		Odour
Insects – Large	Sand/Soil		Cereal Smut
Insects – Small			Cereal Ergot
			Ryegrass Ergot
			Honeydew
			Objectionable Material
			Pickling Compounds or Artificial Colouring
			Stored Grain Insects and Pea Weevil - Live
			Type 2 weed seeds

* May or may not include a contaminant

5.13.2 Scope

This method is applicable for all deliveries of sorghum.

5.13.3 Apparatus

Wheat Screen 2.00mm with the following specifications:

- 300mm diameter discs x 0.9mm stainless steel, perforated with 12.7mm x 2.00mm slots, hit and miss on ends with 4.77mm end bar and 2.0mm side bar.
- Slot width as assessed by an Engineers Pin Gauge is to be 2.00 mm ± 0.01 mm. Pin Gauge, being 2.01mm and 1.99, needs to have a valid Regulation 13 certificate.
- Compliance testing shall be undertaken by randomly selecting 74 slots and measuring using the above Gauge. 0 to 25 slots is an acceptable failure rate. Refer to separate procedure.

Analytical balance accurate to at least 0.01g

Visual Recognition Standards with the following photographic standards being recognised by GTA:

- Visual Recognition Standards Guide for Grain Commodity Sampling and Assessment – Issued August 2015, GTA
- Seed Impurities of Grain Identification Guide, 3rd Edition, GTA
- Insects of Stored Grain, A Pocket Reference, 2nd Edition, CSIRO

A 300 grain tray or mechanism capable of holding 300 grains. Alternatively a 100 grain tray.

Mesh Screen (optional)

Funnel with a 20mm aperture

5.13.4 Reagents

Not applicable.

5.13.5 Method

- Sample to be "as is".
- For contaminants with tolerances above zero, assessment is made on the half litre sample on grain above and below the 2.00 mm screen after the Screenings assessment has been conducted.
- For nil tolerance contaminants, the tolerance (rejection of the load) may apply if the contaminant is detected at any stage of the delivery or testing process, including in the truckload before sampling, in the probe sample, in the half litre sample or during discharge into the receival hopper after assessment.
- Following sieving, the grain remaining on the top and in the bottom screen should be examined under conditions of good lighting. There is no time restriction for this assessment. If contaminants are found, they shall be removed by hand and assessed in accordance with the tolerance prescribed in these Standards under 5.13.1.
- In the case of Honeydew detection, a quick test to determine whether the grain will flow through machinery needs to be conducted. When checking the sample, a half litre of sorghum should run freely through a funnel with a 20mm aperture. Likewise a trailer of sorghum should run freely through the bag chute.
- In the case of Sorghum Ergot detection, for practical reasons, to count the level of contamination, a 100g subsample of the ½ litre should be accurately weighed and carefully checked to remove all Sorghum Ergot which is then weighed as a percentage of the 100g. Alternatively the entire ½ litre sample should be assessed.
- For Sand/Soil, assess these parameters together, using the definition section to determine what material qualifies under this category.
- If any Stones are found above the 2.0mm screen in the initial half litre sample, then a further four half litre samples should be taken. If the total weight of all Stones found in the combined 2.5L sample is above 4.0g, the load is to be rejected.
- Seed contaminants are to be assessed using the appropriate visual assessment method and in accordance with the tolerance prescribed in these Standards. Note that for Type 1 weed seeds, tolerances apply to individual seeds whereas for all other Types listed, tolerances are the total of all seeds in each Type.
- Note that any seed pods detected must not be opened. Whole pods or part thereof are classified as Foreign Material unless tolerances are specified in Foreign Seeds.
- Where depicted, other contaminants should be assessed using the GTA Approved photographic standards. Where reference material is not available, other contaminants should be assessed by reference to the Definitions of those parameters.
- For assessment of Pickling Compounds, Chemicals not Approved for Sorghum or Chemicals in Excess of the MRL, it is recommended that all deliveries are accompanied by a signed declaration referring to its chemical status. Where the receiving agent believes that the visual appearance and/or odour of grain suggests that it has been treated with a non approved chemical, it is recommended the grain is not received until

the representative "as received" sample has been tested by an approved independent laboratory and the presence or absence of non approved chemicals ascertained.

- All material in the half litre sample that is not otherwise listed in the Standards, whether above or below the screen, is to be assessed as Foreign Material. Collect all such material and weigh.

- Report results as follows:

  Count per half litre – nearest whole number

  Percentage by wt in half litre – nearest 0.01%

  Weight in grams in 2.5 litres – nearest 0.1g

5.13.6 References

Visual Recognition Standards Guide for Grain Commodity Sampling and Assessment – Issued August 2015, GTA

Seed Impurities of Grain Identification Guide, 3rd Edition, GTA

Insects of Stored Grain, A Pocket Reference, 2nd Edition, CSIRO

Ute Guide Series, GRDC

5.14 Varietal Declaration Procedure

5.14.1 Definitions

This is the recommended procedure for determining the variety of the load presented for delivery.

5.14.2 Scope

This procedure is applicable to all sorghum deliveries.

5.14.3 Apparatus

Not applicable.

5.14.4 Reagents

Not applicable.

5.14.5 Method

- Driver declares the variety(s) in the load tendered for delivery. It is recommended that the grower sign a Declaration Form and provide this to the driver for provision to the Receival Agent. This Declaration Form should at a minimum contain the grower details and the variety(s) of the load.
- If the declared varietal composition or paddock where the grain was grown is different for each unit tendered for delivery, or more than one variety is commingled in each delivery unit, then a separate assessment of each unit must be conducted.
- Note that depending on the varietal declaration and the procedures of the Receival Agent, a sample of the load may be taken and sent to a laboratory for assessment of the variety within the sample. In this instance sample is to be "as is".
- Report the variety as per the following procedure using the applicable code as defined by the Receival Agent.

<u>Load is Declared as a single permitted Grain Sorghum Red, White or Yellow Variety Only</u>

- Based on the quality results, Grade the load and record the declared variety.

<u>Load is Declared as Multiple Varieties of permitted Grain Sorghum Red, White or Yellow Varieties</u>

- Based on the quality results, Grade the load and record the variety with the greatest percentage in the load.

<u>Load is Declared as Multiple Varieties of permitted and non-permitted Grain Sorghum Red, White or Yellow Varieties</u>

- No matter the percentage of each variety in the load, the load cannot be received as Grain sorghum.

5.14.6 References

Declaration Form, if applicable

5.15 Screen Slot Size Compliance Procedure

5.15.1 Definitions

This is the recommended procedure for determining whether the screen slot size complies with the Standard and relevant legislation.

5.15.2 Scope

This procedure is applicable to all sorghum deliveries and screens used for assessment purposes.

5.15.3 Apparatus

Engineers Pin Gauge, 1.99mm and 2.01mm, with a valid Regulation 13 certificate

Checking template (if available)

Calibration Sticker

5.15.4 Reagents

Not applicable.

5.15.5 Method

- Compliance testing shall be undertaken by randomly selecting 74 slots and measuring using the above Gauge.
- Place screen or disc with the smooth surface up so that it sits horizontally.
- Examine the screen for any damage to the slots. If there is any damage affecting the accuracy of the slots or the screen immediately reject the screen.
- Ensure the screen is labelled with the correct slot/hole size, the commodity that is normally tested on the screen (sorghum) and the screen identification number.
- For screen accuracy, place relevant checking template (testing 74 slots) centred as much as possible (use the handle as a guide) on top of screen and rotate so that all the holes line up. For discs place the disc on top of relevant checking template, rotate disc until all the holes line up then clamp with bulldog clips.
- Select the appropriate GO/NO GO GAUGE for the screen/disk to be tested i.e., for wheat, the wheat gauge 1.99 - 2.01mm.
- Hold the GO/NO GO GAUGE in the middle.
- Place an end of the GO/NO GO GAUGE on the middle of a slot which lines up with a slot on the template so that is perpendicular to the slot.
- Release the GO/NO GO GAUGE. Gauges are not to be pushed through slots.
    - If the GREEN (GO) end does not go through then the slot fails. Record this event and move on to the next slot.
    - If the GREEN (GO) end does go through then the slot size is greater than the nominated size of the GREEN end. Proceed to test the slot with the RED (NO GO) end as follows:

- If the RED (NO GO) end does not go through then the slot size is less than the nominated size of the RED end and greater than the nominated size of the Green End, hence the slot is within the accepted range and passes.
- If the RED (NO GO) end does go through then the slot fails. Record this event and move on to the next slot.

- Proceed to test all 74 slots, recording each failure.
- 0 to 25 slots is an acceptable failure rate.

- If the screen meets the tolerances:
  - Record results on the equipment record
  - Affix the relevant calibration sticker to the side of the sieve (not the catch pan)

5.15.6 References

Not applicable.

SECTION 6 REFERENCE MATERIALS

At the time of publishing this Manual, the following photographic Reference Material referred to in this Manual is considered by GTA to be suitable as an aid to classification of sorghum.

Industry should be aware that all such material is controlled by the author of that material and appropriate copies of that material can be obtained from the author.

The method of printing, copying, storing, using or otherwise obtaining such Reference Material may impact on the appearance of its content. This may impact on the classification of sorghum. Industry should note the method of publication of the material by the author and other relevant information such as version number to ensure they have the appropriate version.

Name of Material	Material Type	Author	Version Number	Applicable Dates
Defective Grains				
Visual Recognition Standards Guide for Grain Commodity Sampling and Assessment	Hardcopy booklet	GTA	n/a	Issued August 2015
Contaminants				
Grain Quality Winter Grain Crops: The Ute Guide	Hardcopy booklet	GRDC	n/a	n/a
Weeds: The Ute Guide	Hardcopy booklet	GRDC	Various editions	n/a
Insects of Stored Grain, A Pocket Reference	Hardcopy booklet	CSIRO	2nd Edition	2007
Visual Recognition Standards Guide for Grain Commodity Sampling and Assessment	Hardcopy booklet	GTA	n/a	Issued August 2015
Seed Impurities of Grain Identification Guide	Hardcopy booklet	GTA	3rd Edition	n/a