Crop Produce Analysts:

Grain Grader

Curriculum Code 684301001

KNOWLEDGE MODULE

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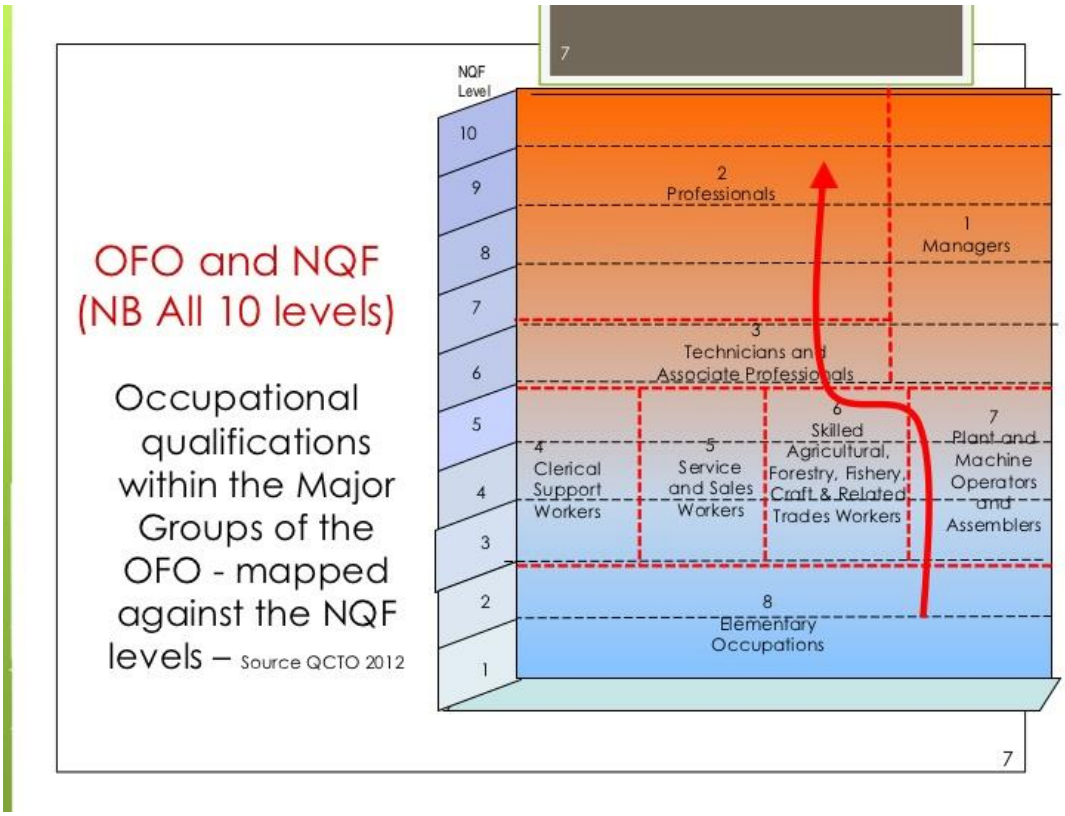
INTRODUCTION

Qualification description

The Department of Higher Education and Training (DHET) published the proposed Qualifications Sub-Frameworks for General and Further Education, and Trades and Occupations in the Government Gazette on 23-12-2011.

The QCTO was established in terms of the Skills Development Act in 2008 to oversee the design, development and quality assurance of qualifications required for the practise of trades and occupations

The sub-framework introduces two types of qualifications to be registered on the OQF. The National Occupational Qualification is the main qualification. It is a full qualification of 120 or more credits, and is associated with a trade, profession or occupation (or specialisation within an occupation). Occupational Awards will be the second type of qualification in the OQF, with a minimum of 25 and maximum of 119 credits. Occupational qualifications will be based on occupations listed in the Organising Framework for Occupations (OFO), and could be on all 10 levels.



Occupational qualifications will be designed to include three different types of unit standards, i.e. knowledge, practical and work experience unit standards. Each type of unit standard must cover a minimum of 20% of the total credits of the qualification, with the remaining 40% allocated according to the need of the particular occupation or occupational specialisation. The knowledge and practical unit standards can be taught and assessed in an integrated way.

All occupational qualifications will be assessed externally through an appropriate nationally standardised integrated summative assessment. The QCTO will issue occupational qualifications to learners who successfully complete these assessments

Each occupational qualification will have an Occupational Curriculum Document that describes:

- Specifications for the three learning components, with internal assessment guidelines for each
- Provider accreditation requirements for knowledge and practical skills components
- Workplace approval requirements for the work experience components
- Foundational learning competence that is a pre-requisite for the awarding of the national occupational qualifications on NQF Levels 3-4 (optional on NQF Levels 1 and 2)

Occupational Curriculum: Grain Grader

This occupational curriculum is aligned to statutory requirements of the Agricultural Products Standards Act, 1990 (Act No 119 of 1990) and associated regulations.
This qualification is associated with the occupational group listed as Skilled Agricultural and Related Trade Workers and is specifically aligned with the unit group Product Graders and Testers (Except Foods and Beverages) (6843) and the occupation Crop Produce Analyst (684301) listed on the OFO. Crop Produce Annalists is a collective grouping of a number of regulatory functions in the South African Agricultural sector and relates to persons qualified to perform these functions including a Grain Grader, Seed Analyst, Seed Unit Inspector and Seed Sampler.

National Occupational Award: Crop Produce Analysts: Grain Grader		**Curriculum Code**	684301001
Associated Occupation	684301	**Crop Produce Analysts**	
Specialisation	684301001	Crop Produce Analysts: Grain Grader	
Grain graders plan and perform grain grading processes during the intake and/or dispatch processes to ensure that grains and oilseeds comply with grading standards and statutory food safety and hygiene requirements.			

Knowledge Modules				
684301001-KM-01	**The collection and grading of representative grain and oilseed samples**		**NQF 3**	**12 credits**
KM-01-KT01	**The Grains and Oilseeds Industries**			
	KT0101	Grains and oilseeds quality properties		
	KT0102	Grains and oilseeds grading principles and regulatory framework		
KM-01-KT02	**Grains and oilseeds sampling**			
	KT0201	Concept and principles of representative grains and oilseeds sampling		
	KT202	Sampling methods and procedures		
KM-01-KT03	**Grains and oilseeds grading**			
	KT0301	Organising and preparing the workplace		
	KT0302	Grading methods and procedures		
Practical Modules				
684301001-PM-01	**Plan and execute grains and oilseeds sampling and grading processes**		**NQF 3**	**16 credits**
PM-01-PS01	**Collect and prepare samples of a grain/oilseed consignment for the grading process**			

	PA0101	Select the appropriate instruments/equipment and personal protective clothing/equipment required for the sampling procedure
	PA0102	Draw the required primary samples of the grain or oilseed consignment
	PA0103	Apply the applicable sample reduction technique to obtain a representative working sample
	PA0104	Present the prepared sample and documentation for the grading process
PM-01-PS02	**Plan and prepare for the grading of a grain/oilseed consignment**	
	PA0201	Determine a sequence of operation and prepare the workplace with the instruments and equipment required for the testing procedures pertaining to the specific grain or oilseed to be analysed.
	PA0202	Select and check the functionality and calibration (where applicable) of the appropriate instruments and test equipment and make adjustments where required.
	PA0203	Select the appropriate personal protective clothing and equipment.
PM-01-PS03	**Analyse and grade the grain/oilseed working sample**	
	PA0301	Determine the moisture content of a working sample using appropriate equipment and record result
	PA0302	Separate grain/oilseed and screenings, defective grain, poisonous seeds, other grain and foreign matter.
	PA0303	Calculate and record screening percentage and identify, calculate and record defects, poisonous seeds, other grain and foreign matter
	PA0304	Prepare falling number sample and determine and record result (where applicable)
	PA0305	Prepare a protein content sample and determine and record result (where applicable)

Work Experience Modules			
684301001-WM-01	**Sampled and graded grains and oilseeds**	**NQF 3**	**24 credits**

WM-01-WE01	**Collect and prepare a grain/oilseed consignment sample for grading**	
	WA0101	Collect the prescribed primary samples of a grain/oilseed consignment
	WA0102	Obtain a working sample and a file sample
	WA0103	Complete the required documentation
WM-01-WE02	**Grade grains and oilseeds**	
	WA0201	Attend to all pre-grading preparation activities in accordance with workplace procedures
	WA0202	Measure, prepare, analyse and grade samples of grains/oilseeds of at least four varieties in accordance with statutory requirements
	WA0203	Maintain grading standards during work pressure situations such as high volumes and borderline deviations
	WA0204	Attend to queries and requests received from line managers and customers on grading standards allocated with confidence
	WA0205	Apply workplace procedures for the retention of file samples
	WA0206	Apply applicable workplace procedures for non-conforming grain or oilseed consignments
	WA0207	Allocate graded consignment to the nominated storage area according to the storage specifications of the workplace
	WA0208	Complete the documentation for receiving, grading and storage allocation according to workplace procedures

PURPOSE OF THE QUALIFICATION

The purpose of this qualification is to prepare a learner to operate as a Crop Produce Analysts: Grain Grader

Grain graders plan and perform grain grading processes during the intake and/or dispatch processes to ensure that grains and oilseeds comply with grading standards and statutory requirements

A qualified learner will be able to:

- Plan and execute grain and oilseed sampling
- Grade grains and oilseeds

ENTRY REQUIREMENTS

NQF Level 1 with Mathematic and Natural Science, or ABET Level 4 with Communication and Mathematical Literacy plus 3 years work experience in a gain handling and grading context

Methodology

Knowledge Modules facilitated in classroom with a knowledge assessment.

Practical Activities in simulated environment with observation sheets

Prescribed workplace activities in a real work environment with logbook

MODULE 1: THE GRAIN AND OILSEEDS INDUSTRY

Learning Outcomes

- List and describe the properties that influence grains and oilseeds quality
- List and explain the physical and chemical quality properties
- Explain the effect of quality properties on biological processes
- Explain intrinsic and induced quality characteristics
- Explain the purpose and types of grains and oilseeds grading standards incorporated in regulation, specifically the regulatory requirements and food hygiene and food safety standards
- Explain the grains and oilseeds quality factors that are part of the grading standard
- Explain the grains and oilseeds quality factors that are not part of the grading standard

Grain Grading in South Africa: An introduction

Grading of grain and seeds is a subject that has roots embedded in a rich history of trial and error. This is not confined to a South African perspective but a global heritage. The grain grading and handling processes are based on a basic principle of supporting the demand and supply of the commodities concerned. To provide background on the grain and oilseeds industry the focus will be on the quality properties of the grains and oilseeds as well as the regulatory framework governing the industry.

THE FOLLOWING GRAIN, OILSEEDS AND LEGUMES WILL BE INCLUDED AS PART OF THE SCOPE OF THIS QUALIFICATION:

Grains		Oilseeds	Legumes
Summer	**Winter**	Sunflower	Dry beans
Maize	Wheat	Soyabean	Lupins
Sorghum	Barley	Groundnuts	Peas
Popcorn	Canola	Canola	Lentils
	Oats		
	Triticale		

In order to fulfil the outcomes of this qualification, the learner Grain Grader must complete the grading standards for MAIZE and WHEAT, and can then choose two additional grain types according to the needs within his/her specific region.

Grain and Oilseed Quality Properties

Oilseeds, as with grains, have individual properties and qualities that are ideal for a specific commercial purpose. The properties for each commodity are stipulated as per heading and are emphasized when the uses for each commodity are highlighted. Trade within the industry facilitates the movement of ownership over the oilseeds and grains between stakeholders.

Grain, oilseed and leguminous seed structure and nutritional quality

Grains

Typical composition of different types of grain with their nutritional values.

	Maize	Sorghum	Bread Wheat
Endosperm	84.0%	85.0%	83.0%
Germ	10.0%	10.0%	3.0%
Bran / pericarp	6.0%	5.0%	14.0%
Total	100.0%	100.0%	100.0%

Nutritional values per 100g (12% moisture)

Factors in %	Maize	Sorghum	Bread Wheat
Fibre	2.8	2.0	2.0
Starch	73.0	70.7	71.0
Protein	9.2	10.4	11.6
Ash	1.2	1.6	1.6
Fat / oil	4.6	3.1	2.0

Oilseeds

Typical composition of oil seeds with their nutritional values.

	Soya
Cotyledons	90.0%
Germ	2.0%
Seed coat / Hull	8.0%
Total	100.0%

Sunflower
Physical characteristics of sunflower seed are composed of a sunflower nucleus covered by a hull / seed coat

Nutritional values per 100g (12% moisture)

Factors in %	Soya	Sunflower
Protein	30.2	24.0
Fat / oil	19.9	47.3
Starch	36.5	19.4
Ash	4.9	4.0
Fibre	9.3	3.8

Leguminous Seeds

Typical composition

There is no specific composition of dry beans other than what the eye can observe. Dry beans consist of two seed lobes which are covered by a test.

Nutritional value per 100g

Factors in %	Dry Beans
Protein	23.0
Fat / oil	2.0
Starch	65.0
Fibre	8.3

Uses for grain, oilseeds and leguminous seed

Grains

Uses for maize

Uses include feed for livestock, human consumption and industrial products.

Livestock feed constitutes a significant factor in the consumption of maize in South Africa. Cattle, pigs and poultry are the primary consumers of maize as animal farming provides meat for human consumer products.

Maize forms part of the human diet as humans are omnivores and consume a combination of meat and vegetable products. Maize as a food source for human consumption include maize meal “pap”, cornflakes, snack food, cooking and brewing (beers and whiskey).
Industrial products manufactured from maize include filler for plastics, packing materials, insulating materials, adhesives, chemicals, explosives, paint, paste, abrasives, dyes, insecticides, pharmaceuticals, organic acids, solvents, rayon, antifreeze, soaps, and many more.

Uses of sorghum

Sorghum is utilized for a variety of functions such as fodder, human consumption and industrial products.
Livestock or animal feed is one use of sorghum that makes this commodity so sought after.
Products produced for human consumption stretches from milled edible product to “pap” known as ‘Maltabella’ and alcoholic beverages such as milk stout.
Industrial products manufactured from sorghum beats down the path of biofuels production.

Uses of wheat

Different types of wheat exist of which each contain certain characteristics for direct consumption or for manufacturing of specific products. It can be concluded that wheat is used for human-and-animal consumption and for the manufacturing of a wide range of industrial products.
Human consumption consists of products manufactured from wheat which includes bread, biscuits and pasta. Alcohol is another product derived from wheat which is used to produce drinkable beverages.
Wheat is utilised for animal feed by mixing the wheat with other grains.
Industrial products are manufactured by processing the raw wheat commodity to produce adhesives, coatings, polymers and resins. The list of industrial products that can be manufactured is nearly endless.

Oilseeds

Uses for soya beans

The areas of use for soya beans are allocated to human consumption, animal feed and industrial products.
Soya beans function as an edible bean for humans after the bean has been processed through cooking in water. Other human consumables derived from soya include soya vegetable oil, soy milk, tofu, soy sauce and textured vegetable protein that serves as ingredient to many meat and dairy products.

Due to the high protein content embedded in soya beans it is an excellent protein supplement in the dietary mix to animal feeds.
Soya oil obtained from the raw commodity has various applications such as biofuels, coatings, binders, foams, sealants, coatings, adhesives, crayons, ink and carpets. Soya oil is also used in electronic devices to transfer heat and functions as an electrical insulation medium.

Uses for sunflower seed
Applications for sunflower seed and derived qualities are for human consumption, animal feed and manufacturing of industrial products.
Vegetable oil for cooking and food preparation is one of the major applications of sunflower seed for human consumption. Snack foods such as granola bars, mixed seeds bread and roasted sunflower for garnishing and dressing are but a few other uses for sunflower seed in the human context.
Unprocessed sunflower seed are utilised as animal feed more specific bird feed. Processed sunflower seed into pellets is applied as a protein supplement to beef and dairy cattle's diet.
Industrial uses for sunflower are biofuels derived from sunflower oil. Sunflower oil is also implemented in the manufacturing of paints and plastics, dyes, lubricants, fabric softeners, soaps and even detergents. Hulls or loose seed coats serves as an alternative fuel source and can also be processed to produce an alternative to wood products. Stems from harvested sunflower can be turned into fertilizer

Leguminous seeds

Uses for dry beans
Dry beans are predominantly used for human consumption. Products include soups, stews, spreads, chips and pasta.

Grains and oilseeds trade

Grains and oilseeds trade

The grain and oilseeds industry, like many other industries, is made up of producers, manufacturers, and final consumers. The grain industry has additional parties in the chain such as grain traders and storage agents not common to other industries. Important stakeholders in the value and supply chain will be briefly discussed.

Producers / farmers

The farmer grows the grain. When the grain is physiologically ripe and the moisture content is low enough for the grain to be stored safely, the crop is harvested. The producer now has the following options:

- he/she can deliver or sell the grain to a storage agent;
- he/she can sell his grain directly to a buyer or grain trader; and/or
- he/she can store his own grain, use it himself or sell it to a buyer or trader when the price has improved.

Grain traders and storage agents

Grain traders

The grain trader acts on behalf of the producers if the two parties come to such an agreement or can act on behalf of its own interests through purchasing the raw commodity from the farmer on which the trader can deliver it immediately to a buyer or, can decide to store the grain at a grain handler to be sold at a later stage.

Storage agent

When delivering grain to a Storage Agent, the following actions must be taken:

1. A representative sample of not less than 10kg must be taken from the consignment.
2. The sample will be reduced by utilising a multiple slot divider to obtain two working samples.
3. One of these samples will be used to determine the moisture content of the consignment.
4. The second sample will be used to determine the quality of the grain.
5. The balance of the sample will be screened to determine the presence of any stones, sand, soil or poisonous seeds in the sample.
6. During sampling, the consignment will be checked for the presence of living grain insects, undesirable substances or odours in or on the consignment.
7. A grade will be awarded to the consignment according to the Grading Regulations.
8. The mass of the consignment will be determined and if the moisture content is above 12.5%, a mass adjustment will be made.
9. The producer will now be remunerated for the grain delivered taking in consideration the mass, moisture and grade awarded to the consignment.
10. When a consignment is accepted for storage, the grader in conjunction with the silo operator, will make the decision where the grain must be tipped. A decision will be made whether the consignment should be cleaned and /or dried.
11. Depending on the grade awarded to the consignment, a decision will be made regarding which silo bin the grain will be transferred into.

12. The silo operator under the auspices of the depot manger, must now ensure that the grain in the silos is stored in such a way that the grain quality will not deteriorate during storage.

To achieve this, certain actions must be taken, namely:

- The silo must be cleaned regularly to prevent contamination of the stored grain.
- Regular silo bin inspections must be conducted, to check for the presence of insects. It is imperative to identify any factors which may influence the quality of the grain negatively such as insect infestation, presence of sour- or any other undesirable odours, water ingress into the silo bins; and
- Placing of rodent bait stations or traps to control rodents in the storage facility.

When a buyer for the grain is found, a decision can be made regarding transportation of the grain. The majority of grain is transported either by road or rail. There are some mills which are fortunate enough to be able to receive grain directly from the storage facility, via a grain conveying system.

- Road transport - trucks are used to transport the grain. This method is quick but expensive.
- Rail transport - Spoornet trucks are being used to transport grain. Availability of suitable wagons is a problem as well as the availability of rail lines at storage facilities and buyers.

Irrespective of the method used, is it the operator's responsibility to ensure that the following actions are adhered to:

- Arrange for trucks to be available when needed.
- Ensure that the truck and tarpaulins used for the transportation, are clean and insect free.
- Ensure that the truck and tarpaulins used are dry.
- Ensure that the outlet valves on the wagons are sealed off properly, when making use of Spoornet wagons.
- Only the prescribed mass must be loaded onto the truck.
- Take a representative sample of the consignment and determine the moisture and grade of the grain of the consignment.
- Ensure that the consignment does not contain undesirable odours, stones, or poisonous seeds exceeding the official allowance.
- When making use of Spoornet wagons, ensure that the top hatches are properly closed and that two truck labels are placed onto the wagons.
- Complete the necessary delivery documentation.

Processors, manufacturers and buyers

Grain (maize) received by the processor, is processed and used as follows:

1. The grain can be milled and used as human consumption. Examples are: maize meal, samp, or maize rice.
   Additionally, the mill can process the grain and supply the product to companies who manufacture “maize pops” and “frito’s”.
   Maize grist’s are used by breweries in the brewing process, to accelerate the process and is also used to manufacture spirits such as “whisky”.

2. The grain can be send to an animal feed mill, where it will be used in various feed mixtures.

3. In addition to the well know primary maize products such as maize meal, stamp and maize grits, the following products are also manufactured from maize:
   - Starch - is used in chemical factories for the manufacturing of plastic, sugars and numerous acids. It is further used as an ingredient during the manufacturing of baking powder, sweets, beer, yeast, in the paper- and textile industries, laundries, foundries, aspirin and other tablets, matches heads and even as raw material in explosives.
   - Dextrin - it has an adhesive property and is used as an adhesive in the packing industry. The gum for labels is made from maize dextrin.
   - Maize syrup - is used in sweets factories, bakeries, jam and in the manufacturing of artificial silk (rayon).
   - Maize sugar (dextrose) - this is an important foodstuff which when ingested, enters the blood stream at once. It is used in numerous foods such as bakery products, preserved foods and energy drinks.
   - Maize steep water - it is used for the manufacturing of antibiotics such as penicillin and Aureomycin.
   - Maize malt - maize is used in some parts of the country to brew traditional beer.

Physical quality properties of grains and oilseeds

Commodities are utilised to produce certain commercial products due to the specific quality properties each commodity possess. The quality properties for each commodity will now be discussed.

MAIZE

From an agricultural point of view, maize is classified in the following three groups:

Group 1 – maize commonly produced and stored by the grain handlers, in silos/grain depots

Dent maize (Zea mays indentata)

The types belonging to this group are easy to identify by the dent or dip at the crest of the kernel. The soft starch of the endosperm extends up to the crest of the kernel, whereas the horny starch is only found at the sides. The dent which ever form it takes, is caused when the soft starch of the endosperm shrinks in drying; and

Flints (Zea mays indurata)

The kernels are round, hard and clearly without any dents on the crest. The white starch is surrounded by the horny endosperm. In some cases, this horny endosperm is a relatively thin layer over the crest, making the lower white endosperm easily visible.

Group 2 – sub species that are normally planted under contract:

Bread maize (Zea mays amylacea) (White above the sieve)

Kernels of bread maize are not easily distinguishable from flint maize, since there is a degree of similarity in the form of the kernel. Bread maize however, has a dull colour and the entire endosperm consists of soft starch;

Sweet corn (Zea mays saccharata) (White or yellow above the sieve)

The kernels of sweet corn are easily distinguishable on account of their transparent- and shrivelled appearance;

Popcorn (Zea mays everta) (White or yellow below the sieve)

Popcorn has small-, round- and flinty kernels. The white- and yellow kernels look the same, but there is a slight colour difference;

Waxy maize (Zea mays ceratina) (White or yellow above the sieve)

Kernels of waxy maize are not easily distinguishable from dent maize, since there is a degree of similarity in the form of the kernels. Waxy maize however, has a waxy appearance. To distinguish waxy maize from other classes, a small cut should be made on the crest of the kernel and the kernel immersed in an 0,1% iodine solution. The kernel will be coloured brown, whereas ordinary maize assumes a blue colour; and

Group 3 – lesser known varieties such as:

dwarf-, dog-, pubescent- and striped maize.

WHEAT

The classification of wheat serves as indication of the quality and commercial purpose thereof. Three classes of wheat are identified:

Class B wheat is wheat with good baking properties,
Class C wheat is wheat with poor baking properties suitable for biscuit baking, and
Class D wheat is durum wheat for the manufacture of pasta products.

SUNFLOWER

There are two classes of sunflower namely:

Class FH It consists mainly of sunflower seed with a high oil content, and
Class FS it consists mainly of sunflower with a low oil content and is used as bird feed.

SORGHUM

There are three classes of sorghum namely:

GM malt class sorghum which is mainly used for malting purposes;
GL low tannin sorghum mainly used for food and animal feed, and
GH high tannin sorghum mainly used for commercial manufacture of sorghum beer.

SOYA

Soya beans means the threshed seeds of the plant Glycine Max, and is classified as class SB.

DRY BEANS

There are three types of beans that are currently referred to as dry beans namely:

Phaseolus acutifolius A Gray	Tepary beans
Phaseolus coccineus L.	Large white kidney beans, and
Phaseolus vulgaris L.	Dry beans including garden beans.

The effect of quality properties on biological processes

The quality of the product is very important because it will have a great influence on biological processes for example the quality of maize would influence the milling system. It would be impossible for a miller to make Super maize meal if the quality of the raw material does not conform to a grade WM1 standard. Naturally dried maize will give superior milling results to artificial dried maize. Maize stored for a long period would negatively influence the quality of maize products due to the migration of the fat content into the endosperm.

The quality of wheat specifically related to protein, falling number and grading factors result in poor baking properties.

The oil content of sunflower and soya beans is significant in the monetary value of the product. Damage sunflower or soya beans would negatively influence the quality of the end product.

Grains and oilseeds grading principles and regulatory framework

The grain industry is a longstanding trading market that entertained the economic principle for a number of decades. Through passed years' procedures developed to address the motions of purchasing pared with selling of grains and oilseeds. Grading principles form part of these procedures and are discussed sufficiently in the sections to follow.

A regulatory framework came to existence which governs all aspects of the grain industry due to the central role the industry portrays in human consumption products. Grading principles and food safety are factors governed by regulation to ensure fair trade and that quality

standards of the commodities are met and maintained. The necessity of grading is highlighted in the regulatory framework.

Grain, oilseed and dry bean grading principles

A representative sample of the consignment grain, oil seed or dry beans, must be sensorially assessed or chemical analysed, to determine that it does not contain:

- a sour-, musty- or other objectionable odour; and
- in case of wheat an un sifted working sample may be grinded to a fine meal with a mill, in order to determine the abovementioned determination;
- grain, oil seed or dry beans contaminated with a hazardous substance rendering it unfit for human- or animal consumption, and
- comply with the standard set out in the: **Act on Foodstuffs, Cosmetics and Disinfectants 1972 (Act 54 of 1972)**

Regulatory requirements and food hygiene and food safety standards

The grading of grain, oilseeds and dry beans is regulated by the by the **Agriculture Product Standard Act 1990 (Act 119 of 1990) and the Act on Foodstuff, Cosmetics and Disinfectants Act 1972 (Act 54 of 1972)**

- The grading of maize is stipulated in Government Gazette No R473 of 08/05/2009
- The grading of sorghum is stipulated in GOVERNMENT GAZETTE NO R 15 OF 08/01/2016
- The grading of wheat is stipulated in Government Gazette NO R 64 of 29/01/2016
- The grading of sunflower is stipulated in GOVERNMENT GAZETTE NO R45 of 22/01/2016
- The grading of soya beans is stipulated in Government Gazette NO R478 OF 20/06/2014,
- The grading of dry beans is stipulated in Government Gazette NO R112 of 14/02/2014

Standards incorporated in the regulations

Notwithstanding the provisions of Sub Regulations, all consignments of grain, oilseeds and dry beans must:

- be free from any toxin, chemical or other substances that renders it unsuitable for human consumption or for processing into or utilisation thereof as food or feed;
- may not exceed the permissible deviations regarding aflatoxin in terms of the Foodstuffs, Cosmetics and Disinfectants Act 1972 (Act No. 54 of 1972);

"aflatoxin" – maximum of 10 microgram aflatoxin per kilogram, of which aflatoxin B1 should not exceed 5 micrograms per kilogram;

- poisonous seeds should not exceed the tolerance as prescribed in Regulation R1225 of 04/10/2002 of the Act on Foodstuffs, Cosmetics and Disinfectants 1972 (Act 54 of 1972);
- ergot sclerotia - does not exceed the tolerance of 0.02% in a 5 kg sample of wheat;
- be free from organisms of phytosanitary importance as determined in terms of the Agricultural Pest Act, 1983 (Act No. 36 of 1983);
- be free from mould infected, sour and rancid other grain, foreign matter and any other matter;
- be free from any sour, musty or any other undesired odour;
- be free of animal matter;
- be free from insects;
- be free from stinking smut infection where applicable; and
- have a moisture content not exceeding the prescribed limit for each grain, oilseeds and dry beans.

Grading factors for various grains, oilseeds and dry beans

The grading factors for each grain, oilseeds and dry beans are as follows:

Maize:	Defective kernels
	Foreign matter
	Other colour
Sorghum:	Defective kernels
	Foreign matter
	Unthreshed kernels
	Small kernels
	Other sorghum
	White sorghum
	Weather stained sorghum
Wheat:	Damaged wheat
	Heat damaged wheat
	Heavily frost-damaged wheat
	Field fungi infected wheat
	Foreign matter

	Other grain and unthreshed ears
	Storage fungi infected wheat
	Gravel, stones, turf and glass
	Screenings
	Hectolitre mass
	Protein
	Falling number
Sunflower:	Damage sunflower
	Foreign matter
	Screenings
	Sclerotini
Soya beans:	Wet pods
	Foreign matter
	Sunflower seeds
	Other grain
	Stones
	Sclerotinia
	Defective above the 4.75 mm sieve
	Defective below the 4.75 mm sieve
	Soiled soya beans
Dry beans:	Foreign matter
	Stones and sand
	Defective dry beans
	Broken or split dry beans
	Not true to type dry beans (not applicable to type mixed dry beans)
	Dry beans with a broken testa
	Dry beans with a wrinkled or cracked testa

The necessity for grain, oilseeds and dry bean grading

The grading of grain is essential since prices for the product are determined by quality.
Apart from this, there are also other very important advantages inherent in a grading or standardization system, namely:

- It serves as an incentive to the producer to produce grain of good quality, as he is compensated in accordance with the standard quality of grain;
- It serves as a basis for the orderly marketing of grain;

- It promotes trade and financing because a specific class, subclass and grade are a guarantee of a specific quality;
- It assists prospective buyers in obtaining the specific standard or quality of product they desire;
- it lays down a standard which is understood by local- as well as international grain traders;
- it eliminates the necessity of contracts between buyer and seller;
- it eliminates the red tape and the time wasting procedure of buying on sample;
- the Grading Regulations are based to some extent on the commercial requirements, to which grain must conform for a certain purpose; and
- It simplifies the bulk handling, storage and management of the grain.

Module 2: GRAINS AND OILSEEDS SAMPLING

Learning outcomes

- Define the concept and principles of representative sampling in terms of grading standards and practical workplace procedures (including, the need for sampling, composite primary representative sample, working sample sizes for various grains and oilseeds)
- Describe the sampling tools, method and procedure for obtaining primary samples from bagged grains and oilseeds
- Describe the equipment, method and procedure for sampling bulk grains and oilseeds
- Describe the method and procedure for sampling moving grains and oilseeds
- Describe the equipment and procedure for sample reduction
- Explain the possible consequences of not following the correct sampling procedures
- Explain the need to use sampling equipment according to quality, safety and workplace procedures
- List and explain sampling documentation and record keeping during grain sampling procedures

Concept and principles of representative grains and oilseeds sampling

Determining the quality of a consignment of grain, oilseed or leguminous seed is vital for decision making on all levels of the industry. These decisions will affect the immediate parties involved in the purchase and sale agreement as well as other parties further down in the distribution channel.

Quality aspects in the operational levels of manufacturing give indication whether the raw commodity can be used to produce the final product which must conform to certain quality and nutritional values. Example would be a consignment of maize procured to manufacture maize meal. If the quality of the consignment does not conform to the requirements for the purpose of use the consignment will be rejected and forced to follow a new route which will affect a new chain of event in terms of logistics and actions.

Out of a financial perspective the decision will affect the price that the purchaser will pay and the corresponding price the producer of the consignment will receive. The logic rings clear that the higher the quality, the higher the price of the consignment.

The need for sampling

As the first step in the grading process sampling's primary function is to enable a grader to determine the quality of the consignment of grain, oilseed or leguminous seed. Why is this so important? Quality is a measure of use of the commodity. Thus through sampling a representative sample is obtained from the consignment which will be analysed to determine the quality.

In the context of quality, sampling enables the grader to determine the presence of unwanted materials in the consignment such as glass, metal, coal, dung and stones. Insect content present in the consignment can also be detected. Quality further entails the determination of the moisture content of the commodity for either storage or processing of the grain, oilseed of leguminous seed. The consignment must also be inspected for poisonous or noxious seeds done through the analysis of the representative sample obtained through sampling.

A factor sharing importance of quality with regards to sampling is price. With the quality known a price can be allocated to the commodity usually per ton. The logic is simplistic in that the higher the quality the higher the price.

Sampling can also be implemented as verifying factor between two parties of a contract. Verifying through sampling the consignment's quality can be determined ensuring that the

commodity does comply with the contractual requirements and thus binding the price that needs to be paid for the delivery.

Thus to summarise the need of sampling, it produces a representative sample which will be analysed to determine the quality and the price of the consignment. Furthermore, sampling functions as a verifier based on contractual essentialia and naturalia.

Principles of representative sampling

The primary function of sampling is to obtain a representative sample from the consignment in order to determine the quality.

It must be emphasised that sampling is not a stand-alone procedure but is an integral part of the entire grading process. If the sampling procedure is done incorrectly the final grade will correspondingly be incorrect.

Determining the correct grade of the grains, oilseeds or leguminous seeds each step of the grading process must be based on strict accuracy. The best grader in the world can only grade what he or she has in front of him or her on the grading table. The first step of utmost accuracy is the sampling process.

Basic characteristics of sampling can be listed as follows:

- **Representative**

The sample must be representative of the consignment at hand. Thus the sample cannot be drawn from one consignment and labelled as another.

- **Objective**

The sample must be impartial as it is drawn at random places in the consignment in order to not be biased.

- **Sufficient**

The representative sample must be of sufficient size. If the sample is too small or too big the accuracy and objectivity of the sample is lost. It is therefore important that the sample is the correct weight as prescribed by the regulation.

- **Accurate**

The sample obtained must be as accurate as possible as this will affect the final grade determined through the grading process.

It must be emphasised that the sampling of the consignment in order to obtain an accurate, sufficient, objective and representative sample is extremely important in the determination of the correct final grade of the grain, oilseed or leguminous consignment.

Composite primary representative sample

A representative sample obtained through the sampling process must conform to or represent the consignment at hand. This means that the representative sample must be mass per mass made up of the same composition as that of the consignment from which it was drawn. To better understand this concept, let us define a consignment:

> *It is a quantity of grain, oil seed or dry beans of the same class, which belongs to the same owner, delivered at any one time under cover of the same consignment note, delivery note or receipt note or delivered by the same vehicle or bulk container, or loaded from the same bin of a grain elevator or from a ship's hold; or*
>
> *In the case where a quantity referred to in above mentioned paragraph, is subdivided into different grades - each such quality of the different grades.*

The consignment consists of all material present in the container including the commodity and all unwanted material (glass, metal, coal, dung and poisonous seeds) which must be present in the representative sample drawn from that consignment.

Working sample size for various grains and oilseeds

The various representative sample sizes for grains, oilseeds and dry beans and their working sample sizes are tabulated below. These weights are based on the regulations governing the grading processes and procedures of South Africa.

GRAINS	REPRESENTATIVE SAMPLE	WORKING SAMPLE
Maize	10kg	150g
Sorghum	10kg	100g
Wheat	10kg	500g

OILSEEDS	REPRESENTATIVE SAMPLE	WORKING SAMPLE
Soya Beans	10kg	100g
Sunflower Seed	5kg	100g

DRY BEANS	REPRESENTATIVE SAMPLE	WORKING SAMPLE
Dry Beans	10kg	100g

Sampling methods and procedures

In order to obtain a representative sample, the grader will require the necessary equipment to fulfil the sampling task effectively. Each form of transport of the commodity will require a unique set of instruments in order to obtain the representative sample from that consignment. Other than that the grader must take her / his immediate environment into consideration. The sampler / grader will be subject to various different circumstances and situations that can inflict injury or death from which the grader must be protected.

Before the method of sampling can be explained or implemented it is vital to understand the different forms or methods of transport of a consignment of a specific commodity. The method of transport is also different from commodity to commodity and must be recognised as well. The forms of transport for grains and oilseeds are very similar due to corresponding characteristics. Leguminous seeds are transported in methods different from that of grain and oilseed and will be distinguished in this section.

Grains and oilseeds are transported through two industry-wide methods being bulk and bag transport.

Bulk transport is a form of transport where the grain or oilseed is moved from the supplier to the purchaser in large volume in sizable containers such as road truck trailers and railway trucks. Consignment weights run into tons.

Bags are a mode of transport in which the commodity is packed into similar weighted containers or bags. The number of bags in the consignment will be determined by the mode of transport or the order of the purchaser. The consignments also run into tons but the consignment is compiled by a number of bags varying from 25kg to 70kg individually.
Bags can also be implemented as bulk due to one-ton bag capacities.
Bags individually are easier to handle than bulk where on the other hand bulk consignments are easier to load and offload.

With a better understanding of the different modes of transport utilised to convey a consignment from one point to another the corresponding sampling method can now be addressed.

Selection and safe handling of sampling tools, instruments and equipment

The equipment required for different types of consignments are as follows:

TRANSPORT METHOD	EQUIPMENT
Bulk static consignment	Double tube grain probe
Bulk offloading stream	Bucket
Bag consignments	Bag probe
Bulk bags	Double tube grain probe

Bucket

Bucket on scale

Rolsif (giftige sade)

Monsterneem apparaat (elektries)

Monsterneem apparaat (hand)

Monster verdeler

Procedure and equipment for sampling bulk grains and oilseeds

Bulk sampling can occur in one of two methods. Firstly, the grain is static in a bulk container and the sample is drawn with a suitable bulk sampling apparatus into the entire depth of the commodity in the consignment. Second method of bulk sampling is the instance where the commodity is being offloaded or moving from the bulk container into the collection hopper and then taking a sample with a bucket drawing from the consignment as it flows in bulk with regular intervals through the entire stream. The sampling methods will now be discussed in detail.

STATIC CONSIGNMENT IN BULK CONTAINER

Using a bulk sampling apparatus, sample the consignment throughout the whole depth of the consignment in at least six different places chosen at random, in the bulk quantity to the bottom of the truck in order to sample the cross section of the consignment. Deposit the contents of the sampling apparatus in a suitable container. The minimum mass of the representative sample must be as follows:

- grain, soya beans and dry beans - 10 kg; and
- sunflower - 5 kg

The sample should be thoroughly mixed, before it is divided.

SAMPLES TAKEN WHEN DISCHARGING A CONSIGNMENT / MOVING CONSIGNMENT

If, after the discharge of a consignment in bulk has commenced and it is suspected that the consignment could be of a class or grade other than determined by means of the initial sampling, the discharge must immediately be stopped and the part of the consignment remaining in the bulk container, as well as the part that is already in the collecting hopper (on condition that no other grain, oil seed or dry beans were present in the hopper) shall be sampled anew.

In the case where a bulk sampling apparatus cannot be used, or if it is suspected that a representative sample cannot be taken in such a way, the sample can be obtained as follows:

Use a suitable container and obtain at least twenty samples taken at regular intervals throughout the discharge period from the stream of grain, oil seed or dry beans that is flowing in bulk, whilst the consignment is off loading. Deposit the contents of the sampling apparatus in a suitable container.

The minimum mass of the representative sample must be as follows:

- grain, soya beans and dry beans - 10 kg; and
- sunflower - 5 kg.

The sample should be thoroughly mixed before it is divided.

Procedure and equipment for obtaining primary samples from bagged grain, oilseed and dry beans.

Number of bags to be sampled:
If a consignment of grain, oil seed or dry beans consists of 25 bags or less, a sample must be drawn from each bag.
Where a consignment of grain, oil seed or dry beans consists of more than 25 bags, samples must be drawn from 10 % of the consignment, provided that at least 25 bags are sampled.

In the case of dry beans in bulk quantities (Bags containing more than 10 kg);
Sample each bag in that consignment with a bag probe as stipulated if the consignment consists of 100 bags or less; or
Sample at least 50% of the bags in the consignment chosen at random, provided that a minimum of 100 bags are sampled.

Apparatus and method:

Use a suitable bag probe with a length of approximately 500 mm, of which the diameter should be 22 mm;
Samples must be taken to determine the point in the middle of the face of the bag, to be sampled;
The probe must be horizontally inserted at this determined point into the center of the depth of the bag;
Endeavor to obtain equal quantities from each bag; and
Deposit the contents of the sampling apparatus into a suitable container.
The minimum mass of the representative sample must be as follows:

- grain, soya beans or dry beans - 10 kg; and
- sunflower - 5 kg

The sample should be thoroughly mixed, before it is divided.

Sampling dry bean in retail quantities

In the case of dry beans in retail quantities packed in containers:

Randomly taking from the number of containers concerned, at least the applicable number of containers as indicated:

Number of containers in the consignment	Number of containers to be selected at random
Less than 10 containers	2
Between 10 to 50 containers	4
More than 50 containers	6

Sampling such containers by hand provided that the contents per container is 1 kg or less, the total contents of the containers chosen will be taken as a sample.

In the case of dry beans in retail quantities that are kept for sale in loose quantities, obtain a sample by hand.

Sampling of a consignment by hand shall be done as follows:

- Open the containers in the consignment that have to be sampled.
- Insert the open hand into the container or loose quantity concerned, close the hand into a fist and withdraw it evenly.
- Place the contents of your hand in a container or suitable collecting tray.
- Repeat the procedure as described alternately at various depths in the containers or loose quantities concerned.
- Take more or less equal quantities from each container that is sampled.
- Thoroughly mix the material obtained and divide the sample to a mass of at least 1 kg.

Sampling if contents differ:

If, after an examination of the grain or oil seed taken from different bags in a consignment it appears that the contents of those bags differ substantially, namely:

- the bags concerned, must be separated by sampling each bag in the consignment in order to do such separation; and
- each group of bags with a similar content in that consignment, must for the purpose of these Regulations, be deemed to be of a separate consignment.

If it is suspected that the sample referred to is not representative of that of the consignment, an additional 5 % of the remaining bags chosen from that consignment at random, must be emptied into a suitable bulk container and sampled in the manner previously described.

If no differences in grade are apparent:

If all the grain in a consignment appears to be of the same grade, the samples drawn from different bags will be placed in a basin or bucket and should be thoroughly mixed.

Suggested use of the double tube probe and other bulk sampling apparatus during the sampling of Spoornet rail trucks:

Although the following procedures are not described in the current Government Gazette, it is worldwide accepted to obtain representative samples.

1. use a bulk sampling apparatus of suitable length (must be able to reach the bottom of the rail truck);
2. take at least 2 (two) samples from each hatch (hatches on top of each rail truck);
3. in the case of a double tube sampler, it must be ensured that the apertures are closed before insertion into the consignment;
4. the bulk sampling apparatus should be inserted, cross-wise in the length of the truck, into each hatch at an angle of 10º to the vertical line, to the bottom of the truck, (in order to sample the cross section of the consignment;
5. in the case of a double tube probe, the apparatus must be opened and the probe lightly shaken to allow the grain, oil seed or dry beans to fill the probe. Close the probe and remove the probe from the consignment;
6. deposit the contents of the sampling apparatus into a suitable container; and
7. the minimum mass of the representative sample, must be as follows
   - grain soya beans and dry beans - 10 kg; and
   - sunflower - 5 kg

The sample should thoroughly be mixed, before it is divided.

Sample-reduction procedures and equipment

After the primary representative sample has been obtained through sampling the sample must be reduced to a working or grading sample for grading purposes. The grading factors for each grain, oilseed and dry bean will be analysed through the grading of the working sample in order to establish the quality.

The reduction of the representative sample to a working sample is a direct instruction stipulated in the regulation. The working sample shall be obtained by dividing a representative sample of the consignment according to the ICC 101 (approved 1960) method.

The sample may be divided by using the following apparatus:

- Multiple slot divider; and
- Boerner divider.

The multiple slot divider has the following characteristics:

It consists of a dividing apparatus and three hoppers. The dividing apparatus must have at least twelve slots with a width of between 25 mm and 30 mm and not less than 100 mm in length. Every successive slot must empty in the opposite direction. The divisions between slots must not be more than 3 mm thick. At the top, the group of slots must be surrounded by a wall, high enough to prevent grain, oil seed or dry beans from overflowing, when a sample is poured into the container for division. The construction of the apparatus must have legs of sufficient length to enable grain, oil seed or dry beans to fall freely into any of the two hoppers, placed underneath the opposite outlet slots. The dimensions of the hoppers must be such that all grain, oil seed or dry beans from the outlet slots, are collected in the hoppers.

The representative sample is poured through the divider and one portion caught at the outlet of one of the group of outlet-slots will repeatedly be poured through the divider until the required weight of the working sample is obtained.

Decanter the representative sample into one of the hoppers. This is considered to be a mixing action before division of the sample. Under no circumstances should the bag or bucket containing the representative sample, be used to decanter the sample directly into the multiple slot divider. Where grain, oil seed or dry beans are de-cantered directly from a bag or bucket, segregation of the sample will take place, which will influence the representativeness of the samples negatively. In the case where triangular- or square buckets are used, care should be taken to ensure that the dimensions of the bucket correspond with those of the multiple slot divider.

Sampling documentation and record keeping

It is imperative that the representative sample be weighed after sampling. This gives indication that the representative sample weight is according to the regulated weight and creates more accurate result in terms of poisonous seeds detection.

Recordkeeping of the sampling process and results is necessary for reference purposes as well as grading. Proper recordkeeping must be maintained and adhered to ensure sustainable sampling and grading operations.

The sampling information is usually captured on the grading certificate with all other grading findings. This facilitates the ease of use of the information gathered onto one standard document.

Module 3: GRAINS AND OILSEEDS GRADING

Learning outcomes

- Describe a range of actions to determine the grade for wheat, white maize, yellow maize, sorghum, soya beans, sunflower-seed and dry-beans
- Explain the different stored product insect pests and how to identify them
- Explain the primary causes of grain deterioration
- Apply technical judgement to identify and solve problems when defects or other anomalies are detected
- List and explain the method and equipment used for the following:
    - separation and calculation of screenings;
    - preparation of a falling number sample and determination of the falling number (where applicable);
    - preparation of a protein content sample and determination of the protein content (where applicable);
    - preparation of a hectolitre mass sample and the determination of the hectolitre mass (where applicable);
- Explain the identification and calculation of deviations from set grading standards
- List and describe the measuring instruments/equipment needed and the methods used for the determination of moisture content
- List and explain the necessary grading documentation and the record keeping processes for completed documentation

Worksite preparation and organisation

Grading, as with many other factor in life, require some form of preparation before the activity can commence.

Preparing the workplace prior to grading will include:

- Wipe and clean the grading surfaces as grains, oilseeds, dry beans and other obstacles can contaminate the sample that will be graded;
- The floor must be swept clean as loose grains, oilseeds, dry beans and other materials can cause the grader to lose his or her footing;
- Remove all apparatus that would not be used in the grading process;
- Ensure that all grading apparatus needed to grade the product is on hand and in good working order;
- Ensure that the grading equipment is cleaned prior to the grading as unclean equipment can affect the accuracy of the sample being graded; and
- Ensure that the grading surface is equipped with proper lights to illuminate the grading surface.

Preparing the workplace after the completion of the grading process:

- Collect the graded sample and remove it from the grading area;
- Clean the grading equipment and surface;
- Keeping the grading office clean; and
- Store the grading equipment safely away in their designated storage space.

Personal Protective Equipment

Grading is a process that takes place at a facility where the grader is subjected to potentially hazardous instances. From the first step of sampling up and to the disposal of the grading sample, the grader encounters situations that can cause bodily harm. The grader must allocate and use the appropriate personal protective equipment (PPE) when the grading is being executed as the use of safety equipment can prevent injury or death.

Listed below is some safety equipment that can be used. Please note that the all safety equipment applicable in certain circumstances is regulated by the **OCCUPATIONAL HEALTH AND SAFETY ACT** - (ACT No.85 of 1993).

The **employer must supply** the safety equipment as specified. **It is not up to the employee if he wants to wear this safety equipment or not.**

He is legally obliged to wear the safety equipment and if he fails to do so may be immediately dismissed from his work.

Suggested personal safety equipment:

- Hard hat
- Safety glasses
- Ear protection
- Dust mask (Equipped with a P3 canister)
- Reflector vest
- Overall
- Safety shoes
- Gloves

General overview of safety in the workplace

It is essential for employers to discuss and identify potential dangerous situations and or areas that might occur in the workplace.
It is essential that employees understand these hazards and what the consequences will be if he does not comply with these safety precautions.

Possible dangerous work procedures and the consequences thereof

- Sampling - person can fall of truck or wagon.
- Opening the flaps on road trucks - when opening a flap whilst under pressure, can lead to serious injury;
- Discharge of grain - person can be smothered by the grain;
- Removal of safety grids on silo inlets - person can fall through;
- Entering of silo bins - person can slip on slick surfaces; there may be a shortage of oxygen; and/or there may be other harmful gasses present;
- Open conveying systems - person can get caught on a moving belt;
- Moving machinery - dangerous for people working in the area;
- Moving of wagons - dangerous for any person in area;
- Moving vehicles during loading - persons can slip and fall; and
- Use of dangerous fumigation gasses - persons might be exposed to lethal concentrations.

Identifying basic safety procedures in the workplace

- It is compulsory to wear head protection before entering a grain silo. There is always the possibility of falling objects. When struck on the head by a falling object without head protection, may cause serious injury or death.

- It is compulsory to wear hearing protection when entering a silo. All grain silos are classified as a noise area, therefore hearing protection must be worn to prevent injury to your hearing.
- Safety harnesses must be worn when entering a silo bin or when climbing onto unprotected surfaces, such as railway trucks or outside normal areas. The floor of the silo bins is always slippery, due to grain and dust on the concrete. The surface on top of Spoornet wagons is extremely slippery when wet and the possibility of slipping is very high.
- The donning of PPE's such as gas masks and gloves is of the utmost of importance when handling fumigants and insecticides.
- These substances are highly toxic for man and beast. Unprotected exposure can influence your health and may lead to death. In some cases, death may occur immediately or you can become sick over a period of time and death may then occur.

Basic application of safety regulations

The application of basic safety regulations makes provision for the uninformed, as well as old hands in the workplace to adhere to the safety regulations.

There are mainly three institutions which describe safety regulations, namely:

- Act 36 of 1947 requires that everyone who handle formulations which are classified as poison group 1A and 1B, must be trained. During training, candidates are informed of the type of chemicals used in grain storage and the processing facilities. The candidate learns the characteristics of these substances, the safe handling and usage of these products and the symptoms of poisoning if someone indivertibly comes in contact with or, is exposed to these toxins.
- Act 85 of 1993 makes provision so that all people who may come in contact knowing or unknowing, or might be exposed to these substances, must be informed as to what health risks are involved when exposed to these toxic substances. The Act makes provision for gas monitoring in the workplace as well as management's responsibility to ensure that safe working procedures are implemented and that all necessary PPE's required for a worker to conduct his work safely, are supplied and worn.
- The SABS fumigation codes are written to empower persons who handle these chemicals with safe work procedures as well as the procedures to store- and transport the chemicals safely.

Identifying dangerous chemicals and/or substances and the appropriate safety measures which must be adhered to in the work place

- **Grain dust:**

Grain dust is extremely dangerous in the sense that it can impair your health if work is conducted in a dusty environment without the necessary respiratory protection.
Grain dust is so fine, that it may accumulate in the lungs during inhalation.
Grain dust can ignite in certain conditions. The fire burn so quickly that it occurs in the form of an explosion. These explosions are so powerful that numerous grain processing as well as storage facilities were destroyed, normally with loss of human life. The following safety regulations must be adhered to when persons have to work where grain dust may be present:

Personal safety:
Persons must be equipped with a dust mask fitted with a P3 filter canister or equivalent. The use of normal paper masks does not provide sufficient protection.

Artisans:
Prior to anyone permitted to do any welding or cutting, irrespective whether it is with a saw, grinder or gas flame, a hot work permit must be issued, provided that the area in which the work will be performed is clean and free of grain dust. Care should be taken that no sparks or pieces of hot metal can fall into the silo bin or conveying system.

In order to prevent dust explosions, all personnel must be informed regarding the possible causes of a dust explosion. Videos showing actual dust explosions, how it is started and what the consequences could be must be shown to all personnel.

All personnel must adhere to the no smoking areas. If a person disregards these warnings, it must be seen in a very serious light and handled accordingly. Smoking in prohibited places can cause great financial losses and places his own and other people's life's in jeopardy.

- **Chemicals used in the workplace**

Contact insecticides and or fumigants:
Remember that not all the compounds are necessarily suitable for use on/or in the vicinity of all stored products.
It is compulsory that all personnel who may come in contact with these chemicals or who may be exposed to them during the execution of their work be trained in the safe use of such chemicals.
It is further compulsory that management must indicate all possible places and areas where

workers may come in contact with, or be exposed to harmful chemicals, whether the exposure may be accidental and/or during the execution of their normal duties. The safety risks of coming in contact with/or being exposed to the chemicals, as well as the health risk it holds for personnel in the long term, must be explained to these employees.

Training:
All employees must be trained by a qualified person/institution. Employees attending such a session must sign an attendance register which is placed in a safe place by the employee.

When an employee is required to work with such chemicals, he must be issued and have in possession the following safety equipment:

- Gasmask equipped with a P3 filter canister or equal;
- Face-, head-, body protection and gloves.

The safety measures to follow during the application of a contact insecticide are as follows:

- use rubber gloves when dispensing or measuring the concentrate. It must be done in such a way that all vapours are blown away from you. Use the gloves during application to prevent mixture from contaminating your hands;
- spillages of concentrates on the skin must be washed immediately with soap and copious amounts of cold water. Spillages of the mixture must be washed off as soon as possible;
- wear overalls or clothes which covers the majority of the body. Change into a clean overall or clothing daily, to prevent accumulation of toxins on the clothes which may contaminate your body;
- avoid the spray mist during application;
- wear applicable dust masks to prevent inhalation of the spray mist;
- do not smoke, eat or drink during spraying. If you need to smoke, eat or drink during a break, you need to wash your hands and face and move away from the treated area;
- never carry any tobacco or food in your overall, as it can easily be contaminated with fumigants and insecticides;
- wash directly after completion of the day's activities; and
- dress in clean clothes.

Calibration of equipment

By law all grading equipment must be calibrated.

Legal actions can be instated against an organisation for charges of fraud if the equipment utilised are not calibrated

Gradering sif

Vogtoets apparaat


Grading scale

The following equipment is used in various grading procedures:

Scale	That is capable of determining the representative samples mass. The scale must be capable of determining mass of at least 15kg sample;
Scale	Grading scale needed to determine the mass of at least 1kg sample with a one decimal accuracy (0.1g);
Scale	When determining falling number the scale must be capable of determining a samples mass with a two decimal accuracy (0.01g)
Moisture meter	The moisture contents of a consignment of grain, oil seed or dry beans may be determined according to any suitable method, provided that the results thus obtained, are in accordance with the maximum permitted deviation for a class 1 moisture meter as detailed in ISO 7700/2, based on the results obtained by means of the 72 hour 103° C oven dried

	method. The method referred to is the (AACC Method 44-15A/1981).
Protein meter	The percentage of protein of a consignment of wheat may be determined according to any suitable method, provided that the results thus obtained are in accordance (± 0,3 %) with the results obtained by the Dumas Combustion Analysis Method [AACC ("American Association of Cereal Chemists") Method 46-30].
Hectolitre mass	The hectolitre mass of a consignment of wheat may be determined by any suitable instrument, provided that the instrument complies with the specifications detailed in ISO (International Organization for Standards) 7971-3.
Falling number,	The falling/stirring number of a consignment of wheat may be determined according to any suitable method provided that: the results thus obtained are in accordance (± 5 present) with the results obtained by the ICC (International Association for Cereal Science and Technology) Standard No 107/1 method.
Grading sieves	6.35mm (± 0.05 mm) maize grading sieve; 1.8mm wheat, sorghum and sunflower grading sieve; and 4.75mm (± 0.03 mm) soya bean grading sieve. It is imperative that the sieve sizes are check on a regular basis to ensure that the sieve complies with the prescribe regulations.
Multiple slot divider	The dividing apparatus must comply with the specified dimensions.

All scales, moisture analysers and measuring equipment should be calibrated on a regular basis. **The calibration should be verified with an appropriate calibration certificate**. The intervals of the calibrations will depend on the frequency of use of the equipment or be done on an annual basis or when otherwise prescribed by the supplier.

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