

AUSTRALIAN CROP ACCREDITATION SYSTEM

COARSE GRAINS PROTOCOLS (OATS, RYE, TRITICALE)

SECTION 1 AGRONOMIC CHARACTERISTICS

DESCRIPTORS

These are characteristics which are virtually independent of the environment

Oats

- Panicle shape
- presence or absence of awns
- kernel colour
- husked or naked grain
- straw colour
- early growth habit (prostrate, intermediate, erect)
- maturity classification
- specific genetic traits
- transformations

Triticale and rye

- kernel colour
- presence or absence of awns
- maturity classification
- early growth habit
- specific genetic traits
- transformations

PRINCIPLES FOR THE EVALUATION OF OTHER CHARACTERS

1. Each character will be evaluated relative to an agreed set of standards. Standard/check varieties must be chosen to fairly evaluate the new varieties in the target environment(s). Breeders should nominate appropriate check varieties to the Committee before undertaking future trials. Data from the new variety and checks must come from the same experiments. As variations in seed size and nutrient content can bias results, seed should come from the same source wherever possible.
2. The data for all characters which are measured objectively, e.g by weight, length or weight per unit area, must be presented in the original metric units (g, mm, t ha⁻¹) and not transformed into percentages or non-continuous scores.
3. For all characters which can be measured objectively, data must be obtained from randomised replicated experiments and be analysed by analysis of variance, or other method of equal rigour. Standard errors must be presented.
4. All data collected from the nominated target area should be included so that an accurate picture of the new cultivar's performance is presented. The exclusion of any data from the analysis must be justified.
5. Records must be maintained in a manner which can be audited. Trial data must be made available for auditing if required by the accreditation committee. Raw data from all trials, sample and data analysis must be maintained for at least 5 years.

1. PROTOCOLS FOR INDIVIDUAL AGRONOMIC CHARACTERS

Where relevant the following characteristics are assessed in relation to check varieties which will usually be represented in the yield trials.

1.1 Seed weight

Assessed as weight (grams) of 1000 grains.
Comparisons must be made with checks of similar maturity.
From a minimum of 5 experiments grown over 2 or more years

1.2 Hectolitre weight (test weight)

Assessed as weight (grams) of one hectolitre of grain using standard equipment as used at grain receival sites.
Comparisons must be made with check varieties of similar maturity.
From a minimum of 5 experiments over 2 or more years.

1.3 Screenings

From the same sites as grain size.
Comparisons must be made with checks of similar maturity.
Relevant industry standard must be used and screen size must be specified.
From a minimum of 5 experiments grown over 2 or more years.

1.4 Early vigour.

A visual rating on a 1 to 9 scale (1 poor vigour, 9 high vigour).
The check should be in the mid range for each experiment.
Care must be taken to distinguish vigour from growth habit.
From a minimum of 5 experiments grown over 2 or more years.

1.5 Maturity Classification

Maturity should be classified as ear emergence for Oats, anthesis for Rye and Triticale relative to appropriate standard cultivars for a given sowing date range for a given environment or region. Ear emergence for oats is defined as 50% of culms or spikes having panicles or spikes completely emerged from the flag leaf (dwarf oat genotypes: 50% of panicle emerged from the flag leaf).
Days + or - the standard.
From 10 experiments over three years

1.6 Zinc efficiency

Assessed as the ratio of yield in a low zinc soil to yield in the same soil with zinc fertiliser added. A check known to be efficient and one known to be inefficient must be included.
Comparisons should be from the same site.
From a minimum of 3 experiments grown over 2 or more years

1.7 Manganese efficiency

Assessed as the ratio of yield in a low manganese soil to yield in the same soil with manganese fertiliser and foliar sprays applied to eliminate the deficiency. A check known to be efficient and one known to be inefficient must be included. The manganese level in the soil should be too low for a standard cultivar.
Comparisons should be from the same site.
From a minimum of 3 experiments grown over 2 or more years

1.8 Copper efficiency

Assessed as the ratio of yield in a low copper soil to yield in the same soil with copper fertiliser added. A check known to be efficient and one known to be inefficient must be included. The copper level in the soil should be too low for a standard cultivar.
Comparisons should be from the same site.
From a minimum of 3 experiments grown over 2 or more years.

1.9 Iron efficiency

Assessed as the ratio of yield in a low iron soil to yield in the same soil with iron fertiliser and foliar sprays applied to eliminate the deficiency. A check known to be efficient and one known to be inefficient must be included. The iron level in the soil should be too low for a standard cultivar.

Comparisons should be from the same site.

From a minimum of 3 experiments grown over 2 or more years.

1.10 Boron tolerance

Following method of Chantachume *et al* (1995).

Seeds of each line are surface sterilised with 5.0% sodium hypochlorite and pre germinated for eight days at 4°C. Approximately eight seeds of each test line and three of each check should be included in each roll. A check known to be tolerant to boron and one known to be intolerant to boron must be included in each roll. Seeds are placed embryo downwards spaced across the middle of a filter paper (Ekwip 32*46 cm grade R6) which has been soaked in a base solution of 0.0025mM ZnSO₄.7H₂O ,0.5mM Ca(NO₃)₂.4H₂O, 0.015mM H₃BO₃ plus 100 mg/litre of boron as boric acid, and drained for 2-3 minutes. The papers are rolled and covered in aluminium foil. They are then stored upright at 15°C for 12-14 days. The lengths of the longest roots are then measured.

All test seed should be from the same source.

From a minimum of 3 experiments grown over 2 or more years.

1.11 Herbicide tolerance

Measured as the ratio of the grain yield of a weed-free crop sprayed with the recommended rate of a herbicide to the yield of an unsprayed, weed-free crop. A second measure is the ratio of the grain yield of a weed-free crop sprayed with twice the recommended rate of a herbicide to the yield of an unsprayed, weed-free crop.

From a minimum of 2 experiments grown over 2 or more years.

1.12 Tillering

A visual rating on a 1 to 9 scale (1 low tillering, 9 high tillering).

The check should be in the mid range for each experiment and plant populations (plants per unit area) must be presented.

From a minimum of 5 experiments grown over 2 or more years.

1.13 Plant height

Height of average plant (in cm) in plot measured to top of panicle/spike, excluding awns for oats, triticale and rye.

From a minimum of 5 experiments grown over 2 or more years.

1.14 Lodging Resistance

A visual rating on a 1 to 9 scale (1 on ground, 9 all erect).

From a minimum of 5 experiments where lodging occurs.

1.15 Shattering Resistance

A visual rating on a 1 to 9 scale (1 high shattering, 9 low shattering), measured prior to harvest

From a minimum of 5 experiments where shattering occurs.

1.16 Yield

This needs to be assessed relative to the checks in a target environment(s) nominated by the breeder, which may not be a recognised agro-ecological zone. There have been 3 agro-ecological environments recognised in the Northern Region, 6 in the Southern Region (including an irrigation environment) and 5 in the Western Region. These are subject to continuing research. A target environment, as defined by the breeder submitting data for accreditation, would generally consist of one or more of these agro-ecological environments, but other target environments may be nominated.

The results of any relevant GXE analysis should be referenced.

Data should be presented from a minimum of 15 sites grown in 3 or more years. The number of sites may be unevenly distributed across years. The coefficient of variation after blocking or spatial adjustment should be rated to determine whether a trial should be excluded for excessive variability.

Data should be presented for all sites where the new variety was evaluated in the target environment. Specific sites can be eliminated from the analysis by argument, such as damage by an uncontrollable factor, for example mice or uneven waterlogging, or trials which are exceptionally low yielding.

The minimum plot size (measured centre to centre) is 1m x 5 m. Variations from this must be justified. Data should only be obtained from plots with other plots grown along their long axes (bordered plots).

1.17 Grazing Potential

For grazing potential the technique used to generate that information must be specified. This could include actual grazing or cut and removal or the use of multi probe capacitance meters, and must be specified against an Australian standard.

From a minimum of 5 experiments grown over 3 or more years.

SITE CHARACTERISATION

Site data is not accredited information, but is an important contributor to explaining GXE and other effects. The minimum characterisation is given below. Other soil measurements would be highly desirable. The following site characterisation information should be kept for each experiment.

1. Location of the trial. This can be given as a grid reference, but in addition should be given by the nearest town.
2. Paddock history. For the previous 3 seasons, including herbicide applications and disease status. Longer histories may be valuable in some cases
3. Soil type. Can be given with an appropriate reference, such as Stephens, C.G. (1962), 'A Manual of Australian Soils'.
4. pH. 0-10 cm depth. (or deeper where appropriate).
5. Soil P. 0-10 cm depth.
6. Soil Nitrogen. 0-10 cm depth. Additional depths may be required for some regions
7. Soil moisture at seeding, using an appropriate indicator of status.
8. Monthly rainfall. At each site, or nearby. This should be recorded for the growing season, and with pre-season rainfall where appropriate.
9. Sowing date.
10. Seeding rates and dressings, fertilisers, herbicides, insecticide and fungicide rates and dates.
11. Harvest date
12. Plot dimensions and statistical design of the experiments.
13. Seasonal observations for site and crop.

SECTION 2 QUALITY CHARACTERISTICS

For all three grains, data for test weight, screenings and seed size must be appropriately analysed to achieve a comparison of the test variety with the controls.

Where other quality attributes are claimed, e.g. groat percentage for oats, metabolisable energy etc., the conventional industry/laboratory standard methods must be used, with appropriate statistically valid sample collection.

More explicit protocols for quality may be developed with further consultation.

SECTION 3 DISEASE CHARACTERISTICS

GENERAL PRINCIPLES

3.1 Screening Conditions

The data should reflect field reactions as likely to be experienced in crops, therefore pathotypes should be identified. Seedling, greenhouse or other new methods of assessment can be used as supporting evidence providing they can be shown to reflect field circumstances. For some diseases identification of the presence of a known effective resistance gene can be used as evidence for resistance.

3.2 Check Varieties

Data must be compared with well known check varieties that support the classification being claimed. Evidence for the inheritance of a known resistance, from a known parent variety, will also be useful.

3.3 Disease Levels

There must be a sufficient level of disease in the susceptible check varieties to provide confidence in the data.

3.4 Replication

Data must be replicated over years and/or sites. The level of replication will depend on the disease and will vary depending on the uniformity of the data. Statistical evidence using analysis of variance will be required for assessment of data where there can be any doubt about claims being made.

3.5 Scoring Scales

The scoring scale used should reflect crop damage or else a close correlation with crop damage must be evident. For leaf diseases, percentage leaf area infected is recommended rather than reaction type scales.

Data can be presented using a numerical scale but for farmer extension it will be converted to the preferred rating scale as of :

R	Resistant
MR	Moderately resistant
MS	Moderately Susceptible
S	Susceptible
VS	Very Susceptible

Where necessary intermediate ratings can be used.

As a general guide:

The rating scale is based on the principle that for fungal diseases an:

R signifies that the disease, although it may be observed on the variety, will not cause a yield loss whilst the resistance is operating. For nematodes it signifies that very few nematodes will be produced on the variety and that the variety can be relied upon as a disease break.

MR signifies that whilst disease may be observed on a variety under high inoculum pressure no significant yield losses can be expected and certainly no losses greater than 5%. For nematodes an MR will be expected to provide a disease break under most conditions but that nematodes will be seen on roots more readily.

MS yield losses for plants under disease pressure will rarely exceed 15%.

S losses can be expected to exceed 15%.

VS is reserved for varieties that should not be grown in areas where the disease has a regular risk of occurring.

It is not expected that yield loss data would be provided. The above guide is provided as a conceptual framework and is not relevant for diseases that rarely cause significant yield loss.

The following scale can be used for rating tolerance to nematodes or other reactions:

VT	Very Tolerant
T	Tolerant
MT	Moderately Tolerant
MI	Moderately Intolerant
I	Intolerant
VI	Very Intolerant

3.6 Pathogen Variation

Pathogen variation must be addressed when making claims. For variable pathogens, an appropriate or sufficiently wide range of isolates should be used in the generation of disease data. For example, one isolate is sufficient for CCN. In making claims advice should be sought on such variation. For leaf rust, stripe rust and stem rust the pathotypes/isolate(s) present in the trials should be identified.

3.7 Regional variation

The resistance rating claim must take into account any regional variation in the pathogen populations and/or environments. The claims being made for a variety must match the environments in which it has been tested for disease resistance. It is the responsibility of those seeking accreditation to seek advice on such issues.

3.8 Diseases

The above principles apply, for the time being, to each of the following diseases:

Oats:	Leaf rust, Stem rust, BYDV, CCN, RLN, Septoria
Triticale:	Leaf rust, Stem rust, Stripe Rust, CCN
Cereal rye:	Stem rust, CCN

3.9 Diseases

ACAS should be advised immediately of any known breakdown in the disease resistance/tolerance of a variety that would affect the accuracy of previously supplied data. Breakdown may be on a local, regional or national basis. ACAS will accept information on changes in disease status from the breeder of the variety or other reliable sources.