

# National Variety Trials

## THE PROTOCOLS

### 1. Background

The objective of the NVT system is to provide growers and their advisers with independent information on the performance of newly released varieties of the winter field crops, relative to the current commercial varieties grown in their area. The intention is to have two years of data available at the time each new variety is made available for commercial production. However, because of the large number of canola varieties and their high attrition rate, canola entries are only tested for one year prior to release.

This will require that NVT include advanced breeding lines in the trial system for the two years before they are likely to be commercially released (one year for canola; three years for pulses). In this context, commercial release means the season when there is a significant quantity of commercial seed available for purchase by growers, OR, the season that the variety is contracted to growers in a closed loop marketing arrangement.

Trial Service Providers must do their utmost to ensure that the data for each new variety properly represents its likely performance for growers, and that means that comparisons must be valid, with each breeding line having the opportunity to perform to its genetic potential.

These protocols are designed to ensure that, as far as is possible, all breeding lines can perform to their genetic potential, and that their performance is not compromised or affected by any factor except the environment for that trial site, for that growing season.

The protocols are expressed as outcomes to be achieved, not as a detailed set of operating instructions on how to achieve those outcomes. This means there is a good deal of flexibility allowed to Trial Service Providers on how they achieve these outcomes. However, as emphasised in section 20 of this document, Trial Service Providers are expected to document and adopt their own detailed operating instructions and/or quality management procedures to ensure that the required outcomes are achieved.

### 2. NVT Database

Training will be provided by the NVT Manager to Trial Service Providers on the use of the NVT database, and how to access it for the downloading of trial designs, inputting of data etc.

Access to the NVT Database is provided to Trial Service Providers ONLY for the purpose of managing NVT trials and is NOT to be used for any other purpose. Training in the use of the database will be coordinated by the NVT Manager. User guides for growers and advisors, breeders and trial managers are available on the web site at [www.nvtonline.com.au](http://www.nvtonline.com.au).

### 3. Farmer Agreement

Where the trial site is on land belonging to a farmer or other third party, a written agreement to these protocols must be prepared and signed by both the farmer and the Trial Service Provider to ensure clarity of arrangements for the trial site for any one year. Details of cleaning up the site after harvest and arrangements for managing harvested grain must also be documented.

In reciprocation, the farmer must receive

- a copy of the plot layout after sowing to allow site visits at any time;
- the soil test results for the site once available; and
- results from the trial, for released varieties only, as per the NVT database grower access Trial Report

#### **4. Site Selection and Characterisation**

Sites must be accessible for trial operators, breeders, field day personnel and attendees, and others who need to look at the trials. Visibility for local farmers is encouraged, however not at the expense of uniformity and relevance. Consequently, sites should be as near as practical to access roads.

The soil type of the selected site must be representative of the major soil type in the district.

Access to the site for management operations throughout the year must be considered. In addition, consideration of the farmer's equipment and management of the crop and headlands is important, eg. the trial should be at least one boom width from the fence line and should be an appropriate distance from headlands, roadways, sheep troughs, gates and trees etc to avoid undue variability.

The paddock must be in the same phase of the local best practice rotation, as the crop(s) to be trialled. For example, it is not appropriate to establish a wheat trial if the rest of the paddock is to be sown by the farmer to canola, or a pulse. However wheat, durum, oats and triticale trials could be established in the same paddock in which the farmer was sowing one of those crops. For barley, it is mandatory that trial sites be within paddocks where the farmer is planning to sow barley as part of the normal rotation, so that the protein levels achieved by the trial are at least close to those required for receipt as malting barley. This will ensure that barley breeding lines are compared at protein levels relevant for malting barley, even if all the lines are not being evaluated for acceptance as malting varieties.

Any possible complications from the past use, or the proposed use during the trial season, of residual soil active herbicides must also be assessed and managed to avoid undue variability.

In-crop weed and pest control must likewise be managed to avoid undue variability. The farmer may need to spray with a herbicide or pesticide to control weeds or pests in a crop. This in turn may damage one or more of the crops being established in the trials.

One requirement of a good trial site is that it is not compromised by weed or pest competition. Good judgement is required by the trial manager so that weeds and pests do not influence the performance of varieties. This may require a higher level of weed and pest management than that level considered acceptable to the landholder for the surrounding crop.

Establishing a trial site within a paddock where the farmer has established good weed and pest control is a sensible approach. If herbicide or pesticide resistance in weeds or pests is known, or thought likely to occur on a farm or in a paddock being considered for a trial, a management plan must be developed and implemented. The management plan must detail practical measure to ensure that the herbicide resistance weed or pesticide resistant pest does not compromise the yield performance of the lines in the trial.

Pulses are particularly vulnerable to hares and rabbits, while kangaroos and emus can be a problem in some areas. Trial Service Providers must avoid sites where such pests have adversely affected crops in the past, or where damage is likely. Ensuring that the trial is in a crop of the same type helps reduce pest damage. Insect control must be considered in pulse and oilseed management. For

example canola frequently requires an insecticide application to control red legged earth mite or lucerne flea at seeding or seedling stage, and Heliothis (or Helicoverpa) control may be required at flowering in pulse crops.

The site must be visually and physically uniform in soil type. It must not be subject to excessive drainage from surrounding areas and be large enough to allow for machines to turn within any proposed fence line.

The site must have a uniform soil depth and texture and representative soil samples from 60 centimetres (if possible) below the surface must be taken from each site by the Trial Service Provider and sent to an approved laboratory for analysis. Samples should be split into 0 - 10 cm and 10 – 60 cm for testing. If conditions prevent a depth of 60 cm being achieved, the actual depth is to be recorded.

A soil test is required for each site. This may be a composite soil test for the whole site comprising several trials. Sampling procedures should be adequate to collect a representative sample from the whole site.

A topsoil (0-10 cm) and subsoil (10 – 60 cm) test is required.

The topsoil test should include pH<sub>water</sub>, pH<sub>CaCl2</sub>, EC, Exc cations, P, K, Total N, % Organic Carbon, Al (if soil pH<sub>water</sub> <5.0)

The subsoil test should include pH<sub>water</sub>, pH<sub>CaCl2</sub>, EC, Exc cations, Total N, B (if pH<sub>water</sub> > 8.0),

The results of testing at the laboratory will be entered directly into the NVT database by the Trial Service Provider as soon as the results are received. Results will also be made available to the farmer in accordance with the Farmer Agreement.

The soil type must be described in terms that are meaningful for farmers in the district. In addition to soil characteristics, the cropping, herbicide application, and fertiliser history of the site must be obtained by the Trial Service Provider for the previous three seasons (if farmer records are available), and entered into the database.

The coordinates of plot 1 of the trial site must be recorded by GPS and entered directly into the NVT database by the Trial Service Provider. A white peg is to be placed at the front of plot 1 to allow ease of locating the trial for field observations.

Monthly site rainfall records are preferred if available from either the land holder or a rain gauge on-site. In-crop rainfall will be captured by ACAS directly accessing the Bureau of Meteorology records if accurate site records are unavailable

## **5. Site Preparation**

Preparation of the trial site is to be undertaken in accordance with best management and best farmer practice for the district. Ideally the site will be prepared by the farmer who is simultaneously preparing the paddock for a crop. It is acknowledged that this is not always practical for small plot trials, or small plot machinery, and that the site may need some specific preparation for sowing.

This should be the minimum necessary to get the site ready for sowing by the proposed plot seeder. Best farmer practice would preclude, for example, the burning of a trial area for ease of use of plot equipment when farmer practice is to retain stubble, unless the sowing equipment cannot handle the level of stubble present, or the stubble would interfere with crop establishment.

## 6. Trial Layout

The trial layout must take into account controlled traffic farming systems used by the farmer. This may require adjustment in plot length to ensure that each plot fits between the permanent tracks established by the farmer. The orientation of plots and the choice of numbers of rows and ranges may also need to be adjusted to fit the permanent tracks.

## 7. Seed Acceptance to National Variety Trials (“Acceptance Criteria”)

### Entry to the NVT

#### *Wheat*

The objective of the NVT is to have two years of evaluation prior to growers having access to seed of that variety. Thus, the second year of NVT evaluation is the year that certified seed growers are bulking sufficient seed for commercial release. This means that the first year of NVT evaluation is the year that a decision is made to commercially produce seed of a line. In the past, this has usually been the year that a variety has been named and a commercializing partner may have been chosen. Thus the entries to the NVT system should be those lines from which the decision to commercialise one (or several) is to be made. This should keep the total entry numbers to a manageable level.

#### *Barley*

The objective of the NVT is to have two years of evaluation prior to growers having access to seed of that variety. Thus, for feed quality lines, the second year of NVT evaluation is the year that certified seed growers are bulking sufficient seed for commercial release. This means that the first year of NVT evaluation is the year that a decision is made to commercially produce seed of a line. For malting quality lines, the year that the line is sown to produce the first of the 100 tonne commercial scale evaluation is the year that the lines can be entered into NVT trials. It is realised that the number of lines is low and that it may be three years before growers gain access to the variety.

#### *Oats and Triticale*

The objective of the NVT is to have two years of evaluation prior to growers having access to seed of that variety. Thus, the second year of NVT evaluation is the year that certified seed growers are bulking sufficient seed for commercial release. Thus the entries to the NVT system should be those lines from which the decision to commercialise one (or several) is to be made.

#### *Canola*

Canola moves to commercial release quickly with a high multiplication rate for summer increases. Thus, to retain numbers in the NVT trials at a manageable level, only lines that are being bulked for commercial release in the following year will be accepted. There will be 4 trial types; early conventional, early TT, mid conventional and mid TT. IMI tolerant lines will be included in conventional trials, again for 2007.

#### *Pulses*

Pulse lines are inherently slow to progress to commercial release to growers because of the low bulk up rates and reduced value in summer generations. Lines that are identified for progression to seek a commercial agent for future distribution will be accepted into NVT. It is realised that these may be 3 or even 4 years away from growers gaining access to seed.

### *General*

If it is perceived a breeder is not following these guidelines, evidence may be sought by the NVT Manager to support the inclusion of future entries. This evidence could be the results of the breeder's own trials and evidence of pure seed multiplication.

### **Quality.**

The Seed Provider should aim to supply seed of a quality that enables those lines to perform to their full genetic potential. Seed produced from an autumn sown crop and from a better than average yielding site would be advantageous. Measurements of seed viability and seed size (1000 grain weights) must accompany the seed to the Trial Service Provider. If no supporting germination data is supplied, an assumed figure of 95% will be used.

The Seed Provider must provide weed free seed that is also disease free. Evidence of having passed suitable seed cleaning protocols and accompanying pathologists report on the health of the seed is required. This will lower potential liability to the Seed Provider for issues associated with the distribution of the seed.

When non-GM lines are supplied to the NVT the Seed Provider must take all reasonable precautions to guarantee the genetic purity of the provided seed in order to avoid any unintentional release of GM crops.

### **Genetically Modified (GM) Seed**

Designated GM lines are admissible for testing in NVT subject to

- The Acceptance Criteria being fulfilled; and
- Governing State and Commonwealth law permitting at the time of nomination the commercial release of nominated lines to growers within 2 years from first entering NVT trials.

It is for the Seed Providers to obtain all necessary documentation and permits in compliance with governing State and Commonwealth law prior to nominating GM entries for NVT.

### *Adventitious Presence of GM Material (AP)*

State moratoria have accepted harvested seed to contain not more than 0.9% of AP in harvested grain and for sowing seed to contain not more than 0.5% of AP for the 2007 season.

All canola seed provided to Trial Service Providers will have been tested for AP to this detection level and documentation of the results of those tests is to be provided to the NVT Manager before sowing. Those entries without accompanying documentation will not be accepted into the NVT trials.

### **Timing of seed distribution**

#### *Submission of entries by breeders*

Breeders must submit the names of entries into the NVT system by the **nomination date** specified in Table 1. This will allow the NVT management committee to compile regional seeding lists and to review the total number of entries in each seeding list.

Failure by breeders to submit names of entries by the nomination date will result in exclusion of those lines from the NVT program.

#### *Delivery of seed by breeders*

Seed of entries accepted into the NVT program must be delivered to the Trial Managers designated location for seed receipt by the **delivery date** specified in Table 1. This will allow time for redistribution and packing for sowing by region groups.

The delivery date is also when the NVT manager will contact the Trial managers regarding seed receipt and modify regional seeding lists if necessary.

Failure by breeders to deliver seed to the Trial Managers by the delivery date will result in exclusion of those lines from the trial. Trial Managers are instructed to replace those lines with filler lines.

The nomination date, delivery date and sowing date may vary across the cropping regions of Australia. Dates have been developed and indicative dates for the 2007 season are listed in Table 1 below.

Table 1. **Nomination date** (“nomination”), **Delivery date** (“delivery”) and **Sowing dates** (“sow”) for NVT trials according to state requirements in a year with a normal seasonal break. **Nomination date** being the closing date for acceptance of entries to NVT trials; **Delivery date** being the closing date for seed to be received by the trial managers – after which entries are removed from the seeding lists: **Sow date** is the optimal sowing date after a normal years break in the weather.

	NSW			Qld			SA			Vic			WA		
	sow	delivery	nomination	sow	delivery	nomination	sow	delivery	nomination	sow	delivery	nomination	sow	delivery	nomination
Wheat early sown	Apr10	Mar25	Mar5	Apr 7	Mar 15	Mar 7	*	*	*	Apr 15	Mar 25	Mar 05	April 25	April 1	March 1
Wheat main sown	May1	Apr7	Mar15	Apr 21	Mar 28	Mar 15	May 1	Apr 1	Mar 15	May 1	Apr 7	Mar 15	April 25	April 1	March 1
Wheat durum	May1	Apr7	Mar15	May 5	Mar 28	Mar 15	May 1	Apr 1	Mar 15	May 1	Apr 7	Mar 15	April 25	April 1	March 1
Barley early sown	Apr10	Mar25	Mar5	Apr 7	Mar 15	Mar 7	*	*	*	Apr 15	Mar 25	Mar 05	May 1	April 1	March 1
Barley main sown	May1	Apr7	Mar15	Apr 21	Mar 28	Mar 15	May 1	Apr 1	Mar 15	May 1	Apr 7	Mar 15	May 1	April 1	March 1
Triticale long season	Apr10	Mar25	Mar5	*	*	*	*	*	*	Apr 15	Mar 25	Mar 05	*	*	*
Triticale	May1	Apr7	Mar15	*	*	*	May 1	Apr 1	Mar 15	May 1	Apr 7	Mar 15	*	*	*
Oats	May1	Apr7	Mar15	*	*	*	May 1	Apr 1	Mar 15	May 1	Apr 7	Mar 15	May 1	April 1	March 1
Canola early sown (conv, TT, IMI)	Apr15	Apr7	Mar15	*	*	*	*	*	*	*	*	*	*	*	*
Canola main sown (conv, TT, IMI)	Apr15	Apr7	Mar15	*	*	*	May 1	Apr 1	Mar 15	May 1	Apr 7	Mar 15	April 25	April 1	March 1
Chick Peas	May15	Apr10	Mar15	*	*	*	May 1	Apr 1	Mar 15	May 1	Apr 7	Mar 15	May 1	April 1	March 1
Faba beans	Apr15	Apr7	Mar15	*	*	*	May 1	Apr 1	Mar 15	May 1	Apr 7	Mar 15	*	*	*
Field peas	May8	Apr7	Mar15	*	*	*	May 1	Apr 1	Mar 15	May 1	Apr 7	Mar 15	May 1	April 1	March 1
Lentils	*	*	*	*	*	*	May 1	Apr 1	Mar 15	May 1	Apr 7	Mar 15	*	*	*
Lupins	Apr15	Mar25	Mar15	*	*	*	May 1	Apr 1	Mar 15	May 1	Apr 7	Mar 15	April 26	Apr 1	Mar 15

## **8. Seed supply for commercial varieties**

Seed of the commercial varieties of wheat, barley and triticale is being bulked up each winter in two nurseries that form a backup to each other – one in WA and one in NSW. Having a site in WA also alleviates the concerns of WAQIS. Thus a common seed source is used for all commercial varieties within each trial.

The oat and pulse breeding programs generate the seed of the commercial varieties to be used in the NVT trials. This will most likely be from the same source as the unreleased lines.

Seed will be supplied in bulk for the Trial Service Provider to place in packets.

It will be the responsibility of the Trial Service Provider to ensure the seed is placed into packets or magazines appropriate for their sowing system. The Trial Service Provider must have operating systems in place to ensure that seed is accurately identified throughout this process.

Breeders will be required to provide information on seed size (1000 grain weight) and seed germination for each line. The Trial Service Providers will use this information to calculate the amount of each line of seed required to sow the same number of viable seeds in every plot of every breeding line and variety. This should equate to the recommended sowing rate for that crop for that soil type in that district.

Breeders will have strict deadlines for the supply of seed and for the quality (ie. cleanliness) of seed. If they do not meet these deadlines or standards their line(s) will not be included in trials.

All Trial Managers have agreed to use flutriafol+cypermethrin (eg Veteran C, *et al*) seed dressing for all cereal trials. Some breeding programs have a policy only to distribute treated seed because of a potential bunt problem. Consequently, breeders can supply seed treated only with flutriafol+cypermethrin. Liquid seed dressing is required to prevent powder exposure to the operators at seeding time. Alternatively, seed should be supplied untreated.

For a similar reason, seed of chickpea entries may be treated only with thiabendazole+thiram (P Pickle T) .

Concerns with seed of a particular line or lines should be discussed with the NVT Manager.

Seed of cereals must be treated by the Trial Service Provider with flutriafol+cypermethrin seed dressing to control bunt and smuts before sowing at the recommended rate and by the recommended method of the manufacturer. Seed of all lines and varieties in each trial must be treated exactly the same.

Canola will be required to be sown untreated by fungicides to ensure valid comparisons are possible between breeding lines and standard varieties. A protectant may be required for slugs and or bird damage.

The NVT Manager will determine the list of commercial varieties for each trial. Seed for additional plots to make the trial design more practical will be provided by the Trial Service Provider, but must meet the same standards and be treated the same as the trial seed. The use of

Filler is to be avoided. Use the name of the substitute variety concerned. Buffer seed is to be of a commercial variety suitable for the area.

The Trial Service Provider **MUST NOT** add additional entries to any trial **UNLESS** these are required to make trial design more efficient or practical. Creation of a trial randomisation in both directions is preferred and may often require an additional entry to make the number of plots per range divisible by the number of ranges. All entries, breeding lines, and commercial varieties, are determined by the NVT Manager on an annual basis.

A small sample of each line of seed supplied by the breeder must be retained and securely labelled by the Trial Service Provider in case there is any dispute over the genetic identity of any plot.

Any seed remaining after the requirements for trials has been met must either be returned to the breeder if requested or destroyed by confounding into a common container and delivered for rubbish disposal. Seed is not to be sown or used as stock feed (possible chemical contamination) Each breeder will advise the NVT Manager of its preferred method of excess seed disposal. Trial Service Providers must comply with the preferred method of each breeder and keep records to confirm that they have employed the preferred method identified by each breeder.

## **9. Trial Designs**

The NVT Manager will determine the list of entries for each trial after discussions with the breeders and the NVT Management Committee. Once the list of entries is determined and entered into the NVT database by the NVT Manager, the Trial Service Provider will determine the shape and layout of the trial and enter this information into the NVT database to obtain a trial design.

It is the Trial Service Provider's responsibility to sort the seed packets into the right order so that the trial is sown to the design provided by the NVT database. Last minute adjustments may be necessary **ONLY** if seed is not obtained in time.

The above process must be completed before commencement of the optimum sowing period for the trial crop in the selected district. The trial design is also to be made available to the cooperating farmer in accordance with the Farmer Agreement.

## **10. Fencing**

Fencing may be required to avoid damage by grazing animals, to ensure that herbicides or other pesticides which may be applied to the surrounding crop are not applied to the trial, or to avoid windrowing or other farming activity on the surrounding crop impinging on the trial site.

Where it is required, fencing must be of an adequate standard to achieve the exclusion required and it must be erected well in advance of crop emergence at the trial site.

## 11. Sowing

The trial must be sown according to the trial design provided by the NVT database. Buffers must be included at the start and end of a trial block. Packing plans are used to record alterations due to non-arrival of seed or mishaps in the field at sowing. Packing plans are to be retained by the Trial Managers for a minimum of 18 months after sowing

If pre-emergent herbicide is the district best management practice, it must be applied in accordance with the manufacturer's directions.

Trials must be sown as close as possible to **sowing time** specified in Table 1. This sowing time is the optimum sowing period for the trial crop in the selected district. This requires that the trial area be ready for sowing well before the optimum sowing period. Actual sowing date must be recorded and entered by the Trial Service Provider into the NVT database.

Ideally, each trial should be sown within 3 or 4 days of the farmer sowing the paddock. However, late sowing of the paddock by the farmer is not a reason to delay trial sowing in optimal conditions.

Seed received from breeders after the **delivery date** specified in Table 1 must not be included in the trials. If breeders have failed to deliver seed by the delivery date, the Trial Service Provider must replace those lines with filler lines. Trial Service Providers must not delay sowing of the trial within the sowing period to wait for the late delivery of seed from breeders.

Trial Service Providers must closely monitor soil moisture conditions in the lead up to sowing and be prepared to sow as soon as optimal conditions prevail for sowing the trial crop in the soil type. In many parts of the Australian wheat belt, adequate soil moisture for sowing may only exist for a few days in each sowing season – the opportunity to sow must be recognised and acted upon.

Trials must not be sown “dry” without the approval of the NVT Manager. Very late breaks to the season may warrant some trials on suitable soils to be sown dry.

Trials must not be sown outside the optimum sowing period for the trial crop taking into account the crop maturity group (for wheat and canola) for the soil type and district, without the prior written approval of the NVT Manager.

The Trial Service Provider must ensure that the seeding equipment is well maintained and adjusted and that staff involved in sowing are competent and well trained.

Good farming practice must be adopted for sowing. Depth of sowing must be consistent for all plots and appropriate for the soil type and moisture conditions. Seed must be adequately covered by soil. The distance between plots must be consistent to minimise edge effects. Trial Service Providers must ensure that staff engaged to sow trials are aware of the importance of this, and can manage their sowing equipment to achieve uniformity of distance between plots.

An appropriate fertiliser regime must be established before sowing. The regime must include application pre-sowing, at sowing, and/or post sowing and equate to “best practice rates”. Fertiliser applied at sowing must be applied in a way that will not damage the germinating seed.

On completion of sowing a white peg is to be placed within a metre of the edge of plot 1 in each trial so that authorised visitors to the site, who are not accompanied by the Trial Service Provider, can ascertain the orientation of the trial and hence locate plots of interest.

## 12. Trial Monitoring

The site must be regularly monitored by the Trial Service Provider for weeds, pests, diseases or other incidents, such as grazing or storm damage. The site must be inspected by the Trial Service Provider (at a minimum) 4 weeks after sowing, two weeks after herbicide application, at flowering and shortly prior to harvest. A record is to be made of each inspection, including the name of the individual who conducted the inspection.

The cooperating farmer may be prepared to assist in monitoring, by reporting any incidents or problems to the Trial Service Provider. However this does not replace the responsibility of the Trial Service Provider to monitor the site .

An estimate of plant establishment is to be taken of plots within 4 weeks of emergence if an inspection of the trial at that time indicates there is evidence of significant variation between the lines sown, or within the individual plots. This may be an actual plant count, or a rating, and the data entered into the NVT database. An estimate of plant vigour for canola and pulses may also be required by the NVT Manager, within 8 weeks of emergence, measured according to the ACAS protocols.

Plot observations recorded by the Trial Service Provider are grouped as either variates or covariates. **Variates** relate to a variety (height, flowering time, etc) and allow information on the agronomy of a variety to be collected, as well as a validity check that a variety is in the correct location. **Covariates** are location based, independent of variety, and influence the accuracy in variety performance. Covariates include uneven establishment within a plot, weed infestation, blocked or missing rows, etc. Covariates are very important and, when taken, are required for every plot, not just the first rep.

Yield limiting factors such as frost, disease, weeds, nutrient deficiency/toxicity, and drought are to be recorded and reported. Where required, plot scale observations are to be taken on the trial and entered directly into the NVT database. ACAS protocols for individual agronomic or disease characteristics are to be followed when taking plot observations.

To better discriminate sites that are affected by frosts, Service Providers are required to collect minimum temperature data for each site, not each trial at each site. However, trials at different paddocks within a locality require data collection at each paddock. Data required is minimum temperature, collected half hourly, for a period of 4 months. This time period is to be equally spaced before and after flowering of the trial crop. The minimum temperature data is to be provided to the NVT manager in an Excel spreadsheet by Jan 31 of the following year.

Over time, days to flowering data will provide a sowing window for varieties within the regions tested. It is realised that not every trial will have flowering data recorded due to logistical reasons and cost. At least one trial in each region for each sowing period (fortnightly) must have days to flowering data collected from every plot in the trial.

The other trials may have zadok scores or growth scores for each plot in the trial..

Any incident, accident or other factor that could have an affect on the accuracy or reliability of the trial, especially anything that differentially affects breeding lines or standard varieties, must be reported to the NVT Manager immediately.

### **13. Weed Management**

The objective is to have a weed free trial so that weed competition does not compromise the yield of the lines in the trial. Achieving this without excessive herbicide applications requires planning and good site selection. If in-crop herbicides are required, they should be applied as soon as necessary, and/or when optimal conditions prevail.

Good farming practice must be used in the application of any herbicide, with spray equipment checked for accurate application rates, and the quantity of both active ingredient and water accurately measured. Any herbicide must be applied at the rate recommended by the manufacturer for each trial crop taking into account the soil type and stage of growth. All manufacturers' requirements must be met.

If an applied herbicide appears to have differentially affected one or more breeding lines or standard varieties, this must be recorded and the NVT Manager advised immediately.

Where all entries in a trial are herbicide tolerant, for example triazine tolerant canola, the entire trial area must have triazine applied at the manufacturers recommended rate, at the manufacturers recommended time/s, and in accordance with all other manufacturers recommendations.

As indicated earlier, if herbicide resistance in weeds occurs on the site, a management plan must be prepared and implemented to minimise competition from the weed/s. The NVT Manager must be advised immediately if implementation of the management plan does not succeed in minimising competition from the herbicide resistant weed/s. The trial site must be managed in consultation with the landholder.

### **14. Disease and Pest Management**

The NVT Manager must be notified if and when there is a significant outbreak of a pest or disease. The outbreak must be controlled by best farming practice. If fungicides or insecticides are to be used they must be applied in accordance with the manufacturer's instructions.

An outbreak of a pest or disease may offer an opportunity for assessment of the resistance/tolerance level of the lines in the trial. The Trial Service Provider should notify the NVT Manager of such opportunities so that the NVT Manager can organise for the trials to be inspected by a participating pathologist.

## **15. Site Inspections**

The site must be available for inspection by the NVT Manager, by an Audit Team approved by the NVT Manager, or by any of the breeders whose lines are sown in the trial, at a mutually convenient time.

It is the responsibility of the Trial Service Provider to provide a mud-map indicating the location of the trial in the paddock and the location of the NVT trial in relation to other trials at the same site (if relevant).

The mud-map should include a text box indicating access to the trial site, with relevant landmarks and distances.

The mud-maps are to be loaded onto the NVT website within 6 weeks of sowing to allow easy access by breeders and site auditors.

It is the responsibility of impending visitors to notify the individual Trial Managers about all site visits. Issues of farmer privacy, access restrictions (if any) and possible biosecurity concerns all need addressing by the Trial Manager before each visit.

## **16. Field Days**

It is highly desirable for a field day to be held on most sites, to promote the NVT system and to enable local growers and advisers to see the advanced breeding lines first hand. Such field days are best held in conjunction with a local farmer group meeting. Field days might also include a presentation by a local public adviser, provided that advisor does not represent them as being connected to a breeding company or program. Field days might also include presentations by a group of private advisers, provided that these advisers do not, and do not intimate, that they sponsor a field day. A presentation by a group of private advisers, as opposed to one private advisor, would alleviate any perception of conflict. Any sponsorship **MUST** be limited to advertising the field day, and to refreshments and other costs of holding the field day. The Trial Service Provider **MUST** not accept sponsorship, or money, or any product from a sponsor.

The Trial Service Provider must take responsibility for organising the viewing of NVT trials at the field day, but can delegate the promotion and detailed organisation of the field day as a whole to a farmer group, public agronomist, or group of private agronomists.

At a field day, one replicate (usually the first range) is to be signposted with the names of local check varieties and the breeder's code number. If a breeding line has been commercially released prior to the field day, its name is to be signposted. If one breeding program/company wishes to speak at the field day, the same opportunity must be given to representatives of all breeding programs/companies whose breeding lines are sown at the site.

It is preferable that a representative of the Trial Service Provider be the main speaker and MC at the NVT trial, outline how the trial has been conducted (date sown, fertiliser regime, available nitrogen and water at sowing, in-crop rainfall, weed management etc.) any factors which may have differentially affected yield or other performance, draw attention to the standard varieties and to any lines which appear to have better performance.

## 17. Harvesting

Trials are to be harvested in one direction, not in a serpentine fashion.

The trial must be harvested at the earliest opportunity after physiological maturity of the plots, to minimise grain losses through wind, insect, rain, or pest damage. Observations of any such damage are to be recorded by the Trial Service Provider and reported to the NVT Manager. Observations at harvest might also include head loss, shattering, weak straw or lodging.

Canola is very susceptible to oilseed loss by wind damage close to maturity and during the harvesting process. There are three methods of minimising these losses – windrowing, desiccation, and careful direct heading. If a canola trial is to be windrowed it must be done at the appropriate growth stage and in such a way that crop material is not carried between plots. If a canola trial is to be desiccated, it is to be done at the appropriate time and in accordance with the chemical manufacturers' instructions. Where a canola trial is to be direct headed, great care must be taken to prevent excessive and especially differential oilseed loss during harvest.

The decision of what harvest method to use is determined by the Trial Service Provider, but the outcome must be that oilseed loss is minimised, and that there is NO differential loss between breeding lines and released varieties.

The Trial Service Provider must ensure that the harvesting equipment is well maintained and adjusted and staff involved are well trained to minimise grain or oilseed loss. The header must be adequately cleaned between plots to avoid carry over of grain between plots.

Harvested grain from each plot must be separately and accurately weighed, preferably on site, but if off site then a foolproof system of bagging and labelling must be instituted. Data pertaining to harvesting must be input into the NVT database by the NVT Service Provider immediately following harvest.

Weighing devices used at harvest must be checked at least annually according to an industry accepted protocol, to ensure accuracy and reliability under field conditions. Trial Service Providers must provide details of how their recording devices have been checked, and by whom, to the NVT Manager annually.

If harvested grain is to be retained for sowing or for any other reason, the NVT Manager will inform the Trial Service Provider at least one month prior to harvest. A foolproof bagging and labelling system must be instituted to ensure accurate and reliable seed retention. If breeding programs wish to obtain grain samples from their entries in NVT trials, they will notify the NVT Manager at least 6 weeks prior to harvest and will bear any extra costs to the Trial Service Providers arising from harvest, storage and shipment of grain to breeders.

Any retained grain must be stored in a vermin and insect proof storage area.

Intellectual Property of the breeders in their breeding lines must be protected in accordance with the NVT Service Agreement. Seed must not be used for any purpose other than for carrying out the Services. Third parties must not have an opportunity to remove any seed of breeding lines.

The Trial Service Provider must retain seed samples for the determination of delivery standards (see section 18), and/or for auditing purposes (e.g. confirmation of genetic identify) for two years, or as deemed necessary by the NVT Manager. Seed samples must be kept in a permanently labelled sample bag and stored as mentioned above. The remainder of the harvested grain must be handled in accordance with the NVT Managers instructions, which could include the mixing of grain into a bulk that obscures the genetic identity of a breeder's line. The Trial Service Provider must keep a record of the line(s) destroyed, and the method and date of their destruction. Bulked grain must not be replanted or handed to breeding programs or seed suppliers.

Trials which are obviously lost to seasonal or operational issues must not be harvested without the approval by the NVT Manager although the sites still require cleaning up in the usual manner.

## 18. Delivery Standard Determination

Trial Service Providers are required to determine some delivery standard parameters:

	<b>Protein</b>	<b>Screenings</b>	<b>Plump grain</b>	<b>test weight</b>
wheat	at 11% moisture	<2.0 mm sieve		kg/hl
barley	at 0% moisture - dry basis	<2.25 mm sieve	>2.5 mm sieve	kg/hl
oats	at 11% moisture	<2.0 mm sieve		kg/hl
triticale	at 11% moisture	<2.0 mm sieve		kg/hl

	<b>Protein</b>	<b>Oil</b>	<b>Glucosinolates</b>
canola	At 10% moisture	At 6 % moisture	10% moisture,
	For meal and for whole seed	For meal and for whole seed	Meal
	<b>100 seed weight</b>		
pulses	as is		

For wheat only, Falling Number is required only for the LMA checks nominated from each site.

LMA Prone Varieties –

QLD/NNSW/CNSW – Kennedy & Seri

SNSW – Whistler or Currawong & Kennedy or BD159

VIC/SA – Kennedy & BD159

WA – Westonia & Kennedy

All sites are to have two LMA prone varieties, either as entries in the trials or inclusion in buffer plots. Where, LMA check varieties are sown in buffer plots, it is essential that these buffer plots be harvested.

All these tests are to be conducted by an accredited laboratory and results entered by the Trial Service Provider into the NVT database as soon as practicable after receiving the results.

## **19. Site Clean-up**

If the site requires clean-up, including removal of fencing, it must be done as soon after harvest as practicable to ensure good relations with the farmer and farming community. Details of any arrangements regarding site clean-up should form part of the Farmer Agreement (section 3)

## **20. Quality Assurance**

All Trial Service Providers must have appropriate Standard Operating Procedures and/or Quality Assurance procedures, in writing to ensure the outcomes established in this document. All staff must be adequately trained to accurately achieve these outcomes before they are permitted to undertake any activity on NVT trials.

Trial Service Providers must provide their written procedures to the NVT Manager on request for evaluation.

## **21. Audit**

ACAS has developed an audit procedure to audit achievement against required outcomes. Such audits will serve to reinforce stakeholder confidence in the NVT system.

A site audit that has been developed to utilise plant breeders visiting trial sites will be expanded in 2007 to ensure all sites are inspected during the growing season.

A network of regional agronomists is being developed in every state. Each agronomist will visit nearby sites and complete a Site Audit form that will be returned to the NVT Manager. Any issues raised by these audits will initially be followed up with a telephone call to the relevant Trial Manager. A confirmation visit by the NVT Manager may be required in some instances.

## **22. Winter Nurseries**

Seed of the commercial varieties is produced annually at a winter increase site, one in WA and one in NSW. This is to ensure adequate seed production and the use of seed from a common source for all trials within a region.

The seed increase site is to be managed to be as weed free as possible. An inspection similar to a seed certification inspection is to be carried out by a third party with a written site report produced. This is to indicate the presence and distribution of any weed species at that site.

Seed samples from a random selection of 5 lines is to be sent to an accredited seed laboratory for purity testing.

Seed used for the winter nurseries is to be replaced by fresh seed from a reliable sources to ensure genetic integrity.

## **23. NVT-relevant ACAS Protocols for WHEAT**

### **AUSTRALIAN CROP ACCREDITATION SYSTEM**

#### **WHEAT PROTOCOLS (MODIFIED)**

##### **SECTION 1**

##### **AGRONOMIC CHARACTERISTICS**

The ACAS crop protocols were established to accredit passport information supporting new varieties being released to growers. A standardised measurement process was established to ensure new varieties were adequately described and to enable comparisons between the varieties.

This version of **Wheat Protocols June 1999** has been modified to support the NVT process.

##### **DESCRIPTORS**

These are characteristics which are virtually independent of the environment

- seed colour (white, red , purple)
- presence or absence of awns
- head type (club, etc).
- maturity classification
- 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 relative performance of the new varieties in the target environment(s). Data from the new variety and checks must come from the same experiments
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<sup>-1</sup>) 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..
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 NVT Manager.

## **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 in grams of 1000 grains.

### **1.2 Hectolitre weight (test weight)**

Assessed as the weight (grams) of one hectolitre of grain using standard equipment as used at grain receival sites.

### **1.3 Screenings**

From the same sites as grain size,  
Relevant industry standards must be used and screen size must be specified

### **1.4**

### **1.5 Early vigour**

A visual rating on a 1 to 9 scale (1 poor vigour, 9 high vigour).

### **1.6 Maturity**

### **1.7**

### **1.8**

### **1.9**

### **1.10**

### **1.11**

### **1.12**

### **1.13 Tillering**

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

### **1.14 Flowering date.**

50% of culms in a plot to anthesis. Calendar date or days from seeding (calendar date)

### **1.15 Plant height**

Maximum height estimated for the plants in each plot between flowering and maturity.

### **1.16 Lodging**

A visual rating on a 1 to 9 scale (1 on the ground, 9 no lodging).

### **1.17 Shattering**

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

### **1.18**

### **1.19 Yield**

This needs to be assessed relative to the checks in the target environment.

The minimum plot size is 1m x 10 m (measured centre to centre). Variations from this must be justified. Data should only be obtained from plots with other plots grown along their long axes (bordered plots).

### **SITE CHARACTERISATION**

Site data is not accredited information, but is an important contributor to explaining GXE and other effects.

The minimum desirable 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 is to be given as a GPS reference, but in addition should be given by the nearest town, silo, etc.
2. Paddock history. For the previous 3 seasons, including herbicide use and disease status.
3. Soil type. May be given with an appropriate reference, such as Stephens, C.G. (1962), 'A Manual of Australian Soils'.
4. pH. 0-10 cm and 10 – 60 cm depth (or nominated depth)
5. Soil P. 0 – 10 cm depth.
6. Soil Nitrogen. 0 – 10 cm depth. Sampling at additional depth may be required for some regions.
7. Soil moisture at seeding, using an appropriate indicator.
8. Monthly rainfall. If a rain gauge is available at the trial site, Service Providers are encouraged to record those data and transfer them to ACAS. It is possible to obtain rainfall records from the Australian Bureau of Meteorology as Patched Point Datasets for each trial location.
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

### 2.1 SAMPLE COLLECTION

- 2.1.1 Samples must be collected from trials used for the collection of yield and other agronomic data.
- 2.1.2 All trials undertaken should have samples taken for testing.
- 2.1.3 Trials must include control varieties which are appropriate for the purposes of comparison. These will be determined by the National Variety Trials manager.
- 2.1.4 Grain samples should be cleaned through a Carter Dockage Tester or equivalent using a 2mm sieve to retain the main grain fraction.
- 2.1.5 As a guide, grain samples of cleaned samples should meet grain quality specifications such as:
  - Test weight  $\geq 78$  kg/hl
  - Kernel weight  $\geq 30$  g/1000 kernels
  - Falling Number  $\geq 300$  seconds
  - Screenings  $\leq 5\%$
  - Moisture  $\leq 12\%$

Trial sites which have been exposed to environmental or disease situations that would be likely to adversely affect the validity of end-product quality test results should be included; qualification comments should be provided.

- 2.1.6 Samples should be stored under conditions which maintain the integrity of the quality of the sample such as:
  - Without pesticide treatment or pickling
  - In conditions free from moulds, fungi, insect or rodent infestation
  - Not in contact with treated particle board
  - Control varieties and test varieties to be stored under the same conditions.
  - Suggested desirable storage temperature is below 25°C.

## **ANALYSIS OF SAMPLE**

**2.2.1** A laboratory conducting sample analysis must demonstrate satisfactory competency. Laboratory accreditation or certification is desirable and is encouraged. A minimum requirement would be regular participation and satisfactory performance in the interlaboratory testing programs such as:

The annual RACI Cereal Chemistry Division Check Sample for  
protein content  
moisture

**2.2.2** Analysis may be conducted on:

**2.2.2.1** All individual replicates from each site, and/or

**2.2.2.2** A site composite prepared from equal quantities of each replicate at a site. All replicates should be included. Replicates should not vary greatly in grain quality parameters.

**2.2.2.3**

**2.2.2.4**

**2.2.3**

**2.2.4** .

**2.2.5** Records must be maintained in a manner which can be audited

## **2.3 ANALYSIS OF DATA**

**2.3.1** Data must be appropriately analysed to achieve a comparison of test variety with control varieties.

All data must be included in the analysis so as to present an accurate picture of the test varieties performance. Any data not included in the analysis must be justified.

## **SCHEDULE OF PARAMETERS AND ANALYTICAL METHODS**

Sampling should be in accordance with ICC methods 101/1, 110, 130 or 138, or AACC methods 64-60, 64-70A, 64-71

NIR spectroscopy may be used for protein, moisture and hardness, provided calibration is made to the following standard methods.

Protein content (wheat, semolina or flour) Dumas method (AACC 46-30) or modified Kjeldahl methods (RACI 02-01(1988), AACC 46-08, 46-12, 46-

	13). Protein to be expressed as %N x 5.7 on a fixed moisture basis (11% wheat, 14% flour and semolina).
Moisture	RACI 01-01 (1987), ISO 712-1985, ICC 110/1, AACC 44-19
Grain hardness	PSI (AACC 55-30), NIR (AACC 39-70A)
Kernel weight	Neither ICC, AACC, nor RACI list an official method for kernel weight. Data will be accepted if not less than 500 kernels of dockage free grain are to be weighed to the nearest 0.1 gram. Kernel weight to be expressed as grams per thousand kernels.
Test weight	The only international official method is AACC 55-10 which is not entirely appropriate. Data will be accepted from either a calibrated Franklin or Schopper chondrometer. Test weight to be expressed as kg/hl.
Falling Number	AACC56-81B, ICC 107, RACI 05-08, ISO 3093-1982

### SECTION 3 DISEASE CHARACTERISTICS

#### GENERAL PRINCIPLES

##### 3.1 Screening conditions

The data should reflect field reactions as likely to be experienced in crops in the target area. Seedling, glasshouse or other new methods of assessment can be used as supporting evidence providing they can be shown to reflect field circumstances

##### 3.2 Target area

Suggested target areas are given for each disease. The target area is defined as: an area where a disease of “high public risk”, *sensu* Ballantyne *et al.* (1994), occurs on susceptible wheats, or an area where the potential average annual loss exceeds 5% of yield (Brennan and Murray 1998).

##### 3.3 Disease identification

Evidence must be presented that the disease for which claims are made was identified by a plant pathologist or other person competent to identify that disease.

##### 3.4 Pathogen variation

Pathogen variation must be taken into account. Where appropriate and possible, the race(s) or isolate(s) used should be stated.

### 3.5

### 3.6 **Check varieties**

Data must be compared with approved check varieties.

### 3.7 **Disease levels**

There must be a sufficient level of disease in the susceptible check varieties to provide confidence in the data. These levels will vary with diseases.

### 3.8 **Replication**

Data must be replicated. The level of replication within and between sites will depend on the disease and will vary depending on the uniformity of data.

### 3.9 **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 preferred to reaction type scales.

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

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

As a general guide:

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

R signifies that the disease will rarely or ever be observed on the variety and that there will be no significant yield loss. 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 yield losses are 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 be expected to exceed 15%.

S losses can be expected to exceed 15%.

VS is reserved for varieties that should not be sown where the disease in question is a regular occurrence or risk.

It is not expected that yield loss data be provided. This is only provided as a conceptual framework. The framework is not relevant for diseases that rarely cause significant yield loss in an environment.

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

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

### **3.10 Disease resistance/tolerance breakdown**

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.

## **24. NVT-relevant ACAS Protocols for BARLEY**

### **AUSTRALIAN CROP ACCREDITATION SYSTEM**

#### **BARLEY PROTOCOLS**

The ACAS crop protocols were established to accredit passport information supporting new varieties being released to growers. A standardised measurement process was established to ensure new varieties were adequately described and to enable comparisons between the varieties.

This version of **Barley Protocols April 2001** has been modified to support the NVT process.

#### **SECTION 1**

#### **AGRONOMIC CHARACTERISTICS**

##### **Descriptors**

These are characteristics which are virtually independent of the environment

- grain aleurone (white, blue aleurone)
- husk retention (hulled/covered)
- head type (2 or 6 row)
- maturity classification
- early growth habit (prostrate, intermediate, erect)
- specific genetic traits
- transformations
- ease of skinning

##### **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 variety in the target environment(s). Data from the new variety and checks must come from the same experiments
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<sup>-1</sup>) 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

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 National Variety Trials manager.

## **1. PROTOCOLS FOR INDIVIDUAL AGRONOMIC CHARACTERS**

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

### **1.1 Seed Weight**

Assessed as weight (grams) of 1000 grains.

### **1.2 Hectolitre weight (test weight)**

Assessed as the weight (grams) of one hectolitre of grain using standard equipment as used at grain receival sites.

### **1.3 Screenings and grain size**

Screenings must be expressed as % < 2.2 mm.  
Plump grain must be expressed as % > 2.5mm.

### **1.4 Coleoptile length**

### **1.5 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.

### **1.6 Maturity Classification**

Maturity should be classified as awn emergence relative to appropriate standard cultivars for a given sowing date range for a given environment or region. Days + or - the standard.

**1.7**

**1.8**

**1.9**

**1.10**

**1.11**

**1.12**

### **1.13 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.

**1.14 Plant height**

Height to base of the ear at maturity.

**1.15 Lodging Resistance**

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

**1.16 Shattering Resistance**

A visual rating on a 1 to 9 scale (1 high shattering, 9 no shattering), measured prior to harvest

**1.17 Head Loss**

Counts of heads per unit area on the ground, after harvest.

**1.18 Tolerance to sprouting**

No protocol is available at this time.

**1.19 Yield**

This needs to be assessed relative to the checks in the target environment.

The minimum plot size is 1m x 10 m (measured centre to centre). Variations from this must be justified. Data should only be obtained from plots with other plots grown along their long axes (bordered plots).

**SITE CHARACTERISATION**

Site data is not accredited information, but is an important contributor to explaining GXE and other effects.

The minimum desirable 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 GPS reference, but in addition should be given by the nearest town.
2. Paddock history. For the previous 3 seasons, including herbicide applications, 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 and 10 – 60 cm depth (or nominated depth).
5. Soil P. 0-10 cm minimum depth.

6. Soil Nitrogen 0-10 cm minimum depth - additional depths may be required for some regions
7. Soil moisture at seeding, using an appropriate indicator of status.
8. Monthly rainfall. If a rain gauge is available at the trial site, Service Providers are encouraged to record those data and transfer them to ACAS. It is possible to obtain rainfall records from the Australian Bureau of Meteorology as Patched Point Datasets for each trial location.
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**

### **MALT QUALITY CHARACTERISTICS**

#### **2.1 SAMPLE COLLECTION**

- 2.1.1 Samples must come from the same trials used previously for collection of agronomic and yield data.
- 2.1.2 All trials undertaken should have samples taken for testing.
- 2.1.3 Grain samples including the controls must have the following grain quality parameters measured:
  - Plump grains (% > 2.5 mm) and screenings (% < 2.2 mm)
  - Test weight
  - Protein (% db)

#### **Additional parameters may include:**

- Grain Colour (brightness/ colour)
- Grain germ-end colour (black point/germ-end staining)

Variations to the above may be necessary to meet the specifications used by marketing authorities across Australia. Visual assessment of grain must ensure that samples meet local market authority specifications.

Trial sites which have been exposed to environmental or disease situations that would be likely to adversely affect the validity of end-product quality test results should be included; qualification comments should be provided.

#### **2.1.4**

#### **2.1.5**

**2.1.6** Analyses may be carried out on individual replicates or composites of sites.

**2.1.7** Samples should be stored under conditions which maintain the integrity of the quality of the sample such as:

Without pesticide treatment or pickling

In conditions free from moulds, fungi, insect or rodent infestation

Not in contact with treated particle board

Control varieties and test varieties to be stored under the same conditions. Suggested desirable storage temperature is below 25°C.

### **2.2 MALTING**

### **2.3 MALT ANALYSES**

#### **2.3.1**

#### **2.3.2**

#### **2.3.3**

#### **2.3.4**

### **2.4 ANALYSIS OF DATA (GRAIN AND MALT)**

**2.4.1** Data should be analysed to achieve a comparison with the control variety (varieties).

**2.4.2** All available data should be included in the analysis in order to achieve a true indication of the variety's quality. Data not included must be justified.

#### **2.4.3**

**2.4.4** Records must be maintained in a format which can be audited.

### **2.5 FEED QUALITY**

## SECTION 3 DISEASE CHARACTERISTICS

### General Principles

#### 3.1 SCREENING CONDITIONS

The data should reflect field reactions as likely to be experienced in crops. Seedling, greenhouse or other new methods of assessment can be used 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 approved check varieties. 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. These levels will vary with diseases.

#### 3.4 REPLICATION

Data must be replicated. The level of replication within and between sites will depend on the disease and will vary depending on the uniformity of data.

#### 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 although the latter can be used as supporting evidence.

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.

A similar scale will be used for tolerance ratings for nematode and BYDV reactions.

VT	Very Tolerant
T	Tolerant
MT	Moderately Tolerant

MI	Moderately Intolerant
I	Intolerant
VI	Very Intolerant

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 eg. in an environment such as for wheat rust in WA.

### **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 leaf rust, stripe rust and stem rust the pathotypes/isolate(s) present in the trials should be identified.

### **3.7 REGIONAL VARIATION**

### **3.8 Diseases**

The above principles apply to the following diseases, but should not be seen as exclusive of further diseases such as stripe rust, etc.

Leaf rust, stem rust, scald, net blotch (spot and net forms), spot blotch, powdery mildew, BYDV, common root rot, covered smut, CCN, *Pratylenchus neglectus*, *P. thornei*

### **3.9 Disease resistance/tolerance breakdown**

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.

**APPENDIX I. QUALITY ASSESSMENT METHODOLOGIES**

<b>GRAIN</b>	<b>Units</b>	<b>Method</b>
Grain Size - Screenings (SCR) - Plump Grain (PG)	% < 2.2 mm % > 2.5 mm	Grain size was measured by screening samples through a Sortimat for 1 minute. Four grain size fractions were recorded (< 2.2mm, 2.2 - 2.5 mm, 2.5-2.8 mm, > 2.8 mm). Plump grain was recorded as a percentage for the combined 2.5 - 2.8 mm and > 2.8 mm fractions.
Grain protein	% db % db	Kjeldahl method - As per EBC method 3.2 Dumas method - As per IOB method 2.11
Falling Number (FN)	seconds	As per AACC method

## **25. NVT-relevant ACAS Protocols for COARSE GRAINS**

### **AUSTRALIAN CROP ACCREDITATION SYSTEM**

#### **COARSE GRAINS PROTOCOLS**

The ACAS crop protocols were established to accredit passport information supporting new varieties being released to growers. A standardised measurement process was established to ensure new varieties were adequately described and to enable comparisons between the varieties.

This version of **ACAS Coarse Grains Protocols June 1999** has been modified to support the NVT process. Rye has been deleted from the protocols.

#### **(OATS, 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 relative performance of the new varieties in the target environment(s). Data from the new variety and checks must come from the same experiments.
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<sup>-1</sup>) 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.
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.

## **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

### **1.2 Hectolitre weight (test weight)**

Assessed as weight (grams) of one hectolitre of grain using standard equipment as used at grain receival sites.

### **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.

### **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.

### **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).

**1.6**

**1.7**

**1.8**

**1.9**

**1.10**

**1.11**

**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.

**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.

**1.14 Lodging Resistance**

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

**1.15 Shattering Resistance**

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

**1.16 Yield**

This needs to be assessed relative to the checks in the target environment.

The minimum plot size is 1m x 10 m (measured centre to centre). 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**

**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 GPS 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 and 10 – 60 cm depth (or nominated depth)
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. If a rain gauge is available at the trial site, Service Providers are encouraged to record those data and transfer them to ACAS. It is possible to obtain rainfall records from the Australian Bureau of Meteorology as Patched Point Datasets for each trial location.
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 both grains, data for test weight, screenings and seed size must be appropriately analysed to achieve a comparison of the test variety with the controls.

## **SECTION 3 DISEASE CHARACTERISTICS**

### **General Principles**

#### **3.1 SCREENING CONDITIONS**

The data should reflect field reactions as likely to be experienced in crops. 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 approved check.

### **3.3 DISEASE LEVELS**

There must be a sufficient level of disease in the susceptible check varieties to provide confidence in the data. These levels will vary with diseases.

### **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

### **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 taken into account. Where appropriate and possible, the race(s) or isolate(s) used should be stated.

### **3.7 REGIONAL VARIATION**

### **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, Stem Lesion Nematode  
**Triticale:** Leaf rust, Stem rust, Stripe 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.

## **26. NVT-relevant ACAS Protocols for OILSEEDS**

### **AUSTRALIAN CROP ACCREDITATION SYSTEM**

#### **OILSEEDS**

#### **CANOLA/MUSTARD PROTOCOLS**

The ACAS crop protocols were established to accredit passport information supporting new varieties being released to growers. A standardised measurement process was established to ensure new varieties were adequately described and to enable comparisons between the varieties.

This version of **ACAS Canola/Mustard Protocols June 1999** has been modified to support the NVT process.

#### **SECTION 1**

#### **AGRONOMIC CHARACTERISTICS**

##### **DESCRIPTORS**

These are characteristics which are virtually independent of the environment

- Seed colour
- Maturity (early, mid, late)
- Quality type (high oleic acid, low linolenic acid)
- Herbicide resistance type (conventional, Triazine resistant, Glyphosate resistant, Imidazolinone resistant)
- specific genetic traits
- transformations

##### **GENERAL PRINCIPLES FOR 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 relative performance of the new varieties in the target environment(s). Data from the new variety and checks must come from the same experiments
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<sup>-1</sup>) 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..

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 NVT Manager.

## **1. PROTOCOLS FOR INDIVIDUAL AGRONOMIC CHARACTERS**

### **1.1 Seed size**

Assessed as weight (grams) of 1,000 grains.  
Comparisons must be made with controls of similar maturity.

### **1.2 Early vigour**

Assessed as a visual rating on a 1 to 9 scale (1 poor vigour, 9 high vigour).

### **1.3 Flowering date**

Assessed as 50% of plants with one or more flowers.  
Flowering time only to be assessed from trials sown at the normal sowing time for the region.

### **1.4 Plant height**

Measured as the average height (cm) of plants in each plot at maturity. Height measurement should reflect majority of plot, not a small number of taller individuals.

### **1.5 Lodging resistance**

Assessed as a visual rating on a 1 to 9 scale (1 on the ground, 9 no lodging). Each score to represent approximately 10 degrees of lean.

### **1.6 Maturity**

Assessed as the time when the plot has reached windrowing maturity (40% - 60% seeds changing colour). Presented as days after sowing or flowering.

### **1.7 Shattering resistance**

Assessed as a visual rating on a 1 to 9 scale (1 high shattering, 9 low shattering), measured prior to harvest. Plots of different maturity shall not be compared. Can only be measured on plots left standing.

### **1.8 Yield**

This needs to be assessed relative to the checks in the target environment.  
The minimum plot size is 1m x 10 m (measured centre to centre). Variations from this must be justified. Data should only be obtained from plots with other plots grown along their long axes (bordered plots).

## **SITE CHARACTERISATION**

Site data is not accredited information, but is an important contributor to explaining GXE and other effects.

The minimum desirable 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 GPS 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 desirable in some cases.
- 3.** Soil type. May be given with an appropriate reference, such as Stephens, C.G. (1962), 'A Manual of Australian Soils'.
- 4.** pH. 0-10 cm and 10 – 60 cm depth (or nominated depth)
- 5.** Soil P. 0-10 cm minimum depth.
- 6.** Soil Nitrogen 0-10 cm minimum depth - additional depths may be required for some regions
- 7.** Soil moisture at seeding using an appropriate indicator.
- 8.** Monthly rainfall. If a rain gauge is available at the trial site, Service Providers are encouraged to record those data and transfer them to ACAS. It is possible to obtain rainfall records from the Australian Bureau of Meteorology as Patched Point Datasets for each trial location.
- 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 the site and crop.

## SECTION 2 QUALITY CHARACTERISTICS

### GENERAL PRINCIPLES FOR SAMPLE COLLECTION AND ANALYSIS

#### 2.1 SAMPLE COLLECTION

**2.1.1.** Prior to analysis, samples are to be stored under conditions which maintain the integrity and the quality of the sample:

- Without pesticide treatment or pickling.
- In conditions free from moulds, fungi, insects or rodent infestation.
- Not in contact with treated surfaces.
- Controls are to be stored under the same conditions.
- Below 8% moisture for canola.

**2.1.2** Grain samples should be cleaned of admixture including broken seed, weed seeds or other contaminants using suitable devices.

#### 2.2 SAMPLE ANALYSIS

**2.2.1** Analysis conducted by laboratories which have either NATA or ISO 9000 accreditation is preferred. A minimum requirement is that the laboratory conducting sample analysis must be actively participating in an interlaboratory testing program with demonstrated satisfactory performance for all relevant tests. Such programs include:

The American Oil Chemists Society (AOCS) “Smalley Program”  
or  
The Australian Oilseed Federation (AOF) “Test Check Program”

**2.2.2**

**2.2.3**

**2.2.4**

**2.2.5** Results must be reported at a set moisture content or on a dry basis. For canola and mustard, seed characteristics (eg oil and glucosinolate content) are reported at 8.5% and oil-free meal components (eg protein in meal) at 13% moisture.

**2.2.6** Moisture content should be calculated using official ‘oven dry’ method (AOCS - Ai2-75) or alternatively with NIR.

#### 2.3 Oil content

Official test method: Soxhlet or Goldfish (Reference AOCS - Ai 3-75)  
Alternative test methods: NIR, NMR, critical flow analysis.

#### 2.4 Protein content

Official test method: Kjeldahl or Dumas (Reference AOCS - Ai 4-91 or Ba4e-93)

Alternative test methods: NIR.

Protein results should be presented both on a whole seed and a meal basis.

2.5

2.6

### **SECTION 3 DISEASE CHARACTERISTICS**

#### **GENERAL PRINCIPLES**

##### **3.1 Screening Conditions**

The data should reflect field reactions as likely to be experienced in crops. 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 approved check varieties.

##### **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. The level of replication within and between sites will depend on the disease and will vary depending on the uniformity of data.

##### **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 although the latter can be used as supporting evidence.

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.

A similar scale will be used for tolerance ratings for nematode and BYDV reactions.

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

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 eg. in an environment such as for wheat rust in WA.

### **3.6 Pathogen Variation**

Pathogen variation must be taken into account. Where appropriate and possible, the race(s) or isolate(s) used should be stated.

### **3.7 Regional variation**

### **3.8 Diseases**

The above principles apply to the following diseases:-

Blackleg, Sclerotinia

### **3.9 Disease resistance/tolerance breakdown**

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.

### **Blackleg resistance**

#### **GENERAL PRINCIPLES FOR EVALUATION OF BLACKLEG RESISTANCE**

1. Field rows (easier) or plots to be used.
2. Minimum of one susceptible control as nominated by the NVT manager to be included (eg. Tower, Niklas, Westar).
3. High disease pressure field site to be used. This is best achieved by growing on or directly alongside stubbles or by spreading stubbles over trial area.
4. Minimum two replications.
5. Either the Variety Blackleg Survival Test or the Variety Blackleg Canker Test on Surviving Plants can be used.
6. Varietal Resistance Reaction equivalence to either the Variety Blackleg Survival Rating or to the Variety Blackleg Canker Rating are 1 = highly susceptible, 3 = susceptible, 5 = moderately resistant, 7 = resistant, and 9 = highly resistant

## BLACKLEG SURVIVAL TEST

*Test method:* Survival % is determined from seedling establishment and maturity counts. To be effective at least 75% plant death is required in a nominated susceptible control.

Varietal scores are then expressed using the following:

Blackleg survival (unadjusted score)	% survival
1	0-15
2	16-30
3	31-40
4	41-50
5	51-60
6	61-70
7	71-80
8	81-90
9	91-100

To eliminate variability in varietal scores between sites and years, a Variety Blackleg Survival Rating must be calculated for each variety in each test.

$$\text{Variety Blackleg Survival Rating} = \frac{(\text{varietal score} - \text{minimum score})}{(\text{maximum score} - \text{minimum score})} \times 9$$

(where the maximum and minimum score refer to the highest and lowest *B. napus* scoring variety at that site).

For each set of trial data, the Variety Blackleg Survival Ratings to be adjusted such that the ranking for the variety Dunkeld equals score 7. Adjusted Variety Blackleg Survival Ratings that exceed 7 must not exceed 9; with ratings of 9 to be accompanied by an indication of the relative resistance compared with Dunkeld.

Based on results from field trials with a minimum of 3 site years over at least two years.

## BLACKLEG CANKER TEST ON SURVIVING PLANTS

*Test method:* After the end of flowering, but before maturity, assess the blackleg on crowns of surviving plants. To be effective at least 20% plant deaths/lodging required in a nominated susceptible control.

Take a total of 35 plants/plot or row from a minimum seven positions within each plot or row (i.e. 5 plants each from seven widely spaced positions within each plot or row, and any lodged or dead plants to be included). Data from <10 plants/plot will not be accepted. Cut the tops off plants and retain 20 cm of lower stem portion with the roots intact. After collection keep samples refrigerated until rated.

Thoroughly wash crowns including roots. Assess varietal scores, visually without sectioning, using the following scoring systems :

<b>Variety blackleg canker score</b>	<b>Severity of crown cankering</b>
0	Plant completely healthy
1	Up to 1/3 <sup>rd</sup> of crown circumference cankered
2	> 1/3 <sup>rd</sup> to 1/2 of crown circumference cankered
3	> 1/2 of crown circumference cankered
4	Plant dead or lodged

Percent disease index to be calculated for each variety as follows:

Percent disease index = sum of all scores x 100/ total no. of plants sampled x highest disease category

$$\text{ie. Percent disease index} = \frac{(0 \times N_0) + (1 \times N_1) + (2 \times N_2) + (3 \times N_3) + (4 \times N_4) \times 100}{(N_0 + N_1 + N_2 + N_3 + N_4) \times 4}$$

Where

$N_0$  = number of plants with score 0

$N_1$  = number of plants with score 1

$N_2$  = number of plants with score 2

$N_3$  = number of plants with score 3

Variety Blackleg Canker Rating to be expressed using the following:

<b>Variety Blackleg Canker Rating</b>	<b>Percent canker disease index</b>
1	86-100
2	71-85
3	61-70
4	51-60
5	41-50
6	31-40
7	21-30
8	11-20
9	1-10

The final Blackleg rating is based on results from trials with a minimum of 3 site years over at least two years.

## **27. NVT-relevant ACAS Protocols for PULSES**

### **AUSTRALIAN CROP ACCREDITATION SYSTEM**

#### **PULSE PROTOCOLS**

The ACAS crop protocols were established to accredit passport information supporting new varieties being released to growers. A standardised measurement process was established to ensure new varieties were adequately described and to enable comparisons between the varieties.

This version of **ACAS Pulse Protocols June 1999** has been modified to support the NVT process.

#### **SECTION 1**

#### **AGRONOMIC CHARACTERISTICS**

##### **DESCRIPTORS**

These are characteristics which are virtually independent of the environment

- Seed shape
- Testa colour and markings
- Cotyledon colour
- Leaf type - simple or normal, pinnate, leafless, semi-leafless
- Growth habit
- Specific genetic traits
- Transformations

##### **GENERAL PRINCIPLES FOR 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 relative performance of the new varieties in the target environment(s). Data from the new variety and checks must come from the same experiments
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<sup>-1</sup>) 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..

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 NVT Manager.

## **1. PROTOCOLS FOR INDIVIDUAL AGRONOMIC CHARACTERS**

In the following protocols, the minimum number of trials specified is the total number of trials which need to be carried out over the specified number of years, not the total number per year.

### **1.1 Seed size**

Assessed as weight (grams) of 100 seeds.  
Comparisons must be made with controls of similar maturity.

### **1.2 Early vigour**

Assessed as a visual rating on a 1 to 9 scale (1 poor vigour, 9 high vigour).

### **1.3 Flowering date**

Assessed as 50% of plants with one or more flowers. Presented as days after sowing. Flowering time only to be assessed from trials sown at the normal sowing time for the region.

### **1.4 Plant height**

Measured as the average height (cm) of plants in each plot at maturity. Presented as a mean height and range relative to the control varieties. (Chickpea - length of longest stem)  
Height measurement should reflect majority of plot, not a small number of taller individuals.

### **1.5 Lodging resistance**

Assessed as a visual rating on a 1 to 9 scale (1 on the ground, 9 no lodging).

### **1.6 Pod shedding**

Assessed as a visual rating on a 1 to 9 scale (1 high shedding, 9 low shedding), measured prior to harvest.  
Plots of different maturity shall not be compared.

### **1.7 Shattering resistance**

Assessed as a visual rating on a 1 to 9 scale (1 high shattering, 9 low shattering), measured prior to harvest.  
Plots of different maturity shall not be compared. Can only be measured on plots left standing.

## **1.8**

### **1.9 Yield**

This needs to be assessed relative to the checks in the target environment.

The minimum plot size is 1m x 10 m (measured centre to centre). Variations from this must be justified. Data should only be obtained from plots with other plots grown along their long axes (bordered plots).

## **SITE CHARACTERISATION**

Site data is not accredited information, but is an important contributor to explaining GXE and other effects.

The minimum desirable 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 GPS reference, but in addition should be given by the nearest town.
- 2.** Paddock history. For the previous 3 seasons, preferably 5 seasons, including herbicide applications.
- 3.** Soil type. May be given with an appropriate reference, such as Stephens, C.G. (1962), 'A Manual of Australian Soils'.
- 4.** pH. 0-10 cm and 10 – 60 cm depth (or nominated depth)
- 5.** Soil P. 0-10 cm minimum depth.
- 6.** Soil moisture at seeding, using an appropriate indicator
- 7.** Monthly rainfall. If a rain gauge is available at the trial site, Service Providers are encouraged to record those data and transfer them to ACAS. It is possible to obtain rainfall records from the Australian Bureau of Meteorology as Patched Point Datasets for each trial location.
- 8.** Sowing date.
- 9.** Seeding rates and dressings, Rhizobium type, fertilisers, herbicides, insecticide and fungicide rates and dates.
- 10.** Harvest date.

11. Plot dimensions and statistical design of the experiments.
12. Seasonal observations for site and crop, in particular factors influencing yield and variety performance.

## SECTION 2 QUALITY CHARACTERISTICS

The recommended test protocols for quality parameters are shown in the following table.

<b>Parameter</b>	<b>Recommended procedure</b>	<b>Sample size</b>
Seed size	National Pulse Quality Manual – method 103	500g
Seed colour	National Pulse Quality Manual – method 101	100g
Cotyledon colour	National Pulse Quality Manual – method 101	100g

Additional comments about the recommended tests follow:

### **Seed size**

This is an essential measurement as many markets are very particular and it could be pointless releasing a variety with seed of an unsuitable size. For seed size distribution it will be necessary to use a 1mm range for large seeds and 0.5mm range for lentils and vetches.

Samples should first be cleaned using slotted screens because their use allows removal of more waste material than round screens. Round screens are then recommended for grading all pulses, regardless of their shape. Uniformity within a batch from one site and consistency across sites, allowing for environmental factors, is a desired characteristic.

### **Seed (and cotyledon colour)**

The L, a and b values for colour are important qualities, but even more important is variation within a sample. Uniformity of colour is a big selling point.

## SECTION 3 DISEASE CHARACTERISTICS

### GENERAL PRINCIPLES

#### 3.1 Screening conditions

Data should reflect field reactions expected in crops. Supporting data from seedling, glasshouse or other methods can be provided if the methods reflect field circumstances. Identification of the presence of a known effective resistance gene can be used as evidence for resistance.

#### 3.2 Check varieties

Data should be compared with appropriate named Australian check varieties that support the classification being claimed. Sufficient checks should be included to cover the range in maturities of the varieties. Evidence for the inheritance of resistance from a known parent variety will also be useful.

#### 3.3 Disease levels

There should be a sufficient level of disease in the susceptible check varieties to provide confidence in the data. Where relevant, check varieties should score at least 5 on the International rating system (see below).

#### 3.4 Replication

Data should be replicated. The level of replication within and between sites will depend on the disease and will vary depending on the uniformity of data

#### 3.5 Scoring system

The scoring system used should reflect crop damage or else a close correlation with crop damage should be evident. For foliar and stem diseases, percentage area infected is preferred to reaction type scales, and full use should be made of any sporulation. For nematodes, data for damage is needed and data on nematode numbers is preferred; for root diseases, data on damage or survival time are suggested.

The 1-9 International rating system as defined in the ICARDA and ICRISAT manuals should be used but this may be presented as a descriptive scale with which growers may be more familiar.

The following is suggested:

International Rating	International Host Status	Descriptive Scale	Descriptive Host Status
1	Highly resistant	R	Resistant
3	Resistant	MR	Moderately Resistant
5	Moderately Resistant	MS	Moderately Susceptible

7	Susceptible	S	Susceptible
9	Highly 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 a 1 (R) means the disease will rarely occur on the variety and there will be no yield loss. A 3 (MR) means that whilst disease may occur on a variety under high inoculum yield losses will rarely exceed 10%. For a 5 (MS) yield losses for plants under disease pressure will rarely exceed 25%. For a 7 (S) losses can be expected to exceed 25%. VS is reserved for varieties that should not be sown where the disease in question is a regular occurrence or risk.

This provides a conceptual framework and yield loss data, whilst welcome is not expected. The framework is not relevant for diseases that rarely cause significant yield loss in an environment.

### **3.6 Pathogen variation**

Pathogen variation should be taken into account in making claims. Where appropriate and possible the race(s) or isolate(s) and origins used should be stated.

### **3.7**

### **3.8 Disease resistance/tolerance breakdown**

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.

## Main Pests & Diseases of Pulses

Insects need to be managed. The presence and severity of viral and or fungal infected will require reporting.

Pest & Disease	Lupins			dry peas	faba beans	chick peas	lentils
	narrow	white	yellow				
<b>Insects</b>							
Aphids (feeding)	x	x	xxx	?	x	?	xx
Cutworms or brown pasture loopers	x	x	x	x	x	?	x
Heliothis/Helicoverpa	xx	xxx	xxx	xxx	xxx	xx	xxx
Lucerne flea	x	?	?	x	xx	?	xxx
Pea weevil	?	?	?	xx	?	?	?
Red-legged earth mite	x	x	xxx	xx	xx	x	xxx
Etiella	?	?	?	x	?	?	xx
<b>Virus Diseases</b>							
Alfalfa mosaic	?	?	?	?	?	xx	?
Bean yellow mosaic	xx	xx	xx	x	x	?	?
Cucumber mosaic	xx	?	xx	?	?	xx	?
Luteoviruses	?	?	?	?	xxx	xxx	xx
Pea seed-borne mosaic	?	?	?	x	x	?	?
<b>Fungal diseases</b>							
Anthraxnose	xxx	xxx	xxx	?	?	?	?
Ascochyta	?	?	?	xxx	xxx	xxx	xxx
Botrytis	x	x	x	x	xxx	xx	xx
Brown leaf spot	xxx	xxx	x	?	?	?	?
Downy mildew	?	?	?	xx	?	?	?
Phomopsis	xx	x	xx	?	?	?	?
Phytophthora	?	?	?	x	?	xxx	?
Pleiochaeta root rot	xxx	xxx	?	?	?	?	?
Powdery mildew	?	?	?	xx	?	?	?
Rhizoctonia hypocotyl rot	x	x	x	?	x	?	?
Rhizoctonia patch	x	x	x	x	x	?	x
Rust	?	?	?	?	xx	?	?
Sclerotinia	xx	x	x	x	x	xx	x
Phoma	x	?	?	xx	x	xx	?
<b>Nematode diseases</b>							
Pratylenchus spp	poor host	?	?	poor host	poor host	good host	poor host

xxx can be a major problem

xx can be a problem

x can be a minor problem

? non-host, not in Australia, or not sufficient information

This list is not all-inclusive. Some pests and diseases can be quite important locally but are of less significance nationally.