

OUTCOMES FROM THE FORMAL REVIEW OF THE GRDC NATIONAL VARIETY TRIAL PROGRAM

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Background to NVT

The National Variety Trial (NVT) program replaced the previous Crop Variety Trial (CVT) system in 2005 at a time when there was an emergence of private plant breeding in Australia. In this environment there was recognised to be a need for a national scheme where growers could access reliable, independent information about varieties and their yield performance. This applied particularly to varieties bred in other states. NVT was therefore developed out of a need for independent management, standard protocols and the confidence that material being submitted for trial was being protected, along with the trial results. GRDC, along with industry and plant breeders, developed a management structure where GRDC finances the trial program and contracts out of all NVT management and operational activities.

NVT is managed by the Australian Crop Accreditation System Limited (ACAS), under a service agreement with GRDC. ACAS is a not-for-profit company established to provide information to growers and their advisers on the performance of field crop varieties in Australia. Its trustees are the Grains Council of Australia (GCA), GRDC and the Australian Seed Federation (ASF). Currently, more than 580 trials are sown at over 250 locations each year in NVT and the crops tested are wheat, barley, triticale, oats, canola, lupins, lentils, field peas, faba beans and chickpeas.

GRDC separately tenders and contracts the operational management of trials in each state to organisations that do not have a conflict of interest through direct plant breeding involvement. The service contracts awarded to these trial managers are managed by the NVT Manager on GRDC's behalf. The service contracts are also specific in terms of defining the tasks and milestones required, the outcomes and performance of which are monitored by the NVT Manager. Currently, NVT trials are carried out by selected trial managers in Western Australia, South Australia, Victoria, New South Wales and southern Queensland. The trial program is funded by the GRDC, except in Western Australia where the GRDC has partnered with the Department of Food and Agriculture Western Australia (DAFWA) to evaluate barley, oat and pulse varieties.

Selected service providers have also been engaged for the conduct of a winter nursery (to increase seed of the wheat and barley varieties used as commercial checks in the trials) and for the screening of NVT entries for tolerance/resistance to key pathogens. GRDC also separately tenders out the statistical analysis and reporting of NVT trial results. These results are provided to the NVT Manager to report to growers. The primary vehicle for reporting of results is an internet accessed database (NVT Online - <http://www.nvtonline.com.au>) that ensures a single interaction point for all NVT users and participants.

Rationale for the Review

The review of the NVT program was undertaken to assess the performance of the NVT program against its objectives of delivering accurate and impartial varietal information to Australian grain growers. The review considered both performance and strategy for NVT:

1. **Performance:** In determining whether NVT has met its objectives the review assessed the performance of service providers against contracted milestones, investigated the efficacy of delivery of NVT data to stakeholders and examined the interaction with participating breeding programs.
2. **Strategic:** In assessing the performance of service providers and delivery to stakeholders, the review panel identified inherent strengths and weaknesses in the program as the basis for the future structure and function of NVT and GRDC investment in the NVT program.

Review Process

The review was conducted between September and December 2008.

Structure of the review:

Component 1: Users Submissions and Surveys

All users (including growers, agricultural advisors and extension personnel, pathologists, etc) from all cropping zones of Australia had the opportunity to contribute to the review through written submissions. This was carried out by GRDC prior to the review to capture comments

relating to all aspects of NVT operations. In addition, a survey was sent to grower groups including Regional Advisory Committees (RACs) and Farmers Federations to capture their views on the value of NVT and potential future directions. Comments and recommendations from these submissions were collated into a single document; this, and a copy of the original submissions, was provided to the review team.

Component 2: Participant Interviews and Survey

A large number of public and private breeding programs participate in NVT. Telephone interviews of representative participants were conducted to obtain feedback on a broad range of issues including the current structure of the NVT program, its utility to breeders, project management, interaction with service providers, trial site selection, data analysis (statistical), data provision and access, possible future cost-sharing arrangements and others.

Interviews were complemented by a survey of participants completed prior to the review. The survey gathered responses on specific questions related to NVT operations and future directions which were collated into a single document and provided to the review panel.

Component 3: Review of Trial Managers

The performance of NVT service providers was reviewed against the following terms of reference:

1. Performance against contracted milestones;
2. Quality of trials and timely delivery of data;
3. Interaction with NVT management, participants (breeders) and growers;

All trial managers completed a written survey prior to the review. Assessment of some individual trial managers was carried out by the review team in consultation with the NVT Manager.

Component 4: Review of NVT Management and Extension activities

A performance review of NVT management was conducted against the following terms of reference:

1. Performance against contracted milestones;
2. Interaction with service providers, participants (breeders) and users (growers, advisors and industry);
3. Extension of information to stakeholders

As part of the assessment of NVT management performance, the NVT manager met the review team and provided an internal assessment of ACAS performance with respect to NVT activities. This included a SWOT analysis and lengthy discussion on all aspects of NVT establishment, operation and delivery.

Component 5: Review Team meeting at GRDC Office, Canberra

The review team met for a week in Canberra to review the survey and background documentation compiled by GRDC, and conduct face to face and telephone interviews with representatives of all NVT stakeholder groups. On the final day of the Canberra meeting, the review team considered all terms of reference, and drafted recommendations and key points for the review. The complete process of the Review is summarised in Figure 1 below.

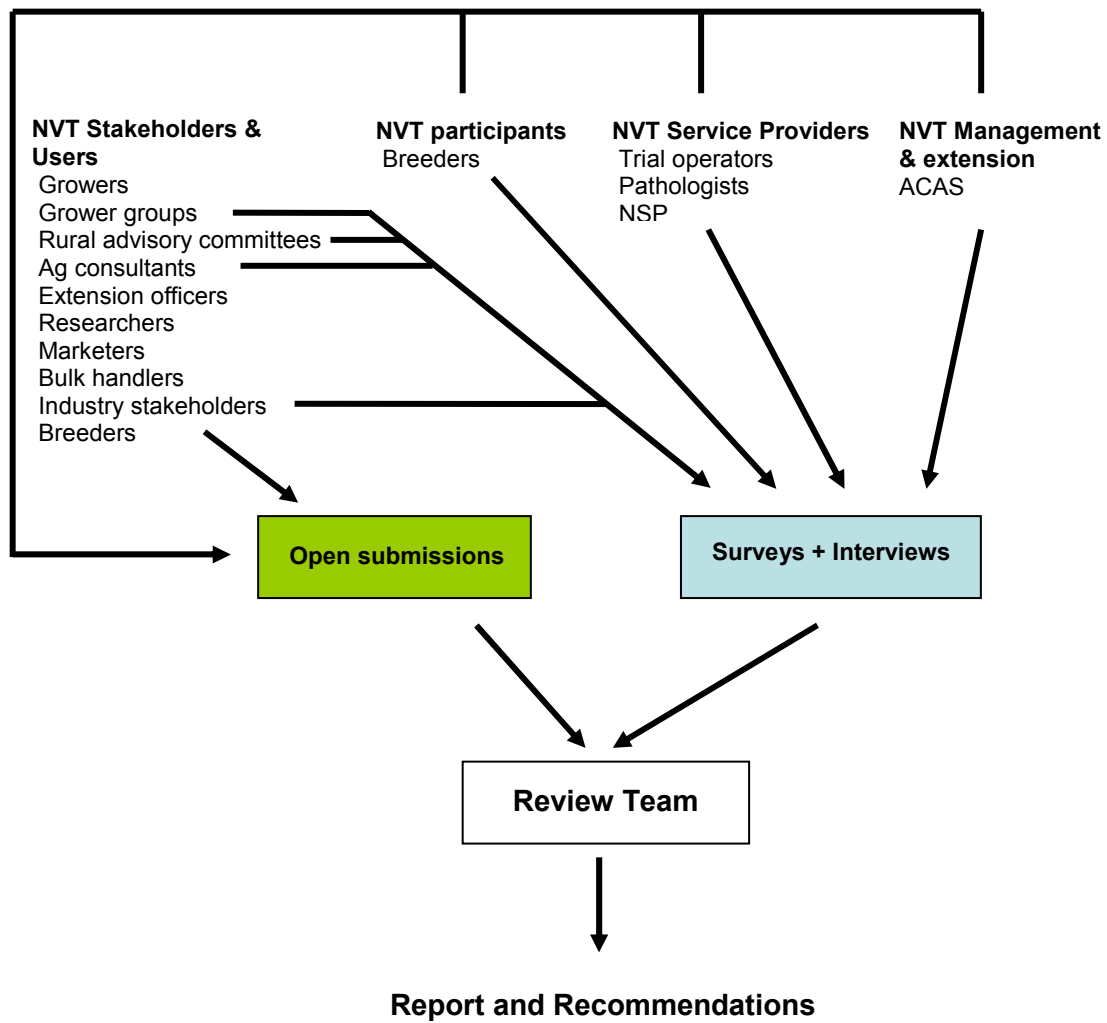


Figure 1. A schematic overview of the NVT review process.

Summary of NVT review Recommendations

The following is a summary of the key review findings and recommendations, drawn from the review report provided to the GRDC.

Findings and recommendations in relation to strategic terms of reference

1. Is there a continued need for NVT?

The review team concluded that NVT is already highly valued as an independent source of data to compare the performance of varieties for the grains industry. All stakeholders – growers, service providers, breeders, grower organisations – supported this view. However, review respondents indicated that few growers currently access NVT information via the NVT website. The need to match the requirement for NVT to deliver with the ability to access and interpret the data is addressed later in this summary.

Recommendation

NVT should continue for a further five year term with recommendations from the review implemented as rapidly as possible to ensure that the problems that have inevitably arisen in the first phase (e.g. in relation to the number and location of trials, variable performance of the service providers, the web site and the analysis of data, amongst others) are rectified and the second phase operates more equitably, efficiently and transparently for the industry.

2. Are there any other roles (beyond varietal trialling and disease screening) that NVT should be adopting?

The review team considered several submissions suggesting that the scope of NVT could be extended. Suggestions included:

- End use quality
- Expanded disease rating testing (root disease)
- Physiological characterisation
- Variety specific agronomy (VSA), and development of management packages
- Variety recommendation (as distinct from data gathering & collation)
- Varietal classification
- Economic evaluation.

These can be considered under four headings:

a) Management Information

This implies increasing the scope of the trial component of NVT to collect additional management information about specific varieties. The review team concluded that grower groups and other providers were better placed to add value to NVT varietal information by conducting their own Variety Specific Agronomy (VSA) or similar trials – these cannot be accommodated in the current NVT system without substantial increase in costs and complexity. These groups can also establish larger scale demonstration sites which are often requested by growers to compare varieties at a scale relevant to their own operations. Eventually, even data from VSA trials has to be adapted to conditions on individual properties, a task that NVT would be unlikely to achieve irrespective of the level of funding or the number and location of trials. However, the Review Team noted that there is an opportunity for GRDC Practices and Varieties operations to work more closely to link varietal performance and management of specific varieties on farm.

b) Additional Data

The review team concluded that NVT should collect additional data (physiological attributes, root disease ratings etc) within the existing NVT trial system. This is more feasible, but again at an additional cost to the program.

c) A broader role for NVT

Perform roles outside those previously considered for NVT – i.e. developing variety classifications on behalf of industry or undertaking economic analysis to assess the potential contribution that new varieties could make to existing enterprises. The review team considered these suggestions, however, found these to currently well-served by other organisations.

d) Expanded NVT Website

Use the NVT website to host additional information that may be collected through separately funded and managed field programs. Suggestions included providing access to VSA 'packages' provided they were identified as such, and not seen as recommendations or advice from NVT.

Whilst these are commendable aims, the review team felt that NVT has a clear mandate to deliver comparative data on the performance of varieties under the same conditions, and this should not be compromised by trying to do too much.

Recommendations

- a) GRDC pursue opportunities to link NVT trial programs in a zone or region with related variety specific agronomy, management package or farming systems trials. This will explore the potential to add value to the grains industry through joint 'Practices' and 'Varieties' investments.
- b) GRDC explore the opportunity to house additional information on the NVT website, where this information is clearly independent of NVT but provides data of value to growers and industry.

3. Should NVT be seeking to deliver to a greater number of customers – for example other industry users?

The review team heard strong support for NVT's role to deliver information on varietal performance to industry – this includes primarily growers, but also grower groups, state grain organisations, breeders, agronomists, consultants, researchers, marketers and processors. The review team felt that the delivery of data via the website allowed nearly everybody to access at least one level of data, with the possibility of acquiring additional data by negotiation or linkage to specialist groups. Without increasing the number of criteria for assessment, or the number of specific traits to be measured the team concluded that it is difficult to see additional customers being serviced by the current NVT model and within the current budget. However, the review team did suggest that this option is kept under review by GRDC as the next phase of NVT evolves, as there may be opportunity to deliver a wider range of grain data to more industry-based customers in the future.

Findings and recommendations in relation to operational terms of reference

1. Are the current service providers (trial managers and pathologists) meeting their milestones and delivering good value for money?

The review team identified considerable variation in the quality of service delivered by the service providers. Perceptions about the performance of individual trial managers were provided in submissions from industry and grower organisations, and through discussions with GRDC and the NVT manager. Whilst some trial managers have a good track record of growing reliable well-managed trials which provide results of high accuracy, others do not.

The review team noted that crop evaluation is subject to risks beyond reasonable managerial control, but that steps can be taken to minimise risk of trial loss e.g. timely sowing. The supply of inappropriate data from poorly managed trials which then enters the data matrix not wastes resources and undermines the quality of processed information supplied to the end-user. The review team noted that the instances of the above are in the minority and most trial managers are doing a good job, but evidence suggests there is a minority who are not, and auditing procedures (discussed later) need to be put in place to address this.

Pathologists supply information of critical importance in terms of helping farmers select the varieties most appropriate for their growing conditions. The review team found that for the most part this is working satisfactorily. Areas of concern relate principally to communication where it appears that on occasion there is little contact between pathologists and trial managers.

Recommendations

Based on the objective of ensuring trials are well managed, appropriately serviced and provide data of reliable quality for entry into the NVT data matrix, the following were recommended:

- a) Payment to trial managers for trials should be by stage payments based on satisfactory results. Key milestones could be 1) satisfactory and timely trial establishment; 2) satisfactory management of weeds, pests and disease; 3) trial harvesting; 4) acceptance of data into the trials data matrix.
- b) All NVT trials (including breeders' trials) should be officially audited at least once per year and a record of likely trial reliability held centrally.
- c) Continue to encourage stakeholders to provide voluntary updates on the condition of a trial using standardised forms whenever they visit.
- d) A nominated pathologist in each determined region should be made available to the service provider to encourage information exchange and ensure that each site is visited at least once per year by a pathologist.

2. Is there a case for expanding or reducing the number of crops tested within the NVT framework? Which crops and what is the rationale?

Within the suite of winter crops grown in Australia, the review team heard no sustainable argument for a change in the number of crops tested.

For summer crops, the picture was less clear. Sorghum and maize have a wide planting window and decisions on planting time depend on stored soil water. Variability in soil types (i.e. water holding capacity), planting time and varietal maturity would require a large number of trials to evaluate performance. Sorghum varieties are widely tested by breeding companies and there has been little demand for additional or independent testing; note, however, that a small number of grower/advisor review respondents requested the inclusion of sorghum in NVT.

The NVT system is clearly robust, is independent and little affected by the various mixtures of funding for breeding that are currently in operation. The review team concluded that this was an area where no change was justified at present but which could be reconsidered in the future should the need arise. Any future review would be triggered by the NVT Advisory Committee (see management recommendations below).

3. Is there a case for expanding or reducing the number of entries of a given crop nominated for inclusion in NVT each year?

The number of NVT entries per crop per year varies widely and was found to not be consistently related to the national area sown to the crop. NVT guidelines clearly instruct breeders to submit for testing only those lines within 2 years of commercialisation. However, analysis of NVT records indicated that these instructions are not always adhered to. Some companies were found to submit lines that are more than the required 2 years from commercialisation and some companies appear to use the NVT system as an inexpensive form of line selection. In 2008, the number of wheat plots sown in unreleased entries was over 17,000. The equivalent numbers for canola and barley were 3,200 each, while for all other crops the number of entries was in the range of 400 – 900. Based upon this analysis the review team concluded there was a clear need to rationalise the number of submissions per year.

The review team also noted that the number of controls (sometimes more than 20) increased trial size and consequent cost across the country – some controls have been in trials for over 20 years and have clearly been well characterised. Whilst there may be arguments for varietal inclusion for extension purposes, use of resources to this extent appears profligate.

Recommendation

The question of the number of control varieties required should be included within the task set to the statisticians to re-look at regionalisation and the number of trials per region. Any inclusion of extra controls above those required for statistical purposes should be on the basis of regional acreage, grower opinion and industry feedback, and should be the decision of the proposed NVT Advisory Committee.

4. Is there a case for expanding or reducing the number of trial sites?

All stakeholders in the NVT emphasised the importance of comprehensive evaluation of new varieties across years and regions, whether in submissions to the review or in the interviews conducted during the review. The site portfolio adopted for each crop was largely based on the historical allocation of resources in the CVT schemes which preceded the NVT.

The question of whether the number of trial sites is appropriate can be approached from two angles – the first based on crop value/areas grown, and the second based on the number of sites required to characterise the genotype x environment interactions for location and years sufficiently well to predict future performance of varieties.

Where the trial program is related to current production in each state the review team found there are a number of crops where re-balancing the portfolio is required (assuming that current production is a reasonable guide to future plantings). Specifically, the review team noted there are no chickpea sites in Queensland, yet chickpea is of considerable importance in that state and the current durum wheat trial program is not well aligned to historical production zones

Whilst these observations are important the review team concluded they are of less significance than the key question – that is how many sites and seasons for each crop are required to characterise genotype x environment interactions well enough to predict variety performance? The review team acknowledged that this question requires serious statistical analysis and concluded that there is now enough data in the NVT (four years, about to be five years) to facilitate this analysis.

The case of canola within the NVT is unique because there are often several experiments at each location, that is, there are separate experiments for each of the herbicide resistance groups (TT, Clearfield, Conventional, Roundup Ready ®, and in future, In Vigour ®). This provides data which the review team found was not required by farmers. Farmers repeatedly stated that they wanted direct comparisons between varieties across the herbicide resistance categories. This requires a re-design of the experiments within replicate blocks for each herbicide group (to facilitate spraying) and this will increase the total number of plots, and therefore the cost.

Recommendations

- a) Chickpea NVT sites should be established in Queensland based on the importance of the chickpea crop in this region.
- b) GRDC to establish a project to examine the number of sites required for each crop as a matter of urgency. Judicious modification of the site portfolio has the potential to maximise the value of the data set and minimise the cost of the program.

5. Is there a need for additional regional disease screening?

5.1 Disease screening:

Respondents to the NVT review surveys, and people interviewed confirmed the importance of rating the disease resistance of varieties in NVT trials. The process is that individual trials are checked for leaf disease during the normal trial management and monitoring procedures, and pathologists provide further advice/identification of disease as required; the review team concluded that this should continue.

To capture emerging or unusual disease pressure, the review team proposed instructing trial managers/pathologists to score for the core diseases and also any other disease that reaches a threshold level on any one variety. For example, if the level of disease reached a leaf area threshold (5 %?) on a susceptible variety, then the whole trial could be scored. This approach would allow unusual diseases to be automatically scored should they appear and will ensure the capture of valuable information on the disease resistance of individual varieties.

Assessment of resistance to root disease was considered and regarded as expensive. The way forward with this could be to explore possible links to root disease projects which may be able to use NVT trials to test for inoculum levels and varietal resistance to root disease.

5.2 Disease management:

A difficult matter raised frequently during the review was that of disease management of trials. A range of views were expressed to the review team. These include no application of fungicides, arguing that varieties must “fend for themselves” in an era when input costs are crippling Australian farmers. Further it was argued that you cannot devise trial management protocols for every contingency and therefore it is simpler to have a blanket policy of “no spray”. The corollary of this policy is that in some years in some regions, the NVT data will basically reflect variety (i.e. genetic) resistance. An alternative view is that failure to control disease masks the inherent yield potential of the varieties under test. Disease resistance is assessed elsewhere and, given that fungicides are getting cheaper, we should manage NVT sites to best commercial practice; this implies that that NVT will better reflect the yield potential of entries.

Based upon these submissions, the review team proposed a possible model with three key components to consider for NVT:

1. Split plot disease management trial – for each crop, conduct 1-2 experiments (depending on crop size) per state/zone in high disease risk areas to compare complete disease control with untreated. This will allow comparison of variety tolerance to disease.
2. Adopt a consistent disease management protocol – i.e. manage NVT trials as follows:
 - a. The standard approach is that they are not sprayed
 - b. Where disease pressure is likely to be severe, spray as per district practice only to
 - avoid severe crop loss
 - avoid a serious bio-security threat (e.g. a new race)
 - avoid the NVT trial being a focal point for disease spread in the district
 - when the paddock and trial is sprayed by the grower (e.g. aerial spraying)
 - c. Record spraying in trial management notes system.
3. Alter the analysis and presentation of data i.e. each season there will be three classes of trial:
 - a. no disease in the trial and unsprayed
 - b. disease present with no fungicide treatment
 - c. disease present with fungicide treatment.

This will then generate MET's for varieties for these three classes of 'disease' situations, so that growers can see 'yield potential – not disease limited' versus 'yield potential – disease limited'. The review team acknowledged that some further statistical research will be required to fine tune this approach to managing disease in NVT trials.

Recommendations

- a) GRDC recommended to review the protocol for collecting disease resistance data in NVT trials, and consider defining 'thresholds' for disease incidence on an individual variety above which the whole trial should be scored.
- b) GRDC to consider the suggested model to manage and analyse trials with and without fungicide, and provide guidance to the proposed NVT Advisory Committee on ways forward.

6. Are current data analysis tools employed by NVT suitable to address the requirements of stakeholders?

The NVT program has sought to adopt the most advanced statistical approaches to the management of its data, through the GRDC funded National Statistical Program (NSP). During the review, the review team heard submissions from several plant breeders that the multi-environment trial (MET) analysis conducted by the National Statistics Program, to produce the data presented on the NVT website, sometimes results in varietal rankings inconsistent with the known biology of variety adaptation in some crops.

Further, comments were received that within the current process for implementation of new statistical methodologies there is no formal mechanism of consultation with breeders and agronomists of each crop. Consequently, the review team recommend that an 'NVT Statistical Advisory Group' meet to discuss development of analytical tools and interpretation of outputs from their use.

Recommendation

That the National Statistics Program work closely with the proposed NVT Statistical Advisory Group to compare the current multi-environment trial (MET) methodology to alternatives that arise in discussion and to develop optimal methods for MET analysis.

Findings and recommendations in relation to management and extension terms of reference

1. Is the current NVT management structure appropriate?

NVT's structure is critically dependent on the performance of the NVT Manager. In delivering the program, the NVT Manager has to manage a complex array of relationships with stakeholders involving trial managers, breeding companies/plant breeders, grower co-operators, statisticians, agronomists, pathologists, GRDC, research advisory committees, grower representative groups and growers. During the review, the review team received positive feedback about the overall management and operation of the NVT program, and particularly about the performance of the NVT Manager and his assistant.

Nevertheless, during the review, the review team were made aware of a number of deficiencies in the overall delivery of the program. The review team considered that there is an increasing need for a more formalised advisory and consultative structure among NVT participants. While many of the protocols for conducting the trials and the reporting of results were agreed when the program was established, emerging issues referred to earlier such as fungicide spraying, number and location of trial sites, disease screening, and data analysis and delivery need to be addressed in a collaborative manner among the participants. Consequently, the review team recommended the establishment of an NVT Advisory Committee, along the lines of the CIMMYT Users Group Steering Committee and the National Cereal Rust Control Program. The Advisory Committee's Terms of Reference could include providing advice on operational and policy issues to the NVT Manager and GRDC on:

- trial site numbers and locations
- rules for retention of lines
- changes to trial protocols
- data analysis and reporting
- auditing of trial site, etc
- review of terms of use of NVT data and logos
- commissioning external reports on NVT issues.

Trial Performance and Auditing

The review team received comments from a number of stakeholders about the quality of trials being conducted in certain regions, especially during the initial phase of the NVT program. It appears that some trial sites were not established to the standard required under the Service Agreement. While the NVT Manager was quick to act to take up these concerns with the trial manager concerned, a number of trials were sown late and/or were so poor that their results were not reported. Although a cost penalty was borne by the trial manager concerned, NVT's reputation amongst growers has suffered in these areas due to the poor practices being witnessed. Given the size of the investment GRDC is making in this program, it is important that all trials are seen to be of a high standard and are delivering the right outcomes. The review team therefore identified the auditing of trial sites as a key component in ensuring the integrity of the NVT program.

Given the number and spread of NVT trials across the country, the review team were of the view that it is impossible for the NVT Manager and his assistant to inspect all the trial sites to ensure that trials are managed to the required standard. The review team therefore recommended that ACAS should contract additional auditing resources to supplement the work being done by the NVT Manager and his assistant to ensure all trial sites are audited each year against agreed guidelines. Independent auditing of all sites is also necessary to enable the staged payment and performance penalties proposed earlier (operational recommendations) to be effectively introduced and managed.

Recommendations

- a) GRDC to establish a formal NVT Advisory Committee, along the lines of the CIMMYT Users Group Steering Committee and the National Cereal Rust Control Program. It was proposed that this group should meet at least annually, be chaired by a GRDC representative, and include the NVT Manager, representatives from the breeders, growers, agronomists, plant pathology, statisticians, and service providers, and include an extension expert.
- b) Performance penalties to be incorporated in all future service contracts with trial managers to cover poor performance or neglect in the establishment and management of NVT trial sites.
- c) GRDC to continue to contract ACAS to manage and develop the NVT program and provide ACAS with the capacity to contract auditor services to ensure that all NVT Trial sites are audited each year.

2. Are NVT outcomes being effectively communicated to growers and other stakeholders?

In general terms, the review team considered that outcomes of the NVT program are being effectively communicated to growers and other stakeholders. However, improvements in delivery methodology could provide valuable enhancements. The key activities of the NVT program include the provision of:

- unbiased and independent variety comparisons
- increased awareness of new varieties for each region
- grain quality characteristics
- foliar disease and soil pathogen resistance and tolerance ratings
- long term and multi-site yield performance data
- physiological and agronomic characteristics.

All these activities were ranked as 'essential' by the majority of growers, consultants and agronomists. However, this 'essential' ranking does not provide data on the effectiveness of delivery.

NVT activities are currently delivered through the NVT website, field days at NVT sites, and presentations at grower and advisor updates and also through activities not funded directly by NVT but using NVT data, e.g. State Department annual variety guides, and through consultants and agronomists. Qualitative comments provided to the review team by grower and grains industry survey respondents indicated that the communication of many NVT outcomes could be enhanced. These are summarised in Table 1.

Table 1. A summary of the issues raised by NVT stakeholders regarding the delivery of NVT outcomes.

Issue	Comments	
	Positive	Negative
Website	<ul style="list-style-type: none"> • Site remodelled • Cheap and powerful • Of survey respondents, 80% of growers and agronomists and 60% of consultants use the site to directly access results 	<ul style="list-style-type: none"> • Many users put off by difficulty to extract data (primarily based on experiences before website was remodelled in November 2007) • Grower access is limited by slow internet speeds, which makes it time-consuming and expensive • Cannot compare multiple varieties against different criteria • A minority of growers and agronomists found the website easy to navigate (of the respondents who have accessed the site post-November 07) • Web data needs to be uploaded earlier in the year and regularly updated

		<ul style="list-style-type: none"> Many growers prefer hardcopy of results
Field days	<ul style="list-style-type: none"> Allows personal verification of the data produced Maturity and general appearance can be compared (especially in tough seasons) Ability to hear variety descriptions from respected local agronomists View trial management to assess the likely reliability of trial data Compare new varieties with local benchmarks Good to be able to talk to local farmers who have adopted new varieties Good to be able to talk to breeder directly 	<ul style="list-style-type: none"> Trials must be conducted on sites that are representative of the region Field days not necessary as yield at end of year is still the final determinant Provide handouts and data at field days on variety characteristics, historical weather and agronomy of site Focus on yield potential and disease tolerance/susceptibility Trial contractors not necessary right personnel to conduct the field day
State sowing guides	<ul style="list-style-type: none"> Of survey respondents, all growers and most agronomists and consultants indicated they use these to source varietal data 	<ul style="list-style-type: none"> Need more effort to include varieties from across state borders

3. How might the delivery of information be enhanced in the future?

The review team considered a range of options that could potentially improve the communication of NVT outcomes utilising both new and existing delivery channels. A selection of suggestions from respondents in the grower and grains industry survey are summarised in Table 2. These complement options discussed against the Operational and Management terms of reference, above.

Table 2. A summary of options to improve the delivery of NVT outcomes through new and existing channels.

Existing delivery method	Suggested Improvements
Website	<p>Interpretation of data:</p> <ul style="list-style-type: none"> Provide information in collated format for easier varietal comparisons Include summaries of variety yield and disease data (by crop and region) made available as downloadable pdf's. Must be small size for easy download. Improve explanations of 'predicted yields' Increase ability to compare more than 3 varieties across selected trial sites Variety filter – an improved variety filtering search function, where users can list the traits (yield, disease etc) they want as mandatory or desirable and watch the search unfold to narrow the lines for which they will ultimately seek a detailed MET comparison <p>Navigation:</p> <ul style="list-style-type: none"> Use a map of Australia to click to a region and then drill down further Locality function – allows comparison of all trials grown in a region Improve 'searchability' of site. Perhaps include simple 'how to' examples to enhance peoples' skill in sourcing information

	<p>Comparisons:</p> <ul style="list-style-type: none"> • Allow comparisons of previous years data • Provide data in tabular form • Don't compress the scale of yield graphs – use 0 kg/ha as starting point • Improve between state comparisons for those who farm near a border <p>Value Adding:</p> <ul style="list-style-type: none"> • Deliver info as early as possible (January) so growers can buy seed of new popular varieties, and agronomists can start using data with their clients • Data needs to be updated regularly and alerts sent out when new info is added • Use photos of varieties growing at field sites to enhance decision making • Link to state sowing guides • Provide estimates of individual variety gross margins (\$/ha) to show variety profitability • Provide data to people seeking to estimate impacts of climate change and carbon trading strategies • Interrogate website statistics to guide future improvements • Supplementary traits – some survey respondents were keen for information on traits such as vernalisation, photoperiod and basic vegetative period responses to be included
Hardcopy	<ul style="list-style-type: none"> • Annual NVT variety performance supplement in Ground Cover • Provide in easy to read format • Continue to encourage production of state sowing guides • Mail out articles on variety performance to grower groups • Wall charts showing variety comparisons • Interactive CD with results for all crops (produced on a state or regional basis?) • Small brochures with basic level of information on varieties to hand out at field days
Field days	<ul style="list-style-type: none"> • Expand NVT field day program • Have multiple plantings with varieties grouped by maturity type to allow comparison of 'like with like' • Only include varieties that are a significant improvement on those widely grown in the region • Include an 'early' planted site with commercial varieties if opportunity arises (Qld)
Agronomist/consultants	<ul style="list-style-type: none"> • Link to industry organisations to help with information transfer • Use AAAC to promote NVT website i.e. encourage their members to use it with their clients • Assist with interpretation of results to show how new varieties fit into farming system • Hold specific sessions at advisor updates to train advisors on NVT website navigation and data retrieval - increase use of website and have the flow-on effect of advisors training growers

Recommendations

- a) GRDC to consider options to formalise the extension component of the NVT program such as employing NVT extension officer(s), and/or a formalised role for the contracted extension providers etc.
- b) GRDC to develop guidelines for the publication of NVT data, which acknowledge both NVT and GRDC, and produce specific NVT promotional material for field sites and field days.
- c) GRDC to investigate all options to improve the utilisation of the NVT dataset, including allowing access to field site characterisation data, providing raw data on variety performance to researchers for approved use (e.g. temperature data for frost risk), and improving linkages to GRDC-funded 'Practices' projects (e.g. variety specific agronomy, grower groups, water use efficiency projects etc).
- d) Establish an email distribution list to deliver information to NVT stakeholders such as new NVT developments/improvements, contact details for local collaborators and service providers.

- e) NVT data to be promoted and recognised as the 'gold standard' of independent variety information in Australia with congruence between data displayed in state variety guides and the NVT website.

Findings and recommendations in relation to financial terms of reference

1. How should NVT be resourced in the future?

The review team concluded that GRDC should continue to be the primary funder of NVT. Reasons for continuation of GRDC's funding role included:

- No other agency can demonstrate the objectivity and commitment to the grains industry that GRDC provides
- NVT is critical to growers, as the data generated is seen as independent (GRDC owns the data). The review team heard that breeders recognise that growers are less likely to believe the information in breeders promotional material than NVT data
- NVT also acts as an unbiased arbitrator, and offers competitive neutrality in tender management and delivery (public vs. private)
- NVT provides an essential link between GRDC's Lines of Business, particularly 'Varieties' and 'Practices'; validating the outputs from investment in pre-breeding and breeding, and providing a platform for varieties to enter variety specific agronomy and farming systems research is essential for GRDC.

Recommendation

GRDC to continue to fund NVT to at least the existing level of budget but with some realignment of activities.