Summary

The Australian Winter Cereals Collection (AWCC) centralises and coordinates most winter cereal plant genetic resources (PGR) services and activities within Australia. This includes introduction, quarantine, documentation, characterisation, distribution and storage of germplasm. The collection promotes the efficient utilisation of genetic resources by assisting scientists identify required germplasm, by developing and nurturing close relationships nationally and internationally to ensure access to exotic germplasm, and by collaborating internationally in the development of standardised information systems as a resource to winter cereal improvement programs.

Report Disclaimer
Conclusions

The demand for winter cereals PGR has increased significantly over the past five years with the number of seed samples distributed annually more than doubling to over 13,000. In the same period, acquisition appears to be more stable, around 3,300 samples per year. However, there is a substantial backlog of germplasm (>3,000) to put through quarantine. Available quarantine infrastructure is a limiting factor.

Access to PGR internationally has improved substantially as a result of collaborative projects, especially in Russia, the Caucasus and Central Asia. All these countries and regions have special significance for winter cereal PGR as they hold large and diverse collections (Russia) or are important centres of diversity (Caucasus and Central Asia). This access will only be maintained while there is active collaboration and the associated relationships can be nurtured.

Recent initiatives aimed at improving the efficiency of PGR utilisation offer exciting opportunities for researchers to more accurately identify those genotypes most likely to possess the traits being sought. The focused identification of germplasm strategy (FIGS), supported by GRDC, continues to provide new sets of germplasm for specific trait evaluation.

Since the current project began (1997), there have been numerous significant changes to the circumstances associated with funding PGR services for winter cereals. Salaries, operating costs and (particularly) quarantine costs have all increased at a rate greater than the rate of funding over the same period. The AWCC now cannot afford to fill the Technical Officer position and other staff cannot continue to cover this position's duties while neglecting lower priority work. Without a substantial increase in the level of funding, the services provided to researchers will be reduced to a level commensurate with resources provided.

Recommendations

An objective assessment of the actual breeding material sourced from the Consultative Group on International Agricultural Research (CGIAR) centres, particularly the International Maize and Wheat Improvement Center (CIMMYT), is urgently required to determine the actual genotypes to be introduced by the AWCC on behalf of researchers. The AWCC tries to service all requirements, but the current situation has the potential to spread confusion, question the identification of material and most likely lead to duplication of quarantine and evaluation.

Outcomes
The main benefit of this project has been coordination of access to winter cereal genetic resources for Australian researchers and enhancement of their efficient utilisation through capturing and dissemination of associated information. If this project had not been conducted, researchers would have had to source, introduce, quarantine and store their own material. This would have led to considerable duplication and a net increase in costs and infrastructure to Australian research.

The project has provided coordinated winter cereal plant genetic resources services, at internationally accepted standards, in Australia. Project DAN360 addresses the original Genetic Resources Centres (National) Investment Objective for the significant crops of wheat, barley, oats, triticale and related species. The AWCC currently stores nearly 54,000 samples of wheat, barley and oats, including related cultivated and non-cultivated species. These seeds are stored at -18°C to ensure their viability for over twenty five years. The AWCC provides introduction, quarantine, documentation, storage and distribution services to all bona fide researchers in Australia, as well as many overseas.

Winter cereals are a significant component of Australia's grains industry and their continued, sustainable production relies on the availability of having a range of genetic diversity for use by plant breeders. This project fulfils this role by introducing, quarantining, documenting, storing and distributing germplasm to bona fide researchers. The major achievements of the project are most easily measured in terms of transactions of seed coming into and being distributed by the AWCC. In recent times, over 4,000 new seed lines have been introduced annually. Of these, most are breeders' germplasm for evaluation and so less than one fifth have been accessioned for longterm storage. Over 13,000 seed samples are distributed to researchers each year. Given the personnel and operating resources available, this level of activity is a testimony to the efficient practices developed and employed by the AWCC in managing PGR.

The outcome of project DAN360 will be the continued provision of these services together with ongoing development of methods to improve the effective and efficient utilisation of available germplasm. Recent initiatives aimed at improving the efficiency of PGR utilisation offer exciting opportunities for researchers to more accurately identify those genotype most likely to possess the traits being sought. The focused identification of germplasm strategy (FIGS), supported by GRDC, continues to provide new sets of germplasm for specific trait evaluation.

Provision of these genetic resources services maintains Australia's position as a key winter cereals producer which, in turn, contributes to the national economy. The preservation and utilisation of biodiversity are of national interest.

Achievements/Benefits

Plant genetic resources (PGR) are internationally recognised as essential components of all plant production industries. The AWCC centralises what was once a fragmented and highly duplicated system where individual plant improvement programs and associated researchers sourced, evaluated and sometimes stored PGR, often as a reactive response to industry needs. The AWCC not only addresses the access to and safe storage of PGR for new industry needs, it is also proactive in the extensive documentation and efficient utilisation of PGR to assist researchers more rapidly counter emerging production and marketing constraints.

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The project was initially designed to deliver efficiency of PGR services in Australia through centralisation. The original practice of several states introducing the same germplasm through their own quarantine facility has largely been eliminated representing significant cost savings to the industries concerned. Now seed storage is not unnecessarily duplicated in up to six different locations, and it is being stored in ideal conditions. All plant improvement programs now have access to all seed stored subject to intellectual property (IP) issues. AWCC staff have built up an enviable level of expertise in all aspects of PGR management and utilisation to the extent that they are usually the most reliable source for unique identification of seed lines available.
brought into Australia. The AWCC also provides many researchers with a conduit to PGR in other parts of the world. AWCC personnel have executive positions on international PGR networks for wheat and barley. Numerous international institutions and agencies regularly communicate with the AWCC in undertaking their own research and in the development of novel utilisation methodology.

The AWCC has been exceptionally active in the development of tools to more efficiently utilise PGR. It instigated the Genetic Resources Information Package for wheat (*Triticum* GRIP versions 1, 2 and 3). GRIP was the first global effort to collate, and make freely available, comprehensive passport data for wheat. This initiative involved developing collaboration across many countries, including China, Russia, South Africa, Mexico, USA and Canada.

In more recent times, a concept to further improve utilisation efficiency, developed by the AWCC, is being prototyped in another GRDC project. The idea is to more easily identify the PGR most likely to contain the characteristics breeders are searching for by linking PGR to the environment with geographic information system (GIS) technology. This concept is a world first, and preliminary results are most encouraging. It has the potential to significantly minimise the number of seed lines it is necessary to evaluate to discover the most suitable source of new genetic variation.

The various achievements and initiatives of the AWCC contribute altogether to facilitate a more rapid path to the development of new and competitive varieties for the winter cereals industries in Australia. In doing so, these industries are able to maintain or improve their competitiveness, both nationally and internationally.

**Other research**

Further development of a system to manage intellectual property (IP), within a gene bank documentation system, will become essential, especially once the International Treaty on Plant Genetic Resources for Food & Agriculture becomes a reality.

There is enormous potential to assist researchers identify the germplasm most likely to possess the variation they require through capturing the collection site data of landraces and other collected germplasm held in the AWCC. Having developed this expertise in the ICA1 project, it would be most valuable to extend to durum wheat, barley and oats.

Close collaboration with international PGR agencies and personnel has demonstrated the enormous value derived, especially in terms of access to germplasm. There should be an ongoing investment in maintaining and broadening these networks.