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Overview

Pulse Breeding Australia (PBA) coordinates a world class Australian pulse breeding program. It has operated since 2006, with its State Department and University based national chickpea, lentil, field pea, faba bean and lupin breeding programs delivering pulse varieties through best practice breeding for Australian growers.

Vision

Pulses are vital to the creation of sustainable farming systems across Australia. They provide disease breaks for cereal crops, broaden weed control options, reduce reliance on artificial fertilisers and assist with diversifying growers’ production and marketing opportunities.

PBA’s vision is to see pulses expand to greater than 15% of the cropping area to underpin the productivity, profitability and sustainability of Australian grain farming systems.

Objective

PBA’s objective is to breed and drive adoption of a pipeline of improved varieties for Australian growers that achieve higher yields, have resistance to major diseases and stresses, and have grain qualities that enhance market competitiveness.

Partners

Pulse Breeding Australia (PBA) is an unincorporated joint venture between:

- Department of Environment and Primary Industries, Victoria (DEPI Vic)
- South Australian Research and Development Institute (SARDI)
- Queensland Department of Agriculture Fisheries and Forestry (Qld DAFF)
- New South Wales Department of Primary Industries (NSW DPI)
- Department of Agriculture and Food, Western Australia (DAFWA)
- University of Adelaide
- University of Sydney
- Pulse Australia
- Grains Research and Development Corporation (GRDC)

Operations

The PBA Board has oversight of PBA and sets its strategy with the PBA Coordination Group, which is responsible for the operations and day to day managements of PBA. PBA varieties are developed within the PBA breeding programs and delivered to industry via PBA’s commercial partners on approval of the PBA Release Advisory Groups (RAGs). Strong relationships with commercial partners ensure new pulse varieties are delivered as quickly as possible to growers.

PBA targets the breeding of its five winter grain legumes (chickpea, faba bean, field pea, lentil, and lupin) to produce better pulse varieties faster. The capabilities, skills and investment of the PBA partner agencies are used cooperatively to develop superior varieties for growers across the Australian cropping regions.

PBA partners take responsibility for specific breeding processes within each crop, including parental line identification, crossing, early generation evaluation and line selection, screening for quality, development of resistance to diseases and tolerance to abiotic stresses, widespread evaluation to identify broad and local adaptation and provision of agronomic support.
PBA Highlights 2013

Variety delivery

PBA launched seven new varieties in 2013, bringing the PBA varietal suite to twenty-eight. Improvements in disease resistance, variation in flowering and maturity profiles, herbicide tolerance, grain characteristics which target specific markets and the introduction of a new forage pulse provide a wider range of viable pulse options to Australian growers across all cropping regions.

The PBA Inaugural Pulse Conference field day held at Tarlee, provided a perfect platform for the release of the new chickpea and field pea varieties in conjunction with commercial partner Seednet, and the release of the new lentil variety with lentil commercial partner PB Seeds.

The PBA Chickpea program launched PBA Maiden, a new desi variety adapted to southern Australia. PBA Maiden has a large seed size targeted towards premium whole seed desi markets. It has moderate ascochyta blight resistance and similar yields to PBA Slasher in south eastern Australia. The second release was of PBA Monarch, the first kabuli release from the PBA chickpea program. PBA Monarch has good adaptation to shorter season kabuli growing environments and a larger seed size than Genesis™ 090. It is higher yielding than other medium and large-seeded varieties, particularly in the traditional kabuli growing environments of South Australia and Victoria.

The two new field peas released at the PBA conference field day were, PBA Wharton and PBA Coogee. These varieties further expand the range of field pea to Australian conditions and attracted strong grower demand on release.

PBA Wharton is a high yielding Kaspa type pea adapted for short to medium rainfall regions with resistance to pea seed borne mosaic virus (PSbMV), bean leaf roll virus (BLRV) and powdery mildew. The early flowering and maturity (similar to PBA Gunyah) of this variety enables effective crop topping with herbicides for weed seed set control. This variety has superior grain quality and boron tolerance compared to Kaspa and is aimed at short season regions where powdery mildew or viruses are a risk.

PBA Coogee is a dual purpose (grain or biomass for hay/brown manuring) conventional dun pea that produces high levels of biomass early in the growing season. This variety is mid to late flowering, but pods rapidly mature allowing growers time to decide the end-use. It is resistant to powdery mildew and moderately resistant to bacterial blight. PBA Coogee is primarily aimed at drought prone regions that are more likely to utilise the forage option in drier seasons. It has superior tolerance to boron and salinity compared with Kaspa and Parafield.

The Field Pea program also released its first forage pea in 2013, PBA Hayman. It can be used as an alternative to vetch or Morgan field pea for hay, silage or for green manuring. It is late flowering and given favourable conditions produces large amounts...
of dry matter. PBA Hayman is resistant to powdery mildew and produces small pods and small white seeds, thereby reducing the seed cost of sowing. The variety does not produce hard seed, ensuring there is no seed carry over to germinate in following crops.

PBA Hurricane XT, the latest herbicide tolerant lentil variety was also launched at the PBA conference field day. This new variety builds on the success of PBA Herald XT, incorporating the same improved tolerance to some Group B herbicides, but with higher grain yields and improved agronomic characteristics.

The Lupin program released a new variety in conjunction with commercial partner Seednet. The second PBA lupin release, PBA Barlock is a high yielding Australian sweet lupin variety suitable as a replacement for Tanjil and Wonga in most lupin growing areas of Western Australia. It also provides a very significant yield improvement in most regions of New South Wales, Victoria and South Australia. PBA Barlock has a considerable improvement in metribuzin tolerance over the varieties Tanjil and Wonga and will allow growers to use metribuzin as an option for controlling broadleaf weeds within the lupin crop.

**PBA Inaugural Pulse Conference**

The PBA Inaugural Pulse Conference 2013, held between 20-23 October 2013 in Adelaide, was highly successful. The conference’s keynote speakers Mr Hakan Bahceci President of the International Pulse Trade and Industries Confederation (CICILS IPTIC), Dr Bunyamin Tar'an, and Dr Eric Johnson from, Scott Research Station Agriculture and Agri-Food Canada, provided excellent input along with many other Australian and international participants.

All delegates certainly experienced the “Expanding Horizons” theme and thanks to the excellent presentations and posters increased the breadth and depth of their pulse knowledge.

The conference began with a field day at Tarlee, South Australia where conference delegates were joined by local advisors and growers.

The Tarlee Field Site, run by the SARDI New Variety Agronomy Group, in association with the Mid North High Rainfall Farming Systems Group was laid out with various historical pulse and research trials especially for the day.

The PBA breeding teams outlined the latest progress in the breeding programs, and along with the PBA commercial partners launched a number of new PBA varieties. Mr Hakan Bahceci spoke about the marketing issues impacting the Australian industry and Dr Eric Johnson discussed the herbicide resistance issues facing Canadian growers, highlighting the similarities and differences between the Canadian and Australian experience of this increasingly important issue. A large number of pulse researchers across a breadth of disciplines explained trials and addressed delegates on the latest in pulse research.
Day two of the conference saw the event officially opened in Adelaide by Gail Gago - MLC following a welcome by Conference Chair Phil Davies, SARDI.

Keynote speaker Hakan Bahceci opened presentations with an overview of the current and future directions of world pulse markets and outlined progress towards having 2016 declared the International Year of the Pulse by the United Nations.

Presentations on day two covered the Australian pulse markets and implications for our breeding programs, an interesting panel discussion on Australian pulse consumption, pulse industry challenges and the research aimed at overcoming these challenges.

A pulse food theme was carried through the conference with pulses included in all meals, including the field day lunch. Conference guest chefs, Simon Bryant and Ragini Day presented cooking demonstrations and a sumptuous pulse feast for the conference dinner at the Adelaide Zoo.

Day three presentations explored breeding and applied pulse research. An interesting and insightful opening keynote was presented by Bunyamin Tar'an Associate Professor Chickpea Breeding and Genomics, University of Saskatchewan. His address examined the globalisation of the pulse industry and the increasing world-wide domination of cereals and oilseeds in crop rotations and questioned how pulse breeding may continue to thrive and deliver in a time of rapid change in the agricultural research economy.

Peter Wilson, Chair Pulse Australia, and Willie Erskine, Director International Centre for Plant Breeding Education and Research, provided conference summaries from marketing and scientific/technology perspectives respectively. Both speakers highlighted some interesting issues which will assist to focus PBA and the pulse research community in continuing to deliver improvements at all levels to industry.

PBA is grateful to the conference and field day committees and all speakers, participants, delegates and sponsors who collectively created this excellent event, which it is anticipated will be held three yearly into the future.
PBA Breeding Programs

Chickpea

**Key Program Outcome 2016:** the delivery of chickpea varieties with higher and more stable yield, fewer input requirements and improved seed quality to significantly increase the profitability of chickpea production.

**Report 2013**

In 2013, the desi variety PBA Maiden was launched at the PBA conference field day in SA and in Victoria at the Southern Pulse Agronomy Wimmera field day. Also released in 2013 was the first kabuli chickpea variety from the PBA Chickpea program, PBA Monarch. This variety was launched at the same field days in SA and Victoria plus two days in the northern region at Pine Ridge (NSW) and Billa Billa (QLD).

An improvement in the efficiency of yield evaluation in northern NSW was achieved through close interactions with the new northern pulse agronomy project. Sites were co-located and managed, resulting in good trial outcomes for both projects. New breeding material has improved adaptation and particular advances have been made in phytophthora root rot (PRR) resistance.

The PBA Chickpea team have been actively involved with Germplasm Enhancement (GE) projects, both GRDC and non-GRDC funded. In addition to the supply of germplasm to numerous projects, intellectual input has been provided to: selecting appropriate germplasm; experimental design; interpreting results; supplying relevant breeding data; and the development of future directions for research.

The PBA Chickpea program held an open session for GE researchers as part of our annual March breeding meeting to streamline the program’s input into GE projects and to ensure the outputs will be relevant to the PBA Chickpea program. Whilst this level of involvement has been time consuming it is anticipated that successful and relevant outcomes from the GE programs will result.

**Outlook 2014**

A review of advanced lines will occur in 2014, with seed multiplication of possible desi and kabuli varieties releases to continue in 2014. DNA tools for variety identification will be explored.

Evaluation sites will be reviewed at the March 2014 meeting. Changes to site selection in NSW and site management in Victoria will be considered to improve the quantity and quality of data obtained by the breeding program.

At Horsham, the 2013 season provided excellent ascochyna blight (AB) disease screening conditions and resulted in high quality disease data for the national Stage 3 and Stage 2 northern, southern desi and kabuli germplasm sets. At Tamworth a very dry season from
August into spring resulted in no AB disease in nurseries despite artificial inoculation with both stubble and spore suspensions. The best method to screen advanced material against high risk isolates and reduce the risk of field based nurseries is via the implementation of controlled environment screening. These controlled environment trials will complement existing field based nurseries at Tamworth, Horsham and Medina and are seen as essential for the program to deliver on its outputs and milestones. Funds have been requested to initiate controlled environment screening methods at Tamworth and Adelaide in 2014 to secure reliable AB screening for the national breeding project.

Faba bean

**Key Outcome 2016:** New faba bean varieties for cultivation in both the Mediterranean-type and Sub-tropical productions areas. These varieties will have greater yield than current varieties, will achieve minimum disease resistance standards, and will either meet the standard required for a premium product in the international food markets or be specifically targeted to the feed industry.

**Report 2013**

Good progress in yield has been observed in trials at all stages of testing in both regions, many breeding lines have yielded significantly more than current varieties and several of these are under consideration for release.

A screening system has been developed that enables simultaneous selection for resistance to cercospora and ascochyta. The proportion of lines in the breeding program with resistance to cercospora leaf spot is increasing and is now in the range 10-20%. The first line from the cercospora resistance selection program to be promoted to NVT has yielded 5-10% more than current varieties throughout the Southern Region for the period 2009 - 2013.

Rust is a significant disease in the Northern Region in all seasons, and an occasional problem in the Southern Region. Single plant selection for resistance to rust through several generations of inbreeding has resulted in development of lines with a high and uniform level of rust resistance. The majority of advanced lines in the Northern Region node are now more resistant to rust than Cairo, and some lines are more resistant than Doza.

Screening for resistance to chocolate spot is conducted in a controlled environment glasshouse at the Waite Campus during December to April. Severe chocolate spot developed in trials at Saddleworth and Cockaleechie in 2013, and the majority of breeding lines were similar to or more resistant than Farah and Nura, confirming the effectiveness of glasshouse screening.

Virus testing is undertaken at Liverpool Plains Field Station and Tamworth Agricultural Institute (TAI). The major virus of interest is bean leaf roll virus, while some screening is also undertaken for pea seed borne mosaic virus and bean yellow mosaic virus. Testing of advanced breeding material and germplasm accessions in screen houses at TAI has identified resistant plants within segregating lines and these are used as a source of BLRV resistance in the crossing program.

In recent years there has been increased emphasis on combining elite lines from the Southern and Northern nodes. A number of these crosses have produced very high yielding progeny. Several new sources of disease resistance and diversity were also
incorporated in the breeding program including chocolate spot, ascochyta blight, rust, BYMV and CIYVV.

Further multiplication and crossing of the imazapyr tolerant selections introduced from SARDI project DAS107 to elite material occurred in 2013, with imi-tolerance now incorporated into advanced breeding material.

**Outlook 2014**

In 2013 severe ascochyta blight infection occurred at several sites in mid-north SA and results indicated a breakdown in resistance for some varieties (Farah and PBA Rana) and breeding lines, but others (including Nura) remain resistant. Resistance of approximately 30-40% of breeding lines targeted to the Southern region has been compromised by the change in the pathogen. Ascochyta screening at the Waite will include a range of isolates, including the new pathotype recently identified in the mid-north of SA.

Crosses will be made to combine high yield potential, resistance to multiple diseases, good quality and key adaptive traits. Of particular note lines with resistance to the new pathotype of ascochyta blight, lines that display a low level of staining due to PSbMV and recently developed lines with tolerance to imazapyr will be included as parents. In addition crosses will be made between elite lines from the Southern and Northern nodes to increase the overall diversity of populations.

Two breeding lines are being considered for release in 2014 and 2015 with both lines having very high yield potential and ascochyta and chocolate spot resistant. A third large seeded northern region line with resistance to rust and moderate resistance to BLRV will also be multiplied in 2014 for potential release.

**Field Pea**

**Key Program Outcome 2016: Increased productivity and profitability of the Australian field pea crop through the delivery of new varieties with improved yield and reliability of yield, crop management and grain quality.**

**Report 2013**

In 2013 three new varieties were released, PBA Wharton, PBA Coogee and PBA Hayman. These varieties have specific characteristics that will further stabilise regional production.

Within the breeding program a number of superior new breeding lines were identified for potential release over the next 5 years. These lines incorporate higher yield potential, broader adaptation, improved agronomy, superior disease resistance and improved tolerance to high soil boron and salinity.

The field pea breeding effort has shifted strategy over the last decade towards the development of erect growing pea plant types with general adaptation to low rainfall cropping zones. Crossing and reselection is focused on pyramiding traits to stabilise yield, particularly in short seasons. Traits that improve crop harvesting efficiency and management are highly advanced in the program. Relatively
more intensive breeding and screening effort is being conducted to improve disease resistance and tolerance to abiotic stress factors by using controlled environment phenotyping. Identifying and utilising molecular markers will accelerate breeding progress for key traits.

PBA field pea breeder Tony Leonforte left DEPI Horsham in June 2013. Tony began his career in field peas in 1996 and many varieties fronted by the industry dominating variety Kaspa were released from the program under his leadership. Current PBA field pea varieties, developed by Tony, including Australia’s first ever forage field pea, PBA Hayman, offer growers an excellent suite of varieties and types across a range of environments and target markets. They will greatly assist with stabilising and expanding field pea production in Australia, in line with PBA’s aim to increase pulse production. Peter Kennedy who was the assistant field pea breeder with Tony was appointed the interim leader of the PBA field pea program.

**Outlook 2014**

There will be an ongoing focus on improving yield and reliability in short growing seasons and low rainfall climates.

Selection in early generation lines will have a major focus on capturing improved lodging resistance, vigour and bacterial blight resistance while combining these traits with virus, blackspot, powdery mildew and downy resistance, boron tolerance and salinity tolerance. Breeding will also focus on pyramiding genes for general yield potential.

**Lentil**

**Key Program Outcome 2016:** The productivity and profitability of lentils in Australia will be increased through the delivery of varieties with improved yield, stability of yield and quality, and which are cheaper and easier to grow and manage in rotations.

**Report 2013**

PBA Hurricane XT, a high yielding imidazolinone tolerant lentil was launched in 2013. This variety follows on the success of PBA Herald XT, the first imidazolinone tolerant lentil, incorporating the same herbicide tolerance but in a higher yielding and better agronomically adapted package. It is the highest yielding small red lentil available in Australia, and based on record high seed sales for a new lentil variety in Australia, it will have widespread adoption among lentil growers in 2014.

The growing season of 2013 was favourable for lentil production, but also highly conducive to foliar fungal diseases. Botrytis grey mould (BGM) incidence and severity was high in medium to high rainfall growing areas of SA and Vic. Ascochyta blight was also evident in susceptible varieties in these areas. The results from 2013 lentil breeding trials (which are not sprayed with fungicide), were testament to the long term breeding effort to incorporate strong resistance to ascochyta in the breeding program. Apart from a small number of mostly older varieties, the levels of ascochyta seen in the majority of breeding lines was low, with most material at the MR or R level of resistance.
Outlook 2014

The 2013 season provided a word of caution for future breeding efforts, with the beginnings of breakdown in ascochyta blight resistance seen in varieties such as Nipper, PBA Bounty and PBA Jumbo. Analysis suggests this is because of a loss of effectiveness (to pathogen evolution) of the resistance genes inherited from the variety Northfield. The program (with related projects) will begin searching for new and diverse sources of ascochyta blight resistance to introgress into elite germplasm - to ensure reliable resistance is available to growers in future varieties.

Ongoing methodology development by the pulse germplasm enhancement and lentil breeding project will be used to increase screening and accelerate breeding progress for higher soil boron tolerance, imidazolinone herbicide tolerance, and to identify sources of elite germplasm with higher stemphylium disease resistance for use as parents. The program will also work towards incorporating higher metribuzin tolerance into lentils using germplasm and new screening methodology from a linked GRDC-funded project (DAS00107). A particular focus is combining this trait in plant backgrounds with higher imidazolinone herbicide tolerance.

An increasing amount of planning in 2014 will be focused on the methodology and timing of marker application, using results from the Pulse Molecular Marker Project.

Three new lines will be released in 2014 by commercial seed partner PB Seeds. These are a medium and a large seeded green lentil (CIPAL1104 and CIPAL1207), and a large red lentil (CIPAL1203). The two green lentils represent a new market opportunity for Australian lentil growers, while the large red is a significant advancement in yield potential and disease resistance.

Lupin

Key Program Outcome 2016: The release of improved varieties of narrow-leafed lupin to increase the profitability for farmers through higher yields and reduced input costs, and through increased suitability for premium paying markets in the aquaculture and food industries, thus increasing profits throughout the value chain.

Report 2013

The PBA Lupin program released its second PBA variety, PBA Barlock a high yielding Australian sweet lupin variety in 2013.

In Western Australia all regions experienced unusual seasonal conditions yet most finished with good yields. With the generally mild to warm seasonal temperatures, lupin crops podded very well and delivered some very good yields. In the northern region, some lupin crops out-grossed wheat and canola in terms of profit margins. Yields of 2.5 to 3.5 t/ha were recorded in the northern regions, while districts like Katanning (where lupins are not particularly well adapted to the shallower soil types) also produced excellent yields. Out of the 16 CVT trials only one, Esperance Downs, was abandoned due to high bean yellow mosaic virus and black pod syndrome (late BYMV).

The breeding program has continued working with wild material to increase genetic diversity, including higher pod set on lateral branches. Identification of root morphology differences – to enable the genetics of rooting structures to be studied with the potential of selecting for larger rooting systems – is being progressed. Further endeavours are underway to integrate the wild material within and across countries of origin rather than keeping them separate. Primary crosses with wild material from Mediterranean
countries have been made with the wild material selected on ability to set more pods on the branches.

This year, due to the change from gel-based markers to the new Lightscanner SNP system of low cost marker application (purchased by DAFWA in late November, 2013) markers were applied to F2-derived F3 plants and where appropriate markers for anthracnose resistance and phomopsis resistance were applied to remove susceptible and heterozygous F3 plants at the over-summer site at Manjimup.

Planting of the F4 lines occurred at Manjimup at the end of September in a system change implemented by Bevan Buirchell. It achieves better establishment in cooler weather compared to a November planting and single plant harvest occurs at more convenient time for the program during February, instead of at the beginning of April when trial seed preparation is at its peak.

The lupin breeding program runs yield trials at 3 sites in WA: Eradu (370km north of Perth) near Geraldton, Merredin (250km east of Perth) and Wongan Hills (150km north-east of Perth). The overall highest yielding named cultivar from S4 NVT trials in WA was PBA Barlock.

After 25 years at the helm of what is essentially the world’s only narrow leafed lupin breeding program PBA lupin breeder Dr Bevan Buirchell departed DAFWA in 2013. The lupin varieties released under Bevan’s leadership provide the varieties necessary to maintain a stable pulse rotation for many Western Australian farming systems and have created a unique industry for Western Australia. The numerous variety releases with higher yield, disease tolerance, herbicide tolerance and stability of performance are a credit to Bevan’s innovative plant breeding skills. His selection of new high performance genetic material has created an excellent pipeline of material for the lupin breeding program. The implementation of an effective and evolving molecular marker program under Bevan’s leadership is also a significant achievement and will assist the lupin breeding program into the future. Dr Jon Clements now leads the program after joining the PBA lupin breeding team as part of the PBA Lupin program succession plan in early 2013.

**Outlook 2014**

The lupin crossing program will continue progressing selections for both WA and the eastern states. Populations of eight wild types backcrossed to Mandelup have been developed for a new GRDC molecular marker breeding program companion project to begin in 2014. Four of these cross-derived populations will form a key part of the phenotyping for yield QTLs and the other four will be used to verify potential markers. A bulk up of Kalya/Tallerack RIL populations has generated enough seed to examine G x E interactions of alkaloid levels in 2014. This will identify markers for low stable alkaloids and help reduce environmental influences on alkaloid levels. The 2014 crossing program will endeavour to introduce traits and parents that include; early winter vigour/biomass; crosses amongst the best breeding lines with long term performance in different states (including NSW, SA, Vic); recent cultivar releases just imported from European breeding programs; and wild types.
PBA Strategy Reports

Strategy One

Target breeding of each PBA crop (chickpea, faba bean, field pea, lentil, and lupin) to specific production and likely expansion areas, based on crop adaptation to region and soil type.

The PBA breeding programs continue to develop improved varieties, while new technologies and genetics are becoming available to the programs from the current suite of pulse germplasm enhancement projects. PBA in partnership with Pulse Australia is examining desirable pulse traits and production requirements to ensure that PBA continues to meet the needs of the pulse industry beyond its current term. Issues being examined include: the potential influences of climate variability; the need for increased yield to meet the widening gap between pulse production and world consumption; international market demand; and Australian competitors.

Key attributes of the breeding programs include breeder succession with new breeders coming into most programs, the development of suitable testing environments to maximise selection for specific traits, and the increasing use of molecular and genetic markers to improve the efficiency of early generation selection.

The release of a number of new well adapted pulse varieties continues to underpin the success of PBA. The developing pipeline of new genetic material for potential commercialisation bodes well for the industry, as new varieties should meet market and producer need simultaneously.

Strategy Two

Use reliable information on evolving production (growers) and market (end-users) needs to refine PBA breeding priorities.

PBA continued to engage with the pulse industry in a number of ways in 2013. The PBA commercial partners provide regular feedback and reporting on the performance of PBA varieties, both in terms of grower satisfaction and acceptance by the marketplace via the Release Advisory Groups (RAGs). PBA with the assistance of Pulse Australia again presented a display of new varieties and advanced breeding lines at the Australian Grains Conference in 2013, with both Pulse Australia representatives and PBA breeders on hand to discuss pulse quality requirements with both domestic and international pulse marketers.

The PBA Inaugural Pulse Conference 2013 provided an opportunity for all levels of industry to come together, with a dedicated field day and the opening conference session focussed on current and future pulse markets requirements. Keynote speaker Mr Hakan Bahceci, President of the International Pulse Trade and Industries Confederation (CICILS IPTIC), attracted the attendance of a number of pulse traders and marketers promoting interactions across the industry.

The conference also afforded engagement with the pulse food/end use sector and associated research on pulses as functional foods, PBA will be looking to strengthen engagement with this sector to ensure requirements are translated into breeding outcomes.

PBA will continue to look for opportunities to engage with all of industry, particularly as plans for the 2016 International Year of the Pulse progress.
Currently much of the information received by PBA is collected informally, a more structured process to facilitate the capture of information year on year may be appropriate.

**Strategy Three**  
*Access technologies and germplasm to advance PBA breeding outcomes.*

PBA develops priorities for pre-breeding activities that are likely to contribute directly to the pursuit of the PBA vision. A number of pulse germplasm enhancement and priority trait projects have resulted from PBA priorities. These projects are now beginning to deliver technologies and germplasm such as molecular markers for breeding traits and herbicide tolerant germplasm.

Adoption of any new technologies and germplasm by the breeding programs requires resources (human, capital, financial, knowledge) and may entail some risks. PBA will in 2014 conduct an adoption gap analysis on current and imminently available technologies/trait being delivered from the pulse research projects to ensure the PBA breeding programs can take full and early advantage of these outputs.

**Strategy Four**  
*Optimise PBA breeding infrastructure and capability.*

In 2013 the PBA Research Capacity Project continued to support the PhD studies of Larn McMurray, a senior PBA agronomist with SARDI. A second round of submission to the PBA Research Capacity Project will be called in early 2014.

While the programs have differing requirements for infrastructure currently these requirements are negotiated within each agency. Ensuring all programs are aware of advancing technologies and that solutions to improve efficiency are shared between the programs assists with optimising infrastructure and capability.

Three PBA Technical Symposia have been held over the past six years. The symposiums draw together the PBA technical staff from across Australia at one of the PBA research sites to discuss and share research techniques and technologies. The aim of the symposium is to enable solution sharing to enhance PBA efficiencies through pulse technical excellence.

Below is a brief outline of improvements made across the PBA research sites as a result of information shared at the PBA Technical Symposia.

**Data capture**
DAFF Qld, SARDI, NSW DPI and DEPI Vic now use tablets and/or mobile phones and in-field data capture programs to improve the efficiency of field scoring plots. These changes were instigated by the 2012 Symposium at Hermitage Research Station (DAFF Qld).

**Sample labelling**
Barcoding of yield samples, which reduces the chance of subscription errors, is now used at DAFF Qld, SARDI and DEPI Vic following presentation of the technology at Horsham (DEPI Victoria) and Hermitage symposiums.

**GPS Technologies**
GPS auto steer is now used in a number of sites following its demonstration at the Horsham symposium, where it was being used by DEPI Vic. GPS auto steer has been adopted by DAFF Qld (CQ) at their research stations sites and in 2014 a mobile GPS station will be transported to grain grower’s properties for planting PBA chickpea trials.
GPS tripping (currently used by DAFWA) is being investigated by both DAFF Qld and DEPI Vic. The University of Adelaide team is also considering GPS steering and modifications to their plot seeder and harvester.

**Equipment**

Better informed decision making around the purchase of expensive equipment has resulted from information shared at the symposiums. Inspection of the DEPI Horsham Haldrup header assisted the DAFF CQ team in making the decision to purchase the same header as a replacement for their program. Harvester screens have been fitted in a number of programs.

**Improved methodologies**

The symposiums have led to better collaborations regarding methodologies, for example the use and application rates of fertilisers and improved the PBA teams’ awareness of seed material available across the PBA sites for experimental projects.

**Human Capacity**

A strong nationwide network of technicians allows information sharing as issues arise within any of the breeding programs. The development if this network has also led to a technical worker exchange with North America – further broadening the collective capacity of the group.

**Strategy Five**

*Maintain PBA breeding activities at Best Practice.*

Given the current resources the PBA Breeding Programs appear to be operating at best practice. Research papers delivered at the PBA Inaugural Pulse Conference 2013 highlighted the high standard of pulse breeding and research occurring within PBA and associated Australian pulse research. The conference provided the PBA breeding teams with an insight into some of the recent discoveries from international breeding programs and research organisations, which should translate to improvements in the PBA programs.

To maintain PBA breeding activities at best practice into the future the following issues are being examined; timely implementation of new technologies; appropriate priority setting for breeding outputs and required supporting research; program data management; and infrastructure monitoring to ensure that new and more efficient technologies are smoothly implemented.

Plans are underway to benchmark the PBA programs against an international breeding program in 2014.

**Strategy Six**

*Drive the maximum adoption of PBA varieties.*

PBA now has 28 pulse varieties, providing a range of viable pulse options across all cropping regions. A maximum adoption plan is developed by the commercial partner for review by the RAG’s for each new variety. Uptake based on seed sales and estimated areas sown is mapped against predictions. Year on year harvest deliveries for varieties which have been on the market for more than two seasons are now increasing markedly, as growers deliver grain after initially bulking up seed to increase their planting areas. Following initial bulk up periods PBA would now expect to see a more steady increase in the harvest delivery of the established PBA varieties over the coming seasons. The PBA seed partners also reported consistently strong seed sales for PBA varieties and increases in the number of growers buying seed across the PBA range.
Of particular interest for 2013 was the strong grower demand for PBA Hurricane XT. All seed available for 2013 was sold and many growers placed orders for the 2014 season. It is estimated that in 2014 about 15% of the total lentil areas will be sown to PBA Hurricane XT, indicating a strong grower desire for herbicide tolerance technologies.

**Strategy Seven**

*Improve the profile and influence of PBA in the Australian grains industry.*

The PBA Inaugural Pulse Conference was the centre point of strategy 7 in 2013. The event was widely publicised, both in Australia and internationally. Approximately 175 delegates attended the conference which attracted local and international scientists, pulse marketers, traders, and growers. The field day (approximately 120 participants) was well attended by local growers and industry representatives and provided a good backdrop for the promotion of the latest PBA varieties. The involvement of two renowned South Australian chefs, who prepared dishes with various pulses at the conference dinner, promoted media coverage of the conference and PBA beyond the rural press and into mainstream media.

A range of PBA promotional materials were again developed this year, with shirts and hats distributed to the PBA research teams, and items aimed at growers distributed at the conference and other field day events.

The PBA seasonal newsletter continues to gain readership, with contributions from both the PBA research team and associated pulse researchers. Initially sent only to the PBA research teams, at the end of 2013 it was distributed to 155 readers and has become a key communication tool for delivering PBA news and research findings.

In December 2013 the General Assembly of the United Nations in New York voted to proclaim 2016 as the International Year of Pulses 2016 (IYOP). This will provide a valuable opportunity for PBA to raise awareness of pulses in Australia and to highlight their contributions to health, nutrition and sustainability.

**Strategy Eight**

*Adopt a business approach to delivering breeding activities.*

In late 2013 a consultant was contracted by the GRDC to examine alternative business models for chickpea, field pea, lentils and faba bean variety development. The PBA Lupin program was excluded from the review as DAFWA instigated an ‘expression of interest in lupin breeding’ process in 2013.

The terms of reference for this review were determined in consultation with the PBA Board. The review report will be delivered in early 2014 for the consideration of the PBA partners.