International Potato Group Meeting

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AUSVEG Ltd

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International Potato Group Meeting

South Africa 2010

1 October 2010 – 31 March 2011

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Project Number: PT09054

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Abstract

The 2010 African Potato Association (APA) Conference and corresponding meeting of the International Potato Group (IPG) saw three Australian delegates from the Australian potato industry travel to South Africa in December 2010 to learn from, and be exposed to, the international potato growing industry.

The delegation to the APA Conference and IPG meeting was instigated by the need for the Australian potato industry to be involved with the international industry for the purpose of remaining competitive and staying up-to-date with international research and issues.

The Australian delegation comprised three high-profile members of the Australian potato industry, selected for their experience and knowledge across the three main focus areas of the IPG program, i.e., Research & Development (R & D), Marketing, and Strategy.

Introduction

Through Australian potato industry discussions and subsequent discussions with representatives of the New Zealand (NZ) potato industry, it was established that there was a need for Australian representation at the December 2010 meeting of the International Potato Group (IPG) in South Africa.

It was suggested that three high-profile members of the Australian potato industry attend the IPG meeting in Cape Town, South Africa, following an invitation to attend by the IPG, as well as the African Potato Association (APA) Conference prior to the meeting.

The IPG was formed through the World Potato Congress and the first meeting was held in 2007, followed by a second meeting in Christchurch, NZ, in 2009. The next meeting was set for 10 and 11 December 2010 in South Africa.

The IPG originally focused on Research and Development (R&D), however, since its inception its view has extended to include potato promotion and marketing.

The IPG Terms of Reference state: *The International Potato Group exists to foster collaborative relationships that deliver synergies to the industry from sharing knowledge focussed on Research and Development and Marketing. We also recognise that potatoes have huge strategic potential for feeding a growing and hungrier world population with nutritious food. Our role will also be to bring this strategic purpose to the attention of the world's policy makers in order to increase investment in the global potato industry at all levels.*

It was believed by key members of the Australian potato industry that participation from Australia should be at a high level for the purpose of retaining Australia's status as a leading potato producer.

The meeting was hosted by a member of the IPG, Potatoes South Africa (PSA). Prior to the meeting the APA Conference was held from 5-9 December 2010, which the Australian delegates also participated in. The theme of the APA Conference was "Potatoes and Sweet Potatoes – the driving force behind food security in South Africa".

It was proposed that the following members of the Australian potato industry travel to South Africa for these important events:

- AUSVEG CEO, Richard Mulcahy
- Chair of the Potato Technical Advisory Committee, Dr Kevin Clayton-Greene
- Horticulture Australia Limited Potato Industry Services Manager, Stuart Burgess

It has been widely recognised that trips of this kind are an important and effective industry development tool, providing the opportunity to foster collaborative relationships, develop personal skills, identify alternative business management practices, compare production systems and expand networks between members of the Australian potato industry and their international colleagues through sharing R&D knowledge, as well as ensuring Australia remains competitive in the global potato industry.

A key objective in participating in both the African Potato Association meeting and the International Potato Congress was to investigate the effectiveness of marketing programmes utilised by the potato industry in other countries. The purpose of the investigation and dialogue was to inform thinking within Australia in relation to the possible establishment of a Potato Marketing Levy for the Australian industry and follows on from work undertaken through project number PT09045.

A number of countries participated in the meetings and were able to demonstrate the use of marketing funds to further enhance acceptance of potato products in their respective markets.

Some countries demonstrated more effective and sophisticated use of marketing methods than other countries and no opposition to the continuation of these programmes was identified.

Some countries - notably South Africa and the UK - presented in strident terms the importance and effectiveness of their programmes.

The issue raised, however, with all countries was our quest to identify tangible data to demonstrate the impact that marketing programmes had made on per capita consumption in those markets.

Responses were varied in this regard with South Africa; in particular, contending that consumption had increased, however, this paralleled improvements in the standard of living amongst the black population and the consequential switch from maize to potatoes as a source of starch in the diet with increased affluence. It was also noted that all production of potatoes in South Africa could be sold i.e. there exists more capacity in the market than the industry is presently producing.

In the United Kingdom, the view was expressed that a decline in consumption had been arrested and this has been attributed to marketing initiatives from the industry.

Acknowledgments

The tour was facilitated by HAL in partnership with AUSVEG and was funded by the National Processed Potato and Fresh Potato Levies. The Australian Government provides matched funding for all of HAL's R&D activities.

Tour Participants

Name	**Organisation / Role**
Richard Mulcahy	AUSVEG CEO
Dr Kevin Clayton-Greene	Chair of the Potato Technical Advisory Group (TAG)
Stuart Burgess	Horticulture Australia Limited Potato Industry Services Manager

Itinerary

Date	**Travel**	**Activities**
Day 1 – 3 Dec 2010	Australia – South Africa	Depart Australia for South Africa

Day 2 – 4 Dec 2010	South Africa	Arrive in South Africa
Day 3 – 5 Dec 2010	South Africa	APA Conference Attend the welcome function at the hotel.
Day 4 – 6 Dec 2010	South Africa	APA Conference The APA Conference program commenced this morning. Registration opened. The President of the APA Mark du Plessis welcomed delegates. The day included a variety of sessions.
Day 5 – 7 Dec 2010	South Africa	APA Conference The day included a variety of sessions.
Day 6 – 8 Dec 2010	South Africa	APA Conference The day included a field visit to potato farms in the Sandveld production area of the Western Cape.
Day 7 – 9 Dec 2010	South Africa	APA Conference The day included a variety of sessions.
Day 8 – 10 Dec 2010	South Africa	IPG Meeting The IPG program began this morning with country overviews. In the afternoon groups split into various disciplines including R&D, Marketing and Strategy.
Day 9 – 11 Dec 2010	South Africa	IPG Meeting The IPG program continued, finishing at lunch time with networking trips organised for the afternoon.
Day 10 – 12 Dec 2010	South Africa	Depart South Africa for Australia.

APA Conference and IPG Meeting Report

The following report is a collation of the information collected during the Australian delegation's participation in the biennial conference of the African Potato Growers' Association and the subsequent meeting of the International Potato Group.

One of the delegates reported that many of the outcomes of the APA Conference aligned with the official Australian Government policy on African rural development and associated actions. The Australian Government has recently committed $100,000,000 over four years towards addressing food security concerns in Africa. The policy has been included in the following report and it also provides some feedback to the Australian potato sector on the possibility of links with countries such as South Africa that could be exploited.

Six countries participated in the IPG meeting. Attendance is by invitation only and competing countries are not normally invited to participate. An exception was Australia and New Zealand.

Several Provincial representatives attended as part of the Canadian delegation where the national organisation appears to hold less influence than the Provincial organisations.

African Potato Association Conference 2010

Conference program:

6 Dec 2010

The day included the following sessions:

- Opening address: The World and South Africa beyond 2010 – how a foxy futurist sees it
- Durable cisgenic resistance to late blight in potato caused by Phytophthora infestans
- Roots for Life: Securing the world potato collection for future generations
- Competitive and sustainable potato production
- Potato production in Angola – challenges and solutions
- An overview on potato production and protection in Tunisia and the possibilities of collaborative projects (bilateral or as a network)
- Piloting and adaptation of aeroponic technology for production potato mini-tubers in Uganda
- Quality seed potato (Solanum tuberosum L.) multiplication using aeroponics innovative system in Malawi: A successful technology transfer from International Potato Center
- Rapid minituber production systems with aeroponics
- Seed systems and farmers' willingness to pay for quality potato seeds in Kenya
- The south African Seed Potato Certification Scheme
- Imported seed potatoes as an opportunity for African potato farmers
- Response of potato (Solanum tuberosum L.) to seed size and seed reconditioning
- Effect of field multiplication generation on seed potato (Solanum tubersosum) quality in Kenya

7 Dec 2010

The day included the following sessions:

- Agricultural productivity trends in Africa (role of potato research)
- Development of sustainability indicators of potato
- Managing nitrogen in irrigated potato for maximum tuber yield, tuber quality and environmental conservation
- Effects of temperature on in situ growth and development of CIP potato clones in Burundi
- Irrigation management of potatoes in the Sandveld region of South Africa
- Conditions affecting the uptake and allocation of calcium
- Insecticides against two key pests in South Africa – are they still effective?

- Forecasting potato viruses in seed potato production using suction traps
- Management of potato virus Y (PVY) in seed potatoes using crop borders: the role of olfactory cues in host plant selection of Rhopalosiphum padi
- Influence of high temperature and water-deficit stress on the potato aphid (Macrosiphum euphorbiae (Thomas) (Hemiptera: Aphididae)
- Landing patterns of aphids in commercial seed potato fields
- Role of major aphids in the propagation of PVY in Tunisian potato fields
- Tuber necrotic strains of potato virus Y (PVY), an ongoing threat to the South African potato farmer

Session 1 – Potatoes

- The use of fluorescent protein tags towards understanding the disease cycle and future management of soft rotting Pectobacterium and Dickeya spp in South Africa
- R gene-mediated resistance to potato late blight
- Ralstonia solanacearum requires a tad system for roots adherence and virulence in vivo
- Discovery of novel gene expression in a 'hot spot' for pathogen resistance located on potato chromosome V
- A decision support system for late blight of potato
- Assessing nematode population levels in potato production soils

Session 2 related to Sweet Potatoes and was not participated in by the Australian delegates

Poster Session

- Occurrence of potato disease in Algeria
- Population dynamics of several species of Aspergillus and Penicillium in potato fields of Setif Region (Algeria)
- Activities of the "International Potato Center – sub-Saharan Africa (CIP-SSA)" in supplying quality potato seed in Eastern Africa
- Effect of mineral oil on aphid PVY propagation
- Tuber yield and quality of irrigated potato (Solanum tuberosum L) as influenced, by preceding green manure cover crops
- Landing patterns of Liriomyza huidobrensis (Blanchard) (Diptera: Agromyzidae) in potato fields
- ARC In Vitro Gene Bank: Securing the diversity of potato in South Africa
- Aphid montoring in seed potatoes in South Africa
- Assessing the potential of applying phosphonate fungicides to enhance host tolerance in

potato to late blight

8 Dec 2010

The day included a field visit to potato farms in the Sandveld production area of the Western Cape.

9 Dec 2010

The day included the following sessions:

- The new problems of potato quality diseases in Tunisia with reference to the black scurf (Rhizoctonia solani)
- Diagnosis, quantification and risk factors of soil-borne diseases on potatoes in South Africa
- The potato pest complex in South Africa
- Participatory innovation to enable small-scale farmers penetrate high-value potato market: A case of Nyabyumba United Farmers in Uganda
- Participatory plant breeding, is a complementary strategy to successful sweet potato breeding in Uganda
- Modelling water use of orange fleshed sweet potatoes using the AquaCrop Model
- Potential of contract farming between smallholder farmers and commercial buyers: a case of potato in Dedza, Malawi
- Farmer-to-farmer experts help African potato growers enhance food security
- Mentorship program and its challenges to small holder potato farmers in Limpopo Province: Case study on RESIS projects under potato production
- Triennial General Meeting of the African Potato Association

The event was held over four days and comprised presentations and posters from all over the continent, although sub-Saharan Africa featured the most prominently. Although mostly covering potatoes, sweet potato also featured prominently in the program.

A list of the papers and abstracts is provided in the Appendix.

The list of countries represented at the 8th Triennial Conference of the African Potato Association included: Angola; Tunisia; Uganda; Malawi; Kenya; East and Central Africa; Burundi; South Africa (Sandveld); South Africa (Limpopo Province); South Africa (Kwazulu-Natal); Mozambique; Algeria; Egypt; United Kingdom; Netherlands; Canada: United States; New Zealand; and, Australia.

While the production of potatoes in Africa is coming from an entirely different perspective to that in Australia or the west, generally the similarity in challenges that are confronting the industry are remarkable.

With the possible exception of South Africa, most countries in Africa are confronted by people who do not have enough to eat, diminishing resources and a scarcity of water. Potatoes, due to their efficient conversion of water and sunlight into dry matter, together with their good nutrient content, are seen as an important crop for food security in most African countries. Sweet potatoes are also important in combating Vitamin A deficiency due to their high beta-carotene content.

Across Africa, with the exception of South Africa, yields are low averaging 10.4t and ranging from 5 -14t/ha.

International Potato Center (CIP)

The following quote comes from the CIP website:

"The International Potato Center (known by its Spanish acronym, CIP) seeks to reduce poverty and achieve food security on a sustained basis in developing countries through scientific research and related activities on potato, sweet potato, other root and tuber crops, and on the improved management of natural resources in the Andes and other mountain areas.

CIP headquarters are in La Molina, outside of Lima, Peru's capital, in an irrigated coastal valley. CIP also has experimental stations in Huancayo in the high Andes and in San Ramón on the eastern, rainforest-covered slopes, taking advantage of Peru's varied geography and climate. The Center has another high Andes experiment station in Quito, Ecuador, and a worldwide network of regional offices and collaborators.

CIP has recruited an international team of scientists from 25 countries, supported by nationally recruited staff. In its first year of operation, CIP was funded by five donors. Today, the Center's budget is underwritten by more than 40 donors (http://www.cipotato.org/cip/donors.asp).

CIP is a member of the Alliance of the 15 centers of the Consultative Group on International Agricultural Research (CGIAR) and so receives its principal funding from the 58 governments, private foundations and international and regional organizations that constitute the CGIAR" (http://www.cgiar.org/).

The Australian delegates were addressed by Dr Peter VanderZaag, the Chair of CIP Board who is also looking for sponsors for the *"Roots for Life"* campaign. This campaign is designed to raise money to help preserve the world's potato germplasm collection in Peru.

A single native variety requires $5,000 to secure it. The aim is to secure sponsorship for 4,235 varieties in the first phase of the campaign. Information on this program can be found at www.rootsforlife.org.

Dr VanderZaag also gave a more general outline of CIP's activities.

CIP has an annual budget of $600million and operates through 15 centres and 40 countries. Their work is in countries where there is a food shortage. The Gates Foundation is a large donor. Their aim is to secure a fourfold increase in potato production in the developing world as a way of combating hunger.

The programs are based around particular environmental conditions. Thus the highland program includes the Andes and sub-Saharan Africa and concentrates on late blight and seed systems, whilst a temperate program in Central Asia focuses upon viruses, drought and seed. A lowland program looks at heat and earliness and a way of growing a potato crop inserted between rice seasons.

As we know potatoes form an important pillar in Chinese food security and the government, together with CIP, has established a center of excellence in Beijing.

Australian Government Policy

Australia works with governments to promote an enabling policy and institutional environment for rural development, private investment and business development. A central feature of the assistance is partnerships with the private sector as core collaborators and implementers. Activities include:

- **Agricultural research and development.**

Advances in agricultural technology offer great potential to increase farm productivity. Through the Australian Centre for International Agricultural Research, Australia provides leadership and fosters important regional collaboration.

- **Community-driven, small-scale rural infrastructure.**

Infrastructure support at the village level provides market access and generates employment.

- **Safeguards for the rural sector.**

Activities include the development of plans, veterinary infrastructure and skilled staff to build capacity for early detection and control of and response to livestock and crop diseases. Of particular concern are those livestock diseases that can be transmitted from animals to humans.

Food security

A major focus of AusAID's support for rural development is through its four-year $464 million *Food Security through Rural Development* initiative. The initiative focuses on: lifting agricultural productivity; improving access to and returns from markets; and, providing social safety nets to protect the vulnerable against economic and natural shocks.

Australia's response

In response the Australian Government developed a comprehensive approach targeting the immediate impacts of the crisis on the poorest, while also strengthening the foundations of long-term global food security. This response included emergency food assistance, increased funding for rural development and international collaboration to prioritise food security issues and pursue trade policy reforms.

The Australian Government is very concerned about the impact that ongoing food insecurity and price volatility is having on the poor in developing countries. To play its part in addressing this, on 12 May 2009, it announced a four-year, $464 million global food security initiative. The initiative aims to assist countries in Asia (estimated $182 million), Pacific (est. $66 million) and Africa (est. $100 million) affected by the global food crisis. It also reflects the government's commitment to increase support for Africa, with this additional $100 million committed to food security across the continent. The initiative focuses on:

1. Lifting agricultural productivity;
2. Improving rural livelihoods; and,
3. Building community resilience.

Lifting agricultural productivity

Australia will support increased agricultural productivity (est. $170 million) by increasing investments in agricultural research. Key strategic partnerships, including between the Australian Agency for International Development (AusAID), the Australian Centre for International Agricultural Research (ACIAR), the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and other centres of Australian expertise, will be enhanced.

The Government will also double current funding to the Consultative Group on International Agricultural Research (CGIAR) network. Created in 2006, the CGIAR brings together 15 international research centres to improve coordination and undertake joint research among centres and their partners on agricultural research for development. Collectively, the CGIAR works in 100 countries, utilises 2000 scientists and invests over US$500 million per year in agricultural research. It focuses on all facets of the agricultural sector including environmentally friendly farming techniques and food policies which benefit the poor. Without the CGIAR's work, it is estimated that developing countries would produce 7–8 per cent less food, world food and feed grain prices would be 18–21 per cent higher, and 13–15 million more children would be malnourished.

Expected outcomes include: Increased productivity of food crops, livestock and fisheries; using environmentally sustainable approaches; and, strengthened, more targeted international agricultural research, especially through the CGIAR network.

Improving rural livelihoods

Australia will work with other governments, donors and the private sector to influence and inform food policy and market activity including by promoting increased trade and the better functioning of markets that directly benefit the poor (est. $155 million).

Examples of programs likely to be supported include:

- Addressing market failures in the Solomon Islands, Indonesia and East Timor;
- Increasing revenues to Pacific Island Countries through better management of fisheries' resources;
- Generating export market opportunities in the Pacific; and,
- Enhancing regional trade opportunities and private sector participation in food production in Africa through the Comprehensive Africa Agriculture Development Program.

Expected outcomes include:

- Increased job opportunities and better returns on goods sold by the rural poor; and,
- An increased number of the poor accessing financial services.

Building community resilience

Reducing food insecurity for poor people involves more than increasing food production and making food markets more effective; it is also about expanding the capacity of poor people to access sufficient, nutritious food at all times, including during price shocks. Australia's focus under this component will be to strengthen and/or expand social protection programs so poor people can purchase or access food (est. $120 million).

Examples of programs likely to be supported include:

- Supporting community-driven development in the Philippines;
- Increasing funding for existing social protection activities in Cambodia;
- Providing social safety nets for the most vulnerable in Burma;

- Extending and strengthening existing social protection programs in Indonesia, East Timor and Bangladesh; and,
- Better management of coastal fisheries in the Pacific through disaster preparedness and mitigation strategies.

Funding will also be provided in Africa to help build community resilience.

Expected outcomes include:

- An increased number of poor men and women accessing resources to buy sufficient and diverse food;
- Improved targeting of beneficiaries through social protection programs; and,
- A reduction in the use of adverse strategies during times of economic stress, for example the removal of children from school or the sale of assets.

The Australian Government is also actively involved in promoting the benefits of open trade and efficient markets. This expands opportunities for farmers in developing countries helping them to maximise returns on their output and improve their incomes. Concluding the Doha Round of multilateral trade negotiations will reduce the distortions to global agricultural trade, especially production and export subsidies in developed countries, which disadvantage farmers in poorer developing countries. At the same time, Australia's agricultural and food production makes an important contribution to global food supplies.

Implications for Australian Horticulture

Varietal Improvement

The technology to develop GMO's already exists within the potato genus and there have been a number of lines already developed due to public concern these have not been released commercially. The Netherlands (Dr Anton Haverkort - Wageningen Uni and Research Centre) have already progressed this significantly using a hybrid and less controversial form of GMO technology.

The key issue is that developed countries are currently resisting such technology, however, developing countries are better placed to take advantage of such tools. The International Potato Centre (CIP) is a leading International Potato Research Organisation with a strong emphasis on potato genetics. Dr Tony Slater has already made links with CIP through Pamela Anderson (current CIP CEO) and more locally with Fernando Fernitas (SE Asia CIP Manager) and Meredith Bonlarval. Dr Slater met with Pamela and Meredith at the World Potato Congress in Christchurch NZ in 2008. Dr Slater prepared a submission for consideration in the Australian Potato Research Program 2 (APRP2). Whilst the submission was unsuccessful it outlines the future direction of proposed genetic improvement strategies for development of new frost tolerant and drought resistant varieties for the Australia industry.

Potatoes are a major food crop internationally and for Australia. The main commercial cultivars suffer from disease susceptibility and will be susceptible to heat and water stress caused by the threat of climate change. Project PT09028 has a number of research activities that address a common theme of pre-breeding physiology and genetics, and will develop techniques and germplasm to address these issues.

Australia may be impacted by climate change. If there is an increase in temperature, rainfall in southern Australia may decrease significantly with fewer but heavier events.

If this occurs, this could make it more difficult to provide consistent soil moisture levels for cultivars such as Russet Burbank and Nadine, which are drought sensitive. Potato production under such a scenario would require cultivars that are more tolerant of heat and drought.

New cultivars, either bred locally or off-shore, could, under that scenario, be needed in Australia that have the traits to overcome these issues. Research may be needed into the physiology and genetics of these important traits if there is to be development of cultivars suitable for Australian growing conditions under this scenario.

That being said, national water policy and our previous experience in dealing with droughts will be probably much more significant over the next 100 years than climate change.

This pre-breeding research will complement the work done within the APRP2's Disease Mitigation program and the National Potato Breeding Program's Strategic Trait Program and have outputs into the National Potato Breeding Program's Cultivar Development programs and disease management practices.

This project will have a number of research areas under a common theme of pre-breeding physiology and genetics. These areas include:

Subproject 1.

The identification of drought tolerant traits in potatoes and understanding the genetics behind these traits (NC1 – 2.3). Drought and heat tolerant cultivars will be compared to sensitive cultivars on both a morphological and physiological basis. Analysis of gene expression and progeny testing will be used to understand the genetics of the traits and to identify candidate genes for potential genetic marker development. International sources of funding will be sought to allow this work to be done as a collaboration between Department of Primary Industries Victoria (DPIV), Scottish Crop Research Institute (SCRI) and the International Potato Centre (CIP).

Subproject 2.

Genetic investigation of resistance to Common scab, TSWV and PCN (NC1 – 2.4). Crossing programs will be undertaken to investigate the genetics of resistance to these diseases. International sources of funding will be sought to allow this work to be done as a collaboration between DPIV, SCRI and CIP.

Subprojects 1 & 2. International collaboration and funding

Links have been established with the Scottish Crop Research Institute and the International Potato Centre, who are both interested in collaborating in pre-breeding research. For this collaboration to occur, suitable international funding sources need to be identified and applied for using the appropriate processes. It is anticipated that if this is successful, this funding will be used to lever HAL VC funds for subprojects 1 and 2. If the international funding cannot be sourced then subprojects 1 and 2 will need to cease or be funded from HAL levies.

A major outcome of the African Potato Association (APA) Conference and International Potato Group (IPG) meeting in Cape Town in December 2010 was the realisation that development of drought resistant varieties is of critical importance to food security across the world. There is potential for Australia to be part of this strategy, that may be of some benefit locally and also opening up potential opportunities in the likes of Sub-Saharan Africa and more importantly the work conducted by CIP.

Research Paper Summary

The major issues covered were soil borne diseases, viruses (especially Y and leaf roll), water availability and seed multiplication/quality. Of particular importance, which was highlighted on a number of occasions, was the inability of most farmers to access finance to effect improvements. This is a significant constraint on productivity gains.

Much of the work that was presented was from agencies such as CIP and was particularly focused on cultivar improvement and seed production.

Australian delegates found through discussions with some other western delegates that it appeared there were 'parallel universes' operating in research between the developed and developing worlds. Many areas of research being undertaken by countries classified as 'developing' had already been covered in other parts of the 'developed' world. Part of the reason for this may be attributed to the fact that the developing world operates in a very different paradigm to the developed world.

From an Australian perspective the situation with respect to virus Y was of most comparable concern.

A paper by Mike Storey from the UK highlighted some interesting data on pricing versus production. A five per cent increase in production above the average will see prices drop on average by 17 per cent, whilst a five per cent decrease will see prices rise by 23 per cent.

Fresh consumption has declined from 70 per cent of the crop in 1988 to only 52 per cent today and the industry is sitting on a generational 'time-bomb' due to the lack of interest in potatoes amongst younger generations. This is why a lot of promotional activity is directed at schools.

Numerous presentations highlighted the impact of the various Y strains across the continent.

Presentations/Discussions at the APA:

An informative discussion took place at the APA with **Dr Mike Storey of the UK** who cited success with a health programme extolling the qualities of potatoes in a dietary context and plans presented of programmes about to be launched in UK schools to target younger consumers and influence their dietary habits. It was conceded, however, by Dr Story that per capita consumption 'would probably not increase' because of these programmes.

He noted the difficulties associated with generic campaigns but one branded campaign for a UK company named Roosters is clearly working. This company supports its efforts with extensive advertising campaigns. The strength of marketing campaigns has forced major supermarkets to stock the brand to meet consumer demand.

(It should be noted that Dr Storey also undertook the review of APRP 1 in Australia).

Dr Storey also expressed the view that, despite marketing efforts, he does not believe the USA has increased domestic per capita consumption.

In discussions with **Mark du Plessis, the CEO of Potatoes South Africa**, it was indicated that it was difficult to produce hard data to support claims as to the effectiveness of their marketing campaigns as all potatoes produced are sold.

It was also explained that potato consumption varies between provinces with the Western Cape being in the top two or three areas for consumption. He noted that the black population mainly consumes maize and this is seen as the main rival to potatoes. As cited in the introduction, the view was also expressed that as the black community achieves greater affluence, so does the diet switch from maize as a starch item to potatoes. It is notable that the highest per capita consumption of potatoes is in the most affluent parts of South Africa.

Mark du Plessis, unlike Dr Storey, is more positive about the potential benefits arising from generic campaigns and believes they can work.

Approximately 25% of the levy collected in South Africa is spent on marketing and this amounts to approximately 5 million Rand. (The other areas of expenditure for their levy are 5 million Rand is expended on R & D, 5 million Rand is spent on information and communications and 5 million Rand is spent on black economic empowerment.) In terms of this funding, only 10% is provided by the Government of the Republic of South Africa.

Further discussions with UK representatives revealed that a new horticulture umbrella body has been recently established - somewhat similar to HAL - but the organisation is struggling in these early days. The organisation is governed by a group made up of the Chairs of the key agricultural sectors and the CEOs of the constituent bodies influence the management direction in the new body. Some uncertainty exists as to whether this new body will survive the test of time.

In other presentations, it was noted that the UK is the world's twelfth largest potato producer and the tenth largest consumer of potatoes. It was noted that there are now fewer than 3,000 producers in contrast to 75,000 producers 40 years ago. 45% of the potato crop is for fresh potatoes and older families are the biggest consumers of potatoes. Young consumers are in decline in terms of potato consumption.

The biggest threats identified in the UK in relation to potato consumption are pasta, health concerns and young consumers. Acrylamide is also emerging as an issue of major concern from a health perspective as it is a known carcinogen and formed when potatoes (and other carbohydrates) are subjected to temperatures over 170^{o}C.

In terms of the UK levy, 24% is spent on marketing and corporate affairs.

A marketing campaign directed at young consumers at school level should reach 350,000 individuals.

Again, UK presenters spoke of the need for GM resistant varieties.

New Zealand colleagues were keen to discuss the state of Zebra Chip disease in their country. They indicated a willingness to participate in the AUSVEG 2011 Convention and to discuss this further. (Subsequently, a joint Australia-New Zealand Potato Summit has been organised and New Zealand will present an update on the state of their campaign against Zebra Chip disease.)

A range of presentations were provided at the APA together from different African nations with detailed statistical information on the South African industry including relativity to other nations globally and on the African continent. In particular, it is worth noting that South Africa is the third largest potato producer in the continent preceded by Egypt then Algeria.

In the context of marketing, competitive markets and disease resistance the view was expressed at the conference that economic circumstances will inevitably lead to the production of GM potatoes in Africa.

International Potato Group meeting 2010

Covering three sectors of the industry; strategic, marketing and R & D, the IPG comprises representatives from six countries: Australia, Canada, NZ, South Africa, UK and the USA. The group was started in South Africa.

This was the third meeting of the group and there had been a number of personnel changes since the last meeting in Christchurch at the World Potato Congress (WPC) in March 2009.

Expected Outcomes of the IPG Program:

- Establishing a procedure;
- Inter-group communication;
- Measurable values/outcomes;
- Promoting the IPG;
- Networking;
- Benchmarking; and,
- Information Sharing.

Country overviews

South Africa

Potatoes South Africa is well-funded employing 28 staff or whom 25 are full-time.

The levy split is already covered in this report.

South Africa is aiming to increase per capita consumption by 4%, exports by 7-10%and to reduce costs by 2% i.e. enjoy lower cost increases than inflation.

A major concern is the increasing cost of electricity, estimated to increase by substantially over the next five years.

The organisation holds around 140-150 meetings annually with growers in South Africa.

New Zealand

It was noted that seed certification is handled by a sub-group of Potatoes New Zealand. There are 235 growers in New Zealand and they are exporting around 500,000 tonnes annually.

It was reported that New Zealand is holding consumption and there is no decline in per capita consumption. 60% of production in New Zealand is for processing.

Canada

It was noted that Prince Edward Island is the number one producer in Canada followed by Manitoba. Both Provinces were part of the IPG meeting.

It was reported that Wal-Mart now requires all growers to be part of an IPM programme. McDonald's shareholders are also demanding reductions in pesticide use.

Communications with government is a key priority for the Canadian Potato Council.

Provincial industry funding occurs on a voluntary basis.

UK

Potato levies received amount to 6.1 million pounds per annum.

The UK Potato Council is now a division of the UK Agriculture and Horticulture Development Board.

The UK has experienced a dramatic fall in per capita consumption leading to there now being only 2,575 growers, however, this has now stabilised. The UK group has 30 staff.

Health perceptions of potatoes are an important area of interest with market research revealing that consumers see potatoes as part of a 'heavy meal'. Total sales of fresh are now stable; however, per capita consumption is still falling with a 3% decline in potato meal inclusions.

USA

Volatility was cited as an issue due to the potential for contracts to be cancelled.

Retailers are also pressing for one point of supply and declining sales were experienced through the GFC. There has been per capita consumption declines over the past two decades, however, this has now stabilised.

The popularity of the Atkins diet and similar programmes has permanently damaged sales.

The largest consumers of potatoes are traditionally low income consumers.

A disconnect between State University researchers and the industry overall was cited.

IPG Country Presentations (R&D)

The meeting began with the representative outlining the structure of R & D in their respective country and also covering off on the major issues confronting their industry. This is summarised below.

This report covers the results from the R & D group meetings. At this meeting there was no research representative from the USA, thus only a brief outline of the US situation has been included in this report.

Canada

The government funds R & D and the process is very disjointed with researchers doing what they want rather than what is required. There is little co-ordination and growers are disengaged from the process. Thus at a national level there is little opportunity to influence R & D, however, at the local or regional level it is much stronger.

The loss of expertise at a national level is of concern.

There is a government-lead breeding program that is regarded as a waste of money. The money actually goes to N Dakota State University and it is mostly designed around crisping varieties.

Knowledge transfer is best described as ad-hoc. There is a need for growers to take control of the whole R & D process. The Government is favourably disposed towards a levy but industry is equivocal.

Late blight, bacterial ring rot and PCN are all significant issues. In addition issues such as QA, export development and Integrated Pest Management (IPM) (being driven by McDonalds) are facing the industry. Currently Canada is finalising an agreement with the US to recognise historical testing for PCN. The suspected PCN outbreak some time ago saw a 50 per cent drop in exports to the US. To export seed to the US growers are required to sample one kilogram of soil per hectare.

New Zealand

Production totals 500,000tonne (t) each year, and of this total, 29,000t of fresh and 68,000t of processed potatoes are exported. Consumers in NZ largely accept that potatoes are good for your health and thus promotion does not continually have to fight a negative perception.

There are 205 growers in NZ and they pay a levy at first point of sale of 0.075 per cent. There is a compulsory vote on the levy every 5 years and it must be passed by 50 per cent of producers. Potatoes NZ is now technically insolvent (-$190,000) due to the expenditure on R & D associated with the Tomato Potato Psyllid (TPP), however, a call for a voluntary extra levy has so far netted an extra $300,000. There is also an agreement with the breeding program that is returning eight per cent of royalties, which brought in $100,000 last year. Although Potatoes NZ is a grower organisation it is now morphing into a whole of industry body.

Until now the research program has been rather reactive but Horticulture NZ is developing a strategic approach. R & D is funded by growers and levies are allocated on a ‘quid pro quo’ basis. Crop and Food is the major R & D provider and potatoes are regarded as a core crop. As such they form part of a government funded “Future Vegetable Project”. There are 4 PhD projects operating under this program as well. Currently TPP is taking up nearly all levy funding. Other priorities are environmental responsibility and agricultural chemical reassessments. Nitrogen management is a significant issue. There is no matching funding for levies, only a competitive grant system for R & D funds.

Potatoes NZ hosts a website and emails out regular newsletters. The website has a special portal for the TPP problem.

Grower meetings are held regularly and industry involvement with the science is high. If anything it appears the TPP issue has acted as a rallying point for the industry.

South Africa

The aesthetics of washed potatoes in South Africa is very high, similar to that from the Mallee region in Australia. Production costs are high despite the low wages and this is largely due to the high cost of inputs such as fertiliser, electricity and, increasingly, water. For example, electricity charges are rising 25 per cent annually. The country does not have enough electricity and this is imported from Lesotho. Seed makes up roughly one third of input cost. Production costs were quoted as being around AUD$15-17,000 per ha. Approximately 80,000t of raw product is imported every year for processing.

Grower numbers have dropped to 640 from over 2,000 just five years ago. Nonetheless 60 per cent of farms are less than 50ha. South Africa needs to double its food production by 2050 and water is scarce. Currently, irrigated horticulture uses 900mm/yr and yet rain inputs are only 450mm/yr.

In South Africa the R & D is almost entirely funded by growers. Less than five per cent comes from Government. The levy is primarily collected from bag manufacturers and this comprises 89 per cent of collected funds. The other remaining sources are from processors and seed producers.

Funding for breeding was stopped two years ago as it was realised that it was better to provide a platform for private imports. Some of the companies involved pay for the evaluation work themselves.

R & D is defined by an R & D committee which has grower representatives from the production regions, processing reps and two seed growers. They select researchers to do research and a trust approves the project. Projects run from three to five years and there is very rarely any project of less than three years that gets funded.

Water, Powdery scab and PVY^{ntn} are the three biggest issues together with energy costs and land reform.

The extension/knowledge transfer process is grower driven. Each of the production areas has its own grower group. This group actually repeats the work on a selected property with input from the researcher. For example, if a project found that a particular type of treatment worked for improving tuber numbers, then this treatment would be compared in a growers paddock against the standard practice for that region. The work would also be done on a sound scientific base with replications so that it could be properly evaluated. Some of these grower groups have even invested in their own equipment for managing small scale trials. During the course of the trial and afterwards the researchers are asked for input and also to help with interpretations.

This is a particularly attractive model as it has both parties working closely together and thus gaining a much deeper understanding of the other's operating imperatives.

UK

The UK R & D program is highly integrated and is funded through a national levy. Research is also on a three to five year timescale and has to be aligned with industry. Thus it needs to deliver practical competitive benefits. There is no breeding program. It is worth noting that the UK Potato Council receives six million pounds per year from levies of which 4.8 million is from growers and 1.2 million from buyers. From this pie 28 per cent is spent on R & D and 17 per cent on knowledge transfer, which means that over one third of R & D funding is on extension activities. From being an independent body two years ago, the Potato Council is now part of the Agricultural and Horticultural Development Board (AHDB), which was constructed as an efficiency measure by the UK government and is an amalgam of five sectors with potatoes; that were previously separate. They were horticulture, milk, pigs, cereals

and oil seeds and beef and lamb. The AHDB can only operate in areas in which there is demonstrable market failure.

The average cost of potato production in the UK is approximately $205 per tonne and yields have reached a plateau.

In the UK the issue of knowledge transfer has a local and also a campaign focus. What this means in practice is that the key findings from R & D are repeated in the field with local grower groups but also relevant to their particular circumstances. The model is somewhat akin to the McCain grower groups (in Tasmania) or the Birchip Cropping Group. The council employs four full time officers from various regions in the country whose task it is to enact the work at a local level, organise field days, farm tours and properly constituted field trials directly with these grower groups. Like Australia, different parts of the UK have a different emphasis, thus in some areas a campaign may be orientated more to processing, whilst in others toward fresh or seed etc. The advantage is that growers are actively engaged and are part of the process (i.e. not having a process delivered to them) and secondly that field work is properly constructed so that results can be interpreted statistically.

R & D priorities are soil borne diseases, especially powdery scab and the new spp of *Dickeyia*.

Type A2 blight is now a very serious issue and now comprises 75 per cent of infections. In addition, the appearance of *Dickeyia solani*, which is a very aggressive form of blackleg, is a major concern. In 2009 it cost the Dutch industry 27 million Euro.

CIPC related R & D is also of importance. Other areas confronting the industry are waste water, climate change and carbon footprinting.

US

In the US, as elsewhere, there has been a dramatic decline in grower numbers from 3,000 down to 1,600 over the past 10 years. The industry is split roughly 50/50 between processed and fresh. The fresh industry is consolidating into regional alliances as retailers increasingly opt for single source suppliers. The decline of recent years, which was partly exacerbated by the economic slowdown, has stabilised. The development of shelf-stable 60 second rice two years ago had a huge impact upon potato production.

Sixty seven per cent of US meals are now single serves.

The US Potato Board is funded via a levy which brings in $12 million per annum and its activities are governed by the USDA.

There is $6.5m US Govt funding for export development.

R & D has five focus points and is designed to reveal market opportunities. Innovation R & D has not been very successful to date. There is little crossover in growers between fresh and processed and knowledge transfer is lead by the directors of state associations, who also direct the R & D. The fresh market R & D is still very state-specific, whilst the processed sector is adopting a national approach.

Discussion

Both in the African Potato Association Meeting and also in the more restricted IPG meeting there was a remarkable concordance on the major R & D challenges facing the industry.

In no particular order these challenges can be summarised as follows:

(1) Soil borne pathogens, particularly powdery scab and bacterial ring rot, with emergence of the new species of *Dickeya* in England and the Netherlands, were of particular concern. There was

also the issue of ensuring that countries adopt that same system for characterising fungal pathogen strains, so that results can be aligned.

(2) Tomato Potato Psyllid is a pest in some countries and very real threat in others. As an adjunct to this issue there is growing concern about the role of phytoplasmas in other vegetable crops, such as carrots, with symptoms every bit as serious as TPP, however, there is also very little known about these organisms.

(3) PVY (especially the ntn strain). The new PVY strains are causing major havoc across Africa and their ability to form recombinants is particularly worrying. There is no doubt a case for at the very least an education campaign in Australia to make growers aware of the consequences of poor hygiene practices in seed.

(4) Late Blight and the rapid expansion and development of the type A2 strain is of great concern.

(5) Water use/availability and the regulatory implications. Environmental compliance, particularly the looming issues of Carbon footprinting and associated legislation. An example here is that although the schemes that will be invoked in each country will be driven by retailers, it is highly likely that they will be different in some areas and it may be necessary to determine differences and equivalences. Most countries were concerned about the need for the industry to at least stay up-to-date with the situation as it evolves.

South Africa has the same issues with water use and scarcity as in Australia, whilst in the UK it has more to do with water disposal. Naturally the various issues associated with 'climate change' were a hot topic, particularly in the UK. Many of the UK topics were being driven by both retailers and the European Parliament.

Resolutions

IPG R & D Group Structure

This meeting resolved to set up a more formalised structure in order to develop a framework that is system orientated.

Before the meeting was held the group had been very informal and relied upon personal relationships to function. Whilst this is satisfactory it does not provide a basis for future development. If key personnel leave there is nothing to sustain the group for the future.

To this end there were some significant developments. It is apparent the project formulating process is similar across all countries and more importantly occurs at more or less the same time of year.

Under the aegis of the South African (SA) Potato Growers Association a web portal will be established. This will be password protected and access restricted.

Its purpose will be to provide a means of recording the 'corporate development' of the organisation, and to facilitate the exchange of project abstracts to provide a formal venue for aligning common R & D projects. Particular care will be taken to protect the IP of individuals and groups to avoid plagiarism, however, it will mean that the R&D providers in each country will have the opportunity to better direct R & D ensuing there is less overlap and greater harmonisation of research. It will also help avoid the situation where R & D that has already been performed in one country is not repeated in another.

The group also resolved to have twice yearly video conferences to follow up jointly on matters. This will be on a rotating basis and the UK will chair/host the first. This will ensure that momentum is maintained between face-to-face meetings. For example the next meeting will not be held until May 2012 at the WPC in Edinburgh, Scotland.

It is also desirable that those involved in this process do not have any vested interest in the outcome of decisions, i.e. they are not R &D or service providers. This will help keep a strategic approach and also avoid potential conflicts of interest and confidentiality issues.

Science

It was apparent that the major R&D concerns across the network were very similar, however, funding mechanisms are very different and these are summarized in Appendix 1.

The group noted that a couple of recent projects that involved international collaboration had been very successful however all countries felt that there was a need to continue this process and ensure R & D providers continue on this path wherever appropriate.

It was felt that there was a need for closer ties with CIP. Some of the work in which CIP is involved would benefit greatly from the outputs from projects already completed whilst the group would or may be able to access results and data from CIP projects. At present CIP and the R &D from the developed world are operating in 'parallel universes'.

Benefit to Australia and R&D Recommendations

Participation

Prior to attendance there were concerns as to what a group like this could achieve and whether there would be any long-term tangible benefits to flow from participation especially given the cost. Despite these concerns, it is clear that Australia has much to gain and little to lose from participation in this group. The similarity of issues faced by the industry, not only within the IPG, but throughout the world is striking. This fact together with the diminishing amount of money for R &D and the increasing complexity and cost of good research demand that wherever possible collaboration and synergies be sought.

Research

Virus Y

This is an area demanding urgent attention in Australia. The emergence of asymptomatic strains, Australia's rather cavalier approach to the use of certified seed and the reluctance of the industry to embrace full virus testing is of great concern. It is of such concern that notwithstanding current interstate quarantine issues of PCN and bacterial wilt etc., it should be a quarantinable disease in itself. Given the situation elsewhere in the world with respect to this virus it is difficult to argue against any movement of material from known PVY areas to those where the disease is absent such as WA and TAS.

In South Africa the appearance of tuber necrosis as a result of PVY^{ntn} infection is increasing sharply.

An industry wide campaign in all states is required. The first priority should be getting handling practices up to speed but it may also be necessary to embark upon an international R & D programme in the future.

Of great concern is the importation of material from overseas. Although this is routinely tested by ELIZA, the experience of South Africa is that this method is not sufficiently sensitive. A number of varieties brought into the country that tested negatively to PVY^{ntn} have subsequently been found by both PCR and real-time PCR to contain the virus. This is believed to be a reason why the virus is almost out of control. The practice of keeping smalls for replanting (kept seed) has exacerbated the problem as in many varieties the only symptom of Y is the production of small tubers.

A risk assessment to establish whether the current requirements for importation of planting material from overseas is adequate to prevent new more virulent strains entering the country.

Knowledge Transfer

This is perhaps the area where Australia has the greatest to obtain benefit and although the situation in most of the member countries was better than in Australia it is apparent that a lot of synergy can be obtained through collaboration and idea exchange. Of the countries participating most had some issues with knowledge transfer, however South Africa has very good 'models' in place and these are discussed below.

Both the UK and South African models share many similarities. It is always hard to ascertain the effectiveness of knowledge transfer

The UK and SA models are both worthwhile and it is recommended that Australia re-evaluate its approach. Over the past thirty years knowledge transfer has been a continual issue and the Australian horticultural industries have wasted millions of dollars on this topic.

The basic problem is a lack of engagement from both sides of the fence. Whilst some strides have been made in some sectors, overall the issue still remains intractable and it is difficult to see any sign that it will improve in the near future.

Whilst diagnosing the problem is easy, coming up with alternatives is a lot harder and then obtaining agreement is even more difficult. As a result of these difficulties affecting change has been very difficult.

IPG Country Presentations (Marketing)

South Africa

As cited in earlier private discussions the industry in South Africa is committed to increasing per capita consumption with matching supply.

Increased consumption will be achieved through the introduction of new products to the market, further development of export markets and capturing a greater share of the local market.

Potatoes SA is seeking to further grow the supply chain relationship and is ultimately aiming to position potatoes as the number one staple food.

Their programmes are also designed to influence consumer perceptions of potatoes in a positive fashion.

Potatoes SA stressed the importance of the supply chain relationship but noted the challenges of 'getting in'. They have been involved in in-store promotions in fresh produce marketing and they also conduct hawker training programmes.

60% of the South African market is for fresh product. Only 12% is retail, 20% goes to processing, exports are 7% and the rural trade is around 40%.

Potatoes SA resource their marketing activities with two full-time staff. They also use external agencies.

Potatoes SA also undertake demand forecasting but growers expressed the view that this is not such a good idea as this can encourage growers to leave potatoes in the ground. In summary, on the issue of forecasting, Potatoes SA expressed doubts that the forecasting model really works.

The South African Government provides the industry with funds for overseas marketing but exporters must adhere to a Code of Conduct.

Potatoes SA also provides daily price information in relation to the top 10% of potato sales. SMS communications are also used to convey information on the various classes of potatoes.

Some of the measures used by Potatoes SA to determine the state of the market include per capita consumption figures; a four yearly comprehensive survey and overall sales versus the growth in the South African population.

It was noted that trends in the South African market are reflective of global trends.

Canada & Provinces

Potatoes Canada is resurrecting export development after around 30 years of inactivity. The organisation has a modest budget of only $CDN600,000 per annum.

It was noted that there exists a Canadian Horticulture Council that primarily does lobbying on fruit and vegetable industry issues.

The United Potato Growers of Canada has key sponsors and undertakes marketing seminars across Canada.

It was noted that trade in Canada is largely North/South rather than East/West.

'Consumption' issued are largely examined by the National Potato Committee in the Canadian Horticulture Council.

Quebec Province

80% of all sales occur through supermarket chains. Prices tend to be fixed. (It is assumed this means contracted).

They expend around $700,000 annually on marketing and their focus is on a health strategy.

The Quebec industry has developed a multi-media campaign comprising print, point of sale, retail competitions and public relations elements. The programme is heavily supported by Quebec growers.

Ontario Province

Due to their being only two or three bag manufacturers it is easy to collect a marketing levy which is set at the rate of two cents per bag, however, the industry does not do their own promotional programme.

Rather this is undertaken as part of a broader programme entitled Foodland Ontario that expends over $CDN52 million over a number of years and has been established to promote local food products from Ontario.

This programme reflects the competition that exists between Canada's Provinces and the support of Provincial governments in some cases and is not unlike the state competition existing in the United States. Buy local is a strongly supported concept in Canada.

Manitoba

This province has a very similar set of arrangements to those existing in Western Australia with a high level of regulatory control, quotas in place and also a closed loop production and marketing arrangement applying.

Alberta/New Brunswick

Very little marketing occurs in these provinces, notwithstanding the fact that the McCain's headquarters is located in New Brunswick.

British Columbia, Saskatchewan and Nova Scotia

Very little marketing occurs in these provinces.

Prince Edward Island Province

They have promoted the 'moderation' message in relation to potato consumption to address health concerns but do not believe this has worked. They expend $CDN550,000 on marketing.

The Canadians reported on research that suggested that consumers don't buy on price. Indeed, only 6% buy on the basis of price.

There are five major retailers across Canada and they control around 80% of the market.

41% of consumers aged 55 or older are loyal to Prince Edward Island potatoes.

PEI producers use their own bags as an effective communications tool and traditionally potatoes are sold in 5lb. or 10 lb. bags.

The market is essentially composed of washed potatoes.

United States

Despite potatoes being fresh and natural, consumer perceptions of potatoes are that they are not a healthy product and are essentially seen as starch and not a vegetable.

In the USA they don't market potatoes by variety types. They have been mostly 'inspired' by UK practice.

Potatoes 'underperform' from a health perspective. It needs to be recognised that they are not eaten on their own but more typically with butter, cream, cheese etc.

The US believes that it is vital to leverage the 'fresh and natural' qualities.

The message of potato goodness has been utilised noting claims such as potatoes being a source of 45% of one's daily requirement of vitamin C, they are fat free, and full of vitamins and minerals. Nutritional information is supplied with recipes as part of their marketing initiatives but the finished products have to look tasty and 'not be too weird'.

Their messages about potatoes include being tasty, convenient, healthy, economic (cost reasonable) and can be prepared in 30 minutes or less.

The GFC saw potato sales decline during this period. Up until this time consumers had a 'loaded pantry' but with the GFC consumers shopped more often, purchased less and avoided waste with purchasing behaviour switching for 20lb to 10lb to 5lb bags of potatoes. In summary, consumers were reducing their purchasing sizes.

In terms of meal consumption of potatoes, US data reveals that 80% of households consume potatoes on seven occasions over the course of every two weeks. But data also reveals that there is a downward trajectory in terms of US consumption as consumers move towards simplification of their dinner meal.

Other benefits cited in potato marketing are that they contain more potassium than a banana.

One indication of the success of the US marketing activities is that they have recorded more than 15,000 recipe downloads. But in response to questioning about the overall impact on consumption, US representatives were unable to cite any evidence of a direct effect on consumption overall.

The gluten-free properties of potatoes are also being promoted and a multi-level approach is being taken in relation to marketing –retailers, consumers and nutritionists. The US programme includes meeting buyers, heads of produce departments in stores, retail merchandisers.

They regularly convene meetings at a locality and have 20-40 participants from these target groups cited above, where they share valuable US consumer data collected by the industry. Participants also often include growers, marketers and industry people.

The frequency of potato consumption is a major issue. Potatoes are mainly consumed on occasions where traditional meals are taken.

Some of the new product initiatives being utilised to improve frequency of consumption include the "mashed in minutes' products that are prepared and ready to eat simply after heating. These products are shelf stable and only require 60 seconds before being ready to eat.

It was also noted that in the USA, the fragmentation of activities between potato producing States causes difficulty. The view was expressed that it would be much better if the States pooled funds for marketing activities.

New Zealand

New Zealand representatives reported that a consumer survey had been conducted in 2006. It was reported that in 2008 potato sales had increased by 30%.

The direction of the NZ marketing had been a 'focus on food'.

Articles are prepared and sent to food writers to encourage positive media reports on potatoes. Flowers are sent to writers when positive articles appear.

The onslaught of the Zebra Chip disease has disrupted sales progress in New Zealand for the potato industry.

The marketing budget for the New Zealand potato industry is $NZ200,000.

In the 2006 study, 1,000 households were surveyed and potato use was similar in 50% of households.

Marketing initiatives have focussed on the children of loyal consumers.

It was ascertained that 52% of consumers are dissatisfied with the labelling of food products.

Healthy bargain hunters buy foods that are on special.

The NZ marketing representative has her own company that is involved in the marketing programme and it stands separately from Potatoes New Zealand.

One of the initiatives taken has been to teach children to cook and targeting grandchildren of loyal consumers has also been one of their initiatives.

Public relations activities is the core focus of the New Zealand programme.

Some government funding has been sourced for work on French fries. 57% of sales are through independents and a theme has been developed entitled "Tips for better chips".

Posters have been produced and utilised and fat content has been lowered by 20% as part of this programme.

A chip group has been set up in New Zealand and badges and certificates are awarded to participants. There are eight modules in the programme and children, in particular, love the certificates issued.

Whereas the US identified that there had been a fall in potato servings of 1.6 billion in 10 years, New Zealand claimed that they had not experienced any fall in consumption.

United Kingdom

The UK representative noted that in 2007 there had been a massive fall in chip sales.

There has been a 3% decline in meal occasions where potatoes had been consumed in the past 10 years.

Pasta consumption is stable and rice is growing. The potato industry is losing young consumers with 66% of regular consumers of potatoes being aged over 45 years.

Potato consumption has also declined in mid-week meals with growing consumer demand for quick and simple meals.

With the concept of 'nostalgia' there may be room to grow product sales in sectors in Britain but there does not appear to be room to grow the category.

In terms of the USP for potatoes (Unique selling proposition) there is no clear answer.

Core themes in the UK marketing programme are tasty, versatility, healthy and sustainability.

The UK also has 10 potato ambassadors with one being for each media area. There were more than 50 applicants for these positions and successful appointees were carefully selected, especially for their capacity and presentation skills for media. All Ambassadors selected were put through media training and they were essentially younger growers.

The marketing programme targets activities to different segments. It was noted that in terms of food, children are considered not to be adventurous.

An example of the versatility in marketing was the creation of potato tapas meals.

Insight and market data is one of the key services provided by Potatoes UK and there are twenty market reports produced annually.

Another fascinating revelation in the UK is that fork dishes now outrank dishes requiring knives by 2 to 1.

The UK industry undertakes tracking research in relation to consumer behaviour 2 to 3 times annually.

New convection ovens have become popular amongst young professionals in the UK. Research also revealed that 25% of consumers would buy more potatoes if there was greater consistency with the products.

Of particular interest has been the success of the "Rooster" brand in the UK. This group expends around 3 million UK pounds annually and this has led to great success. This group provides 20 varieties to retailers; however, research suggests that this large range of varieties tends to confuse consumers.

The promotion of recipes is part of the UK programme, and peer recommendation is being seen as of increasing importance in terms of sales. Emphasis on on-line dialogue is also being seen as important with substantial funds being expended now by Potatoes UK on search engine optimisation measures.

All organisations participating in the IPG meeting attached great 'dollar' value on their free media coverage on behalf of the sector; something Australia has not done to date although could do in view of our extraordinary free media coverage of potato issues.

In the UK, 11,300 schools are participating in their "Grow Your Own Potatoes" programme. The programme is currently being piloted in secondary schools.

Marketing Recommendations

1. That AUSVEG be commissioned to undertake a study in cooperation with Potatoes WA and Western Potatoes to measure the impact of their marketing programmes on a) increasing consumption of potatoes, taking into account population growth and advertising campaigns; b) arresting declining potato consumption. The study would be managed by AUSVEG and utilise the advice of an advertising specialist to undertake the study.

2. Should the results of this study provide sufficient evidence to support the effectiveness of such activities, a voluntary marketing levy be established in a small market such as Tasmania with more manageable media spend. This project would involve a management group comprising AUSVEG representatives, representation from the Tasmanian potato industry and advertising and marketing specialists to develop a two year advertising and marketing programme. The programme would involve testing impacts on per capita consumption as well as arresting decline in consumption by consumers.

3. If positive results are reported from these projects, AUSVEG should then seek to gain industry support for the introduction of a national marketing levy to support national marketing and advertising programmes for the Australian potato industry.

4. Concurrently, further research should be undertaken to measure interest in developing a cooperative branded programme, similar to the branded success of the Rooster range in the UK to enable a collection of growers to produce potatoes and a common label with advertising and marketing support. Consistency in quality control will need to be a major consideration in such a programme. See articles detailing Rooster brand successes:
   http://www.talkingretail.com/products/product-news/albert-bartlett-extends-rooster-potato-range-into-frozen-market

   http://www.fmcgnews.co.uk/rooster-potatoes-partner-with-toy-story-3-cms-363

   http://www.pressandjournal.co.uk/Article.aspx/2082646?UserKey=

IPG Strategic Planning Sessions

The Strategic Planning sessions were attended by industry leaders from each of the participating IPG countries. The group developed a comprehensive listing of countries shared objectives and challenges and grouped these according to their core working group (see below).

Countries' shared objectives/challenges: **Grouping:**

- 1 – Water - R&D
- 1 – Funding Models -Strategic
- 2 – Lobbying - Strategic
- 1 – GMO's - R&D, Strategic
- 1 –Move of Responsibility from government to industry - Strategic
- 2 – Decline in consumption - Marketing
- 3 – Hostile press - Strategic, Marketing
- 4 – Leadership training - Strategic
- 1 – Consumer trends - Marketing
- 1 – Resource use efficiency - R&D
- 1 – Sustainability - Strategic
- 1 – Quality Assurance - Strategic
- 3 – Communication (Internal & External) - All
- 1 – Winning young mouths - Marketing
- 2 – Relationship with CIP - Strategic
- 1 – Sustainable Food Production - All
- 2 – Key Message - Strategic
- 2 – Funding for CIP - Strategic
- 1 – Funding genetic resources - Strategic

The following is a summary of the ongoing strategic objectives for the IPG and includes abbreviated mission statements for each objective. The group concentrated their efforts on those activities that the IPG could conceivably achieve collaboratively rather than simply a wish list of great ideas. The aim was to ensure targeted actions could be implemented on an ongoing sustainable basis.

Strategic Objectives of the IPG:

1. **Growing Sustainably:**

   Talking primarily to our producer base. Most of the focus areas captured under R & D and Marketing outcomes:

   - Water;
   - Funding Models;
   - GMO's;
   - Move of responsibility from government to industry;
   - Consumer trends;

- Resource use efficiency;
- Sustainability;
- Quality Assurance;
- Winning young mouths;
- Sustainable Food Production;
- Funding genetic resources – CIP gene bank; and,
- Climate Change.

2. **Increasing Global Importance of the Potato:**

   Stating our value, our contribution and our social awareness:

   - Sharing collateral;
   - Strategic importance of the potato;
   - Web IP knowledge base;
   - Raising stakeholder awareness of the potato;
   - CIP (International Potato Center) – Develop Strategic relationship with CIP;
   - Lobbying;
   - Decline in consumption;
   - Relationship with CIP;
   - Key Message; and,
   - Funding for CIP.

3. **Communication:**

   Our voice, stating our intent, our message and knowledge exchange:

   - Promote IPG;
   - Secretariat – UK to follow up;
   - Share Core product Range – Share Data base information;
   - Hostile press; and,
   - Communication – internally/externally.

4. **Skills Development:**

   Increasing the skills/knowledge base. Primarily an internal IPG focus:

   - International Networking;
   - Bigger pool of talent;

- People/Personnel Exchange & Scholarships – allow for growers who are traveling to gain information on the potato industry in each country and to gain access to the farms; and,
- Identify & Train Leaders.

Further Recommendations

(1) Australia has much to offer and much to gain from close R & D collaboration and should continue to participate;

(2) The Australian representative should not be from a R & D provider in order to avoid conflicts of interest and related issues;

(3) That the Australian Industry be made aware of many issues surrounding Virus Y and that the industry raise the matter of testing imported plant material with Biosecurity Australia and AQIS; and

(4) That a new approach to knowledge transfer be investigated using examples of what is happening in the UK and South Africa as a potential model.

Appendices

Papers

The potential of sweet potato to combat poverty and malnutrition in sub-saharan africa through a comprehensive initiative

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Sweetpotato, covering 3.2 million hectares with an estimated production of 13.4 million tons in 2005, is one of three widely grown root crops in Sub-Saharan Africa (SSA). Predominantly grown in small plots by poorer farmers, it is known as a food for the poor, grown mainly by women. While the area planted to maize in SSA is 9 times greater than to sweetpotato, the latter is expanding faster than any other major food crop in SSA. Its high energy output per unit land area, ability to produce relatively good yields under marginal conditions, flexible planting and harvesting times, and good yield response to better management are factors underlying its expansion in SSA, where decreasing land holding size, declining soil fertility, and changing climate patterns are driving change. Sweetpotato is considered a staple food in some SSA countries, and a horticultural crop in others. However, investment in sweetpotato relative to other food staples and horticultural crops has been low.

In October 2010, the International Potato Center launched a ten-year *Sweetpotato for Profit and Health Initiative* resulting from a seven months of stakeholder consultative process to identify the constraints blocking the full exploitation of sweetpotato and develop interventions in breeding, propagation and dissemination of healthy planting material, crop management, human nutrition, and marketing. The Initiative's vision is to reposition sweetpotatoes in African food economies, particularly in expanding urban markets, to reduce child malnutrition and improve smallholder incomes. It brings together over 30 partner organizations seeking to positively affect the lives of 10 million African families in 10 years and will establish support platforms in three sub-regions to enable the creation of a vibrant community of practice. The SPHI has now completed its first year and the presentation highlights findings to date.

Durable cisgenic resistance to late blight in potato caused by *Phytophthora infestans*

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Potato is an important crop, grown worldwide. It suffers from many pests and diseases among which late blight, caused by the oomycete *Phytophthora infestans*, is the worst. The disease is still causing major damage in many potato production areas and control is only possible by applying fungicides frequently. The knowledge on the molecular biology and genetics of the interaction between the plant and the oomycete is developing rapidly. These are relevant fields of study, currently dominated by the discovery of many resistance genes and numerous effector proteins and the analysis of their specific mode of action. These studies may yield essential information needed for the development of durable resistance. The long-term and worldwide effort to breed for resistance so far has had little effect. A

novel breeding approach may change this. It is based on cisgenic modification (CM) consisting of marker-free pyramiding of several resistance genes and their spatial and temporal deployment yielding dynamic varieties that contain potato genes only. It is envisioned that this CM approach with potato's own genes will not only prove societally acceptable but may also result in simplifications in the legislation on use of the CM approach. Various parties in the potato research arena intend to cooperate in this novel approach in a number of developing countries where potato substantially contributes to food security. The use of resources such as land, water and energy improves when the effect of late blight is markedly reduced.

Haverkort, A.J. et al. 2009. *Potato Research* 52: 249-264.

Roots for Life: Securing the world potato collection for future generations

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The Roots for Life Foundation (RfL) seeks to provide secure funding for maintaining the "in-trust" world potato collection in Peru. The International Potato Center (CIP) currently obtains donor funding on an annual basis in order to maintain the genebank at CIP headquarters in Peru. It costs CIP over $2 million each year to protect this invaluable collection for humanity. RfL has launched a campaign called "Save a native potato variety in perpetuity." This campaign will highlight why the biodiversity maintained in the world potato collection is critical to the potato's role in food security, poverty alleviation and nutrition in the 21st century. The campaign creates awareness that Roots and Tubers — not just the grain crops — are key components of global food systems; they are Roots for Life. Through "Save a native potato variety in perpetuity," individuals, groups and corporations can invest in one or more cultivated or wild species. To endow one native potato variety in perpetuity will require a one-time donation of $5000 USD. These individuals or groups will be called "Potato Heroes." We need 4235 Potato Heroes for the first phase of our campaign. This presentation will present the details of the "Save a native potato variety in perpetuity" campaign. We are seeking support from the African Potato and Sweet Potato Association membership to join and promote RfL to the public in Africa and beyond. The official campaign was launched in late 2010, celebrating the International Year of Biodiversity.

Competitive and sustainable potato production.

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The potato industry in Great Britain has consolidated. Total production in 2010 of 5.8 million tonnes was produced on 126,900ha by *c.*2,800 registered growers. This production figure of *c.*6m tonnes has relatively stable since 1960, but the production area has declined by almost 60%. Whilst this is a significant decline, grower numbers have reduced even more dramatically and fallen to less than 5% of the number growing in 1960 *(1)*. The total production has been maintained as yield has increased to

*c.*45t/ha. The increase in yield has been driven by improved crop protection, fertilisers, varieties and irrigation.

The turnover for individual business has increased about 10-times in line with the consolidation in farm area, and the businesses are becoming more highly capitalised and specialised. However, the farm gate prices, although rising, have increased only in line with average retail prices over the same period.

The market for the potato crops has also altered dramatically with the proportion of fresh consumed potatoes now just fewer than half the total consumption *per capita* of *c.*90kg/head/yr *(2)*. Consolidation of the processing supply chains and linkage with retail has driven new innovation in marketing and helped maintain a competitive national industry. Exports of ware potatoes from GB are a relatively small proportion of the total production. However, the export of high quality seed potatoes has increased because of the high health status of the crop.

The production of both seed and ware potatoes has been has been achieved within an increasingly rigid legislative and environmental framework for farming and the challenges faced by potato growers and industry in Great Britain will be reviewed. The role of the Potato Council in supporting the industry to address these through investment in research and development and delivery of knowledge will be outlined.

1. *AHDB 2011. Production and Price Trends 1960-2009. August 2010 edition*
2. *AHDB 2011. Consumption and Processing in GB. Annual Trends June 1988 - May 2010*

Potato production in Angola – challenges and solutions

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Angola has great potential to produce good quality potato at competitive price. Main production and marketing constraints are a) lack of quality seed tubers and high cost of imported seed b) lack of high yielding variety with resistance to late blight and with good cooking and processing qualities c) low soil fertility and lack of appropriate recommendations on fertilizer use d) poor agronomic practices e) diseases and poor knowledge of farmers on disease management f) lack of storage facilities g) high cost of inputs such as fertilizers and pesticides h) poor road conditions and high cost of transportation of potato from farm to cities/markets.

Due to the lack of quality seed tubers and high cost of imported seed in many areas no new seed has been introduced in 5 or more years. The current replanting practices further the rapid increase of the virus load. Informal seed distribution and the use of ware potato as seed leads to the uncontrolled spread of soil contamination with bacterial wilt *(Ralstonia solanacearum*).

The results of field inspections showed that virus incidence, including severe viruses such as leaf roll (PLRV), frequently is 100 % with yield losses of 50 % and more, and that bacterial wilt is frequent in traditional potato growing areas of the highlands of Huambo and Huila province, especially in fields under irrigation.

The introduction of certified seed and multiplication on soils without incidence of bacterial wilt is a first step to establish seed potato production in Angola. In the long term only a nation-wide program

supplying clean seed, via imports of certified seed of commercial varieties and their controlled multiplication within a negative and positive seed selection program, as well as minituber production from microplants as a stable source of disease-free basic seed, will give sustainable solution to this grave problem.

An overview on potato production and protection in Tunisia and the possibilities of collaborative projects (bilateral or as a network)

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Considered as a strategic crop since 1994, potato represents about 20% of vegetable crop production. The per capita consumption of potatoes increased markedly during the last years and reached actually about 32 kg. Plantations covered a mean area of 24500 ha annually for the last five years with the aim to reach 25000 ha since 2008. Potatoes are mainly grown in autumn, winter and spring crops allowing a continuous supply of markets with fresh ware potatoes from November to June. The spring crop is the most important with a potential yield of 30-40 tons/ha while autumn and winter crops yield up to 20-30 tons/ha.

All seed potato required for autumn and winter seasons are produced through a certified seed program while imported seeds are used for spring crop. Spunta is the most used cultivar followed by Atlas, Safrane and Nicola.

As other countries in the Mediterranean Basin, many diseases and insects affect the potato crop in Tunisia. Pest importance and impact vary according to local microclimate conditions and production techniques. While some pests concern mainly the crop cycle as the late blight, black scurf, nematodes and viruses, other attack particularly during the storage phase such as the potato tuber moth, wet and dry rots. Many IPM programs were conducted to limit the most important threats such as the late blight and the potato tuber moth.

The Tunisian potential for potato production and exchange could be developed in the framework of partnerships at the international level. Such projects would aim to a permanent data exchange to improve IPM methods which could lead to a better product quality. Besides, a network on germplasm exchanges and evaluation would provide a more efficient approach in breeding programs at the national and regional level.

Piloting and adaptation of aeroponic technology for production potato mini-tubers in Uganda

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Seed quality greatly impact on the productivity on any crop potato inclusive. In potato, seed accounts for a significant proportion of ware potato production cost. Seed quality therefore, in this agro-enterprise, cannot be compromised for profitable potato production. Potato is conventionally vegetatively propagated and during open field seed bulking, the crop is prone to degeneration as a

result of viral, bacterial and fungal infections. To reduce this and slow down yield loss, there should be few open field generation of seed tuber bulking before the stock is used for ware potato production. Rapid bulking of seed potato has not been possible because of the low multiplication rate of parent materials. This can be partly overcome by micro-propagation and deployment of novel technologies for example aeroponics. Consequently, aeroponics technology for rapid multiplication of mini-tubers was piloted in Uganda for testing and adaption for potato mini-tuber production. Preliminary results in indicate that the technology had more than 8-fold mini-tuber production compared to the conventional soil substrate-based media. Prematurely harvested mini-tubers from in aeroponics did not affect their field performance. Differences in performance among test cultivars in aeroponics were evident. Observations of mini-tubers during storage indicated that small tubers (<15 mm) sprouted earlier than large ones (>21 mm) of the same age. The performance of first generation tubers in the field was not significantly affected by plant spacing in the open field but tuber size. Differences in performance between the first (September to January) and second cycle (March to July) aeroponic-grown potato were apparent. The performance of local potato varieties in aeroponics was promising and the technology itself showed a high potential to break the seed potato shortage bottle-neck in Uganda.

Quality seed potato (*Solanum tuberosum* L.) multiplication using aeroponics innovative system in Malawi: A successful technology transfer from International Potato Center

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Potato is important food and cash crop in Malawi. Production is below demand. Lack of quality seed is major production constraint. The potential of aeroponics system was tested for quality seed multiplication during 2008 and 2009 cold 'winter' seasons. In 2008, in-vitro plantlets of three CIP-derived genotypes (CIP381381.13, CIP381381.20 and CIP395016.6) were produced and used to plant aeroponics trial under screen-house conditions at Njuli-Estate, 25km from Blantyre city. The Completely Randomized Design was used with four replications. In 2009, a fourth genotype (CIP393382.44) was added to repeat the trial using Randomized Complete Block Design with three replications. In-vitro plantlets were transplanted on sterilized sand where they stayed for three weeks before transfer to aeroponics. Main variables measured included plant survival, number of stolons/plant, Number of days to tuber initiation, Number of tubers/plant and tuber weight. Data were subjected to analysis of variance. Means of genotypes were separated using LSD and Least Square means procedure in 2008 and 2009, respectively.

The percent plant survival in aeroponics system did not vary significantly among genotypes, ranging from 81.3% to 84.0% and from 99.3% to 100% in 2008 and 2009, respectively. Mean number of days to tuber initiation in aeroponics was 30 and 26 in 2008 and 2009, respectively. The number of tubers/plant varied significantly ($P<0.05$) across genotypes, ranging from 20.5 for CIP381381.20 to 30.0 for CIP381381.13, and from 14 with CIP393382.44 to 41 with CIP381381.20 in 2008 and 2009, respectively. In 2008 and 2009, mean tuber weight across genotypes was 14.2g and 7.5g, respectively.

Aeroponics technique can contribute to increase production of quality seed potato in Malawi and other countries with suitable cold seasons.

Rapid minituber production systems with aeroponics

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CIP scientists have successfully adapted a previously complex process of producing high quality mini-tubers in a specialized soil-less system known as "aeroponics" to become an affordable and low cost production technique Experience of two years of production in Peru has indicated that multiplication rates of 50:1 can be achieved per season and a reduction in cost of production from dollar cents to 8 dollar cents per minituber. The analysis also indicates that up to 60,000 mini-tubers can be produced in a single 15 by 5 m pilot scale screen house (compared with some 18,000 in a conventional system), the final amount varying by variety. The system has low capital cost of assembly and relatively low energy requirements. Components required for assembly are commonly available in the intensive Kenyan floriculture industry and the National program possesses tissue culture facilities and screen-houses required to operate and house the system. This innovative system allows a private sector operator to produce mini-tubers at far lower cost, reduce the number of field generations required to multiply seed and thus reduce the impact serious soil-borne disease constraints such as bacterial wilt.

The first three aeroponic-seasons in Kenya showing following results: High temperatures significantly reduce tuber formation; Tuberosum type varieties did not perform better than in conventional pot systems, whereas Andean type varieties yielded 30-70 minitubers per plant compared to 5-10 in pot systems. Hygiene and disease prevention measures are crucial. Further research to optimize the system needs is ongoing in improving nutrient solutions, plant spacing and disease prevention and plant growth promoting methods.

Seed system and farmers' willingness to pay a premium for quality seed in Kenya

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This study evaluates the seed potato status and farmers willingness to pay premium for seed quality using institutional evaluation and data collected in 2008 from 1337 farmers in ten districts in Kenya. Diagnostics forums were used to evaluate institutions in seed potato value chain while contingent valuation method was used to estimate the willingness to pay premium for seed quality. A double hurdle regression model was also used to assess the suitability of the elicited WTP for estimating demand curve. The study findings indicated that potato remains the second important cash and food crop after maize, and was grown in 158,386 hectares with an average yield of about 7 tons/ha. The

results also showed that use of poor quality seed remained a major drawback in potato production and farmer seed system dominated the sub-sector, contributing about 96% of the total seed used, while both clean and positively selected seed contribute 2.6%, and certified seed contribute 1.1% only.

The high incidences of bacterial wilt (77%) and late blight (67%), and the fact that training increased farmer's willingness to pay premium for seed quality called for increased farmer awareness and training, and the need for government to facilitate use of testing kits at farmer level. The study also showed that farmers travelled long distances to source for certified seeds (124km) indicating that any intervention that improved seed distribution would lead to increased use of quality seeds.

Increased use of clean and positively selected seeds is recommended as an immediate short term stop gap measure of solving seed shortages, reducing disease loads and spread and improving yields as efforts to revamp formal seed system continue.

Key words: Formal seed system, quality seed, willingness to pay

The South African Seed Potato Certification Scheme

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Potato Certification Service is contracted by the Independent Certification Council for Seed Potatoes to manage and administer the South African Seed Potato Certification Scheme. The Independent Certification Council for Seed Potatoes has been appointed by the Minister of Agriculture as the authority and the Scheme has been promulgated under the Plant Improvement Act, 1976 (Act 53 of 1976).

The purpose of certification is to supply quality seed potatoes to the industry, by certifying seed potatoes with a phyto-sanitary status, in respect of diseases and pests, that falls within predetermined norms and which is true to type. The Scheme uses a generation system where each generation complies with specific quality standards. The aim of the Scheme is to minimise the build-up of diseases in seed potatoes and the concomitant building up of diseases in the soil.

The Scheme is based on a dual phasing-out system which takes the generation and quality class into consideration. Units used for seed production is timely registered after establishment. At least two field inspections are conducted to evaluate the occurrence of diseases, variety purity and to determine if isolation requirements are adhere to. Sampling is done at the end of the growing season to test for viruses and bacterial wilt at registered laboratories. Tuber inspections are conducted for determination of the phyto-sanitary status in respect of tuber-borne diseases. Post-control samples are drawn at the time of tuber inspections for the confirmation of virus content and variety purity. Certification is confirmed by field and tuber inspection reports and means of self-sealing labels on certified bags.

Imported seed potatoes as an opportunity for African potato farmers

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The US Potato Board represent over 4000 potato growers in the US. The high price of potatoes in many African countries creates opportunities for both small and large potato farmers. Imported seed

potatoes are an opportunity for potato growers to generate income. The USPB believes that the same benefits that have accrued to potato growers in Latin America from using US seed potatoes can accrue to potato growers in Africa. The price of potatoes in the Dominican Republic averaged $535/MT in 2008(1). Costs of production vary considerably but averaged $8844 per hectare. Imported US Cal White seed was about 34% of the total costs. Growers averaged 35 MT per hectare and sold their potatoes in Dec 2009 for an average farm gate price of $550/MT. Overall return on investment was 1.17 for Dominican potato growers.

www.faostat.fao.org.

Response of potato (*Solanum tuberosum* L.) to seed size and seed reconditioning

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Some potato varieties have characteristically long dormant periods which cause delay in field emergence. Some varieties have comparatively fewer eyes (buds) on the seed tuber which makes them produce fewer stems and tubers per hill, resulting in reduced tuber yield. Studies were conducted at Colorado State University, USA, to evaluate the effect of seed size and seed reconditioning on the performance of a Russet potato variety that has a long dormancy period and has fewer eyes on the tubers. Seed size treatments included seed that was cut to a size of 57-71 and 85-100 g. In 2007, seed reconditioning treatments included seed that was stored at 3.3 ^{o}C (not aged – control) and stored seed that was reconditioned at 21 ^{o}C for 21 days before planting. In 2008, the reconditioning treatment was modified to 10 ^{o}C for 14 days. Reconditioned seed emerged 7-8 days earlier than the control. In 2007, plants from the reconditioned seed showed reduced LAI during tuber bulking, which was due to early leaf senescence. The large seed size (85-100 g) treatment increased average stem and tuber number per hill compared to the standard seed size (57-71 g) treatment. Large seed size increased medium size (114-284 g) tuber yield by 11-13%, compared to the standard seed size. In 2007, the high and prolonged reconditioning temperature caused the seed to age faster before planting, which resulted in reduced tuber yield. When the reconditioned temperature was reduced to 10 ^{o}C for 14 days in 2008, total and marketable tuber yield were increased significantly in the large seed size treatment. Results from this study indicate that seed potato that is cut to a size of 85-100 g and reconditioned for 14 days at 10 ^{o}C before planting can accelerate field emergence and increase stem and tuber number. In this case, leaf senescence could be delayed and tuber yield maximized.

Olsen N. et al. 2004. *Amer. J. Potato Res.* 81: 78-79.

Innovation platforms and sweetpotato seed systems – emerging lessons from East and Central Africa

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The “Dissemination of New Agricultural Technologies in Africa” project (DONATA) is being implemented through innovation platforms known as “Innovation Platforms for Technology Adoption” (IPTAs). In the ASARECA sub-region, IPTAs have been established in Ethiopia, Kenya, Rwanda, Tanzania and Uganda. The IPTAs act as the institutional mechanism to bring together different stakeholders (farmer associations, NGOs/CBOs, research, extension, universities, and private sector) for addressing

key constraints in the sweetpotato seed system and value chain. This approach is still evolving and there has been little experience and practical guidance on how to translate the theory and concepts of innovations systems into operational models in a context of limited policy support, infrastructure and communications.

The study analyses the following areas:

The IPTA institutional and partnering arrangements that best support the processes of out-scaling and up-scaling OFSP technologies;

The key elements of successful uptake pathways;

How different contexts and the characteristics of the commodity influences the type of institutional arrangements and technology uptake and up-scaling processes;

A cross-country "experience sharing workshop" was held where DONATA partners shared preliminary findings. This is now being complemented by in-country focus group discussions and key informant interviews.

The preliminary results show

How the composition, organisation and management of the IPTAs differs across countries and has evolved over the life of the project;

What processes or pathways have been used to promote uptake of technology by communities;

How the new institutional arrangements may have influenced the number of farmers exposed to orange-fleshed sweetpotato technologies;

Potential behavioural change which is contributing to improvements in household food security, income and dietary diversity.

As stakeholders in the DONATA project we are able to draw out lessons about what works under different conditions for informing policy makers and scaling up across the ASARECA region. We have also been able to project questions for further investigation to deepen the lessons learned.

Effect of field multiplication generation on seed potato (*solanum tuberosum)* quality in kenya.

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Kenya has a national average potato production of 8t*ha^{-1}. The main reason for this low yield is the use of poor quality seed by farmers. The seed system is therefore of utmost importance if higher yield levels are to be achieved. Currently the formal seed system is only able to supply 1% of the country's demand. Viruses and other seed borne diseases can cause severe seed degeneration leading to decrease in yield and economic losses. Viral infections like PVY, PLRV and Bacterial wilt, caused by *Ralstonia solanacearum* are the main diseases affecting seed quality.

The purpose of this study is to determine the yield gap caused by degeneration of various seed qualities.

The seed qualities used were from the 2nd field generations (FG) of a private seed multiplier, Basic seed from the National program (3nd FG), certified seed from a public seed multiplier (6th FG), quality declared seed which is seed obtained from credible farmers but which had been produced without the

normal certified seed production regulations (FG 4-6). Positively selected seed which had been selected by following CIP's manual of 'select the best' to improve farmer's own saved seed'- trained by KARI and MOA extension staff - and typical farmer's practice seed were used. The yield gap caused by seed quality was determined by carrying out multi-location On-Farm trials with three main varieties over two seasons in potato growing regions of the country.

The results indicate that seed quality is closely related to degeneration due to viral infections especially PLRV and PVY contributing to severe yield losses. With all varieties additional FG's led to considerable yield losses. In general yields and tuber no. were reduced more or less gradually by seed age all varieties. It can be concluded that the number of FG in Kenya should be limited to maintain high yield potential.

Nurturing a sustainable seed system for sweetpotato in Malawi: A learning process

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Maintaining good calorie intake has proved to be a challenge due to variable weather conditions, declining soil fertility, landholding size and high level of poverty in most Sub-Sahara African countries. Sweetpotato is an important crop in Malawi with a high potential to contribute to the country's food and nutritional basket. Zondeni, a land race and an orange-fleshed sweetpotato (OFSP) variety recommended in 2008 is to provide adequate beta-carotene, a precursor for vitamin A (1). Availability and access to disease free vines of the newly released variety by farmers is a challenge for increased adoption and exploitation. To promote the production and consumption of OFSP, CIP in partnership with relevant Government departments and NGOs instituted a 4.5 year program in October 2009. The entry point was the development of a low-cost and viable disease-free vine multiplication system to farmers. A "1, 2, 3 multiplication system" was adopted and implemented. In year 1, 2 hectares of Zondeni was established at Bvumbwe research station as a primary source of disease free vines and 133 secondary and tertiary decentralized vine multiplications in Dedza, Zomba, Phalombe and Chikhwawa districts. The "1, 2, 3 system" of 7.7 ha produced 6.9 million 30 cm long vine cuttings potentially serves 23,000 households (300 cuttings each). A total of 7,097 vulnerable households were subsidized to get vines from multipliers. Realizing the high demand for OFSP vines multipliers opted to sell their vines at market value and could earn more revenue providing an incentive for a sustainable low-input system for sweetpotato vine multiplication. Massive vine distribution of improved planting material through low-input 'seed' systems may provide the foundation for increased per capita consumption of sweetpotato in Malawi and therefore improving the livelihood of rural poor through increased food and nutrition security and cash incomes.

1 Chipungu et al 2010. Roots Newsletter, SARRNET 12 (2): 9-10

Development of sustainability indicators of potato

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Agricultural production takes place in an environment from which it draws resources and emits substances both potentially jeopardising its sustainability. Potato production in the Sandveld in the South African Western Cape takes place in an ecologically valuable and vulnerable environment. The question how potato production can be sustained in such an area asks for a scientific approach to define sustainability, to monitor it and to improve it. We developed principles related to the ecological impact of potato production (nature preservation, water preservation, minimization of chemical and carbon-dioxide emissions) and derived criteria from them regarding land clearing, irrigation, emissions, and others. Next we defined calculable and measurable indicators of the efficiency with which these resources are used, such as proportion of land cleared, potato yield, water use by the crop, amount of chemicals used and the energy content they represent, and the energy needed for farm operations. In-depth interviews were held with 14 farmers representing 20% of the total potato area to obtain current values of these indicators and compared these to model outcomes of two main sustainability indicators: land and water use efficiencies. The value land use efficiency varied least between growers (36 to 58 Mg ha^{-1}), water use efficiency was recorded between 3 and 9 g potato l^{-1} water and the chemical fertilizer phosphorus use efficiency varied most between about 98 and 995 g potato g^{-1} P applied. Model outcomes confirmed some of the trends revealed by the survey, e.g. growing potato in winter and growing them with less than optimal water offers possibilities to double water use efficiency. Ways to derive indicator threshold norms are proposed based on knowledge of physical and biological processes determining resource availability, the observed variation among farmers and the model outcomes. Knowing indicator values, their range and means of improving them will help to establish sustainability norms providing a quantitative framework for a certification scheme as a licence to deliver potatoes in the Sandveld.

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Managing nitrogen in irrigated potato for maximum tuber yield, tuber quality and environmental conservation

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Nitrogen (N), the most mobile and essential dynamic nutrient, is key to maximize potato production and the sustainability of potato farming systems. Balancing the amount of N needed for optimum plant growth while minimizing the nitrate N that is transported to ground and surface waters remains a major challenge. Two key factors identified to increase nitrogen use efficiencies (NUE) are the use of varieties and better synchronization of applied N with N uptake. The objective of this study was to evaluate the effect of N application rate and N application timing on tuber yield, tuber size distribution, and quality of two potato varieties. The impact of N rate and N application timing on NUE was also evaluated. Treatments evaluated at Colorado State University, USA, included N fertilizer application rates of 0, 67, 134, 201, and 268 kg N ha^{-1}, applied in three split applications. N application timing treatments included pre-plant N application of 0, 67, 90, and 112 kg N ha^{-1}. Data from this study showed that optimum pre-plant N application for maximum total and marketable tuber yield for Canela Russet was 90 kg N ha^{-1}. For Purple Majesty, maximum total and marketable tuber yield, and tuber quality was produced at available N rate of 159 kg N ha^{-1}. The results showed that tuber

production and quality can be affected not only by low N availability, but also by N over-fertilization. N over-fertilization not only increases the potential for N losses to the environment, it also lowered yields and reduced tuber quality. This study showed that with optimum N rates and/or varieties we can reduce N inputs and increase NUE without reduction of yields while maximizing crop quality and potential economic return to farmers.

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Effects of temperature on *in situ* growth and development of CIP potato clones in Burundi

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Potatoes (*Solanum tuberosum* L.) are grown in all areas of Burundi for home consumption and commercial use except in lowlands due to high temperature. Previous studies had never identified appropriate genotypes to grow in this particular environment. Therefore, we introduced from the International Potato Center (CIP) fifteen clones which we compared to nine local varieties for screening. The promising genotypes were evaluated under a series of experiments for three years in four locations. The average temperature ranged from 16.9°C (highlands) to 26°C (lowlands). From the coolest environment to the hottest one, tuber yield and components decreased significantly. The decreases in percentages were 70.3 % (corresponding to a decrease of 25.6 $t.ha^{-1}$) and 72.5 % (corresponding to a decrease of 5.4 $t.ha^{-1}$) for fresh and dry tuber yield respectively (average across genotypes). Tuber dry matter concentration decreased from a value of 20.5 % in highlands to a value of 17.5 % in lowlands. Harvest index decreased in the same way: from 0.77 to 0.54. Effect of temperature was also evident on leaf characteristics, especially the leaf area index. From highlands (Gisozi) to lowlands (Mugerero), LAI decreased from 1.6 to 0.4 despite the crop management (germplasm, plant spacing, fertilizers, etc...) was similar in both environments. However, the specific leaf area and the number of green leaflets per plant were not influenced by temperature or altitude. Despite yield in weight of tubers was satisfactory, the hot climate negatively influenced the tuber set and therefore tuber number was lower (23.3 tubers per plant in highlands and 7.1 in lowlands).

Irrigation management of potatoes in the Sandveld region of

South Africa

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The Sandveld is an important potato production area in South Africa. However, this is also an ecologically sensitive region, where potatoes compete with a rich natural biodiversity for land and

water. Like elsewhere in the country, most farmers do not use irrigation scheduling tools. The objective of this study is to evaluate the accuracy, suitability and ease of use of different scientific irrigation scheduling tools on-farm. The project further aims to demonstrate to producers the advantages of irrigation scheduling and to motivate them to adopt some of these scheduling aids.

During the past year three types of soil measurement equipment (capacitance probes) were installed on six farms in the Sandveld production area and data was collected for two to three seasons per site. Probe measurements and recommendations were compared with SWB model estimations of potato water use. Model simulations generally showed good agreement with actual measurements, but cases of over and under irrigation were also evident. It became clear that initial setting up of the "full" and "refill" lines on capacitance probe graphs of each soil is very critical to ensure reliable and useful recommendations.

Since the initiation of this project, some producers have already started to purchase probes for scheduling their other fields, which is seen as a very positive early outflow of this project.

Conditions affecting the uptake and allocation of calcium

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Calcium binds with pectic substances to strengthen cell walls. Results from pot and field trials showed that increased levels of Ca lower the incidence of internal brown fleck and improve potato keeping quality (1). Experience with other crops and their Ca-related quality problems, helped to identify three different scenarios that may affect the uptake and allocation of Ca (2).

Firstly, the uptake of Ca is poor with insufficient moisture in the root zone, or where root tips are damaged. Ca can only enter roots via young tissue and then moves with water in the xylem. In addition, high levels of competing cations in the root zone restrict Ca uptake. Secondly, sufficient movement of Ca-rich water from the roots to the storage organ is needed for the translocation of Ca. Under warm and sunny conditions, most of the water and Ca move to the leaves for evaporative cooling, to the detriment of low transpiring storage organs. Should storage organs be fully turgid in a moist environment, the inflow of Ca-rich water is blocked. Due to root pressure, Ca-rich water may be pushed into wilted plant parts at night. Thirdly, some intraplant factors may prevent Ca from reaching storage organ cell walls. This may happen under long day, summer conditions where auxin levels are high and plants grow fast, producing high levels of organic acids. These acids are neutralized by Ca ions, forming insoluble Ca-salt crystals, lowering the Ca concentration to the detriment of cell wall strength and tuber quality. When choosing a planting date, mid-summer conditions should be avoided or cultivars, tolerant to low Ca levels should be used.

All three of the mentioned scenarios should be taken into account to avoid Ca-related disorders.

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Insecticides against two key pests in South Africa – are they still effective?

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Two of the major potato pests in South Africa include the potato tuber moth and aphids. The tuber moth causes yield losses of approximately 10% per annum while the occurrence of aphids as virus vectors is a major concern for seed producers. Farmers raised concern whether current insecticides were still effective against tuber moth and aphids. Extensive laboratory and field evaluations of insecticides against these two pests were therefore conducted at ARC-Roodeplaat. Fifteen potato tuber moth populations were collected in several provinces of South Africa for evaluations against registered insecticides. The potato tuber moth populations were collected in areas where potato farmers were concerned about the effectiveness of the insecticides. All collected moth populations were reared in an insectary at ARC-Roodeplaat for two to three generations in order to obtain enough first instar larvae for laboratory bio-assays. Survival of larvae on treated leaves was compared with untreated controls. All populations were also compared with a susceptible reference population. Resistance in the potato tuber moth against registered insecticides in South Africa could not be proven. In the laboratory, all insecticides gave absolute control against all field populations when using the recommended to 25% of the recommended field dosage. At 10% of the recommended dosage, no insecticides demonstrated significantly lower mortalities when compared to the reference susceptible population. This held true for all populations evaluated. Two case studies are examined in an effort to explain the frequent reporting of poor tuber moth control with insecticides during some years and on some farms. All insecticides registered against aphids occurring on potatoes showed excellent control when used at the recommended field dosages in the laboratory. The melon aphid, *Aphis gossypii*, seemed to be more difficult to control with certain aphicides when the dosages were lowered. However, all the insecticides still gave good control against the green peach aphid (*Myzus persicae*) and the potato aphid (*Macrosiphum euphorbiae*), even at 50% of the recommended field dosage. Results from the field trial showed that the insecticides were also effective under field conditions when using the recommended field dosages.

Forecasting potato viruses in seed potatoes using suction traps

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Potato virus Y (PVY) seems to be more important in the northern regions of Europe than potato leaf roll virus (PLRV), which can be explained by differences in vector populations. In the northern regions of Sweden the spread of PVY is minimal. By contrast, in southern regions the spread of PVY has led to serious problems for seed potato growers. Suction trap catches from southern, central and northern parts of Sweden has been analysed in relation to post harvest testing of samples from seed potato fields. A number of factors were considered, such as proportion of virus sources, planting date, number of aphids, proportion of PVY infected progeny tubers and date of haulm destruction (1,2,3). In Sweden strong relationship was found between suction trap catches of aphids and proportion of PVY infected progeny tubers (r^2= 0,47), but even better when taking into account mature plant resistance, number of vectors and proportion of virus sources (r^2=0,78). *R. padi* seems to be the most important vector of PVY in Sweden (3). Thus by using suction traps to forecast PVY incidence, farmers would be able to skip post harvest testing during low- disease years, thereby reducing their operational costs. The seed potato grower would also benefit by being able to predict the proportion of progeny tubers infected in late summer. If there is a great risk that the level of infection of the tuber yield will exceed the threshold set for seed potatoes, it may be more profitable to delay haulm destruction and market the potatoes for consumption or industrial use.

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Management of *Potato virus Y* (PVY) in seed potatoes using crop borders: the role of olfactory cues in host plant selection of *Rhopalosiphum padi*

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Potato virus Y (PVY), a non-persistent aphid transmitted virus, can cause severe yield loss in seed potatoes (3). Crop borders can reduce the incidence of non-persistent viruses. Aphids tend to land in greatest numbers at the edge of a field. Planting a non-virus host plant as crop border causes aphids to purge their mouthparts by feeding on the crop border first, creating a virus sink (1). Aphids use visual and olfactory cues during host location (3). The bird cherry-oat aphid *Rhopalosiphum padi* is a known vector of PVY. Although this species does not colonize potato, alate migrants are important vectors when occurring in high numbers. Three maize and three wheat cultivars compared to three potato cultivars were evaluated as potential crop border plants based on aphid preference and olfactory response. Alate landing rates and offspring produced on the different cultivars were compared under laboratory conditions. Olfactory response of alate *R. padi* to plant volatiles was determined with a four-arm olfactometer. Alate *R. padi* landed most frequently on maize cultivar 1, maize cultivar 2 and wheat cultivar 2. Number of offspring produced was lowest on maize cultivar 2, maize cultivar 1 and wheat cultivar 1. Based on these results Maize cultivar 1 seems to have the most potential as crop border plant due to high landing rates and low reproduction. Alate *R. padi* were attracted to plant volatiles of all plants tested except, maize cultivar 2, potato cultivar 2 and cultivar 1. Results suggest, although plant volatiles do play a role in host plant selection of *R. padi*, other factors are involved as well.

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The influence of high temperature and water-deficit stress on the potato aphid *Macrosiphum euphorbiae* (Thomas) (Hemiptera, Aphididae)

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Climate change in South Africa has been predicted to cause an increase in temperature and CO_2 levels as well as in droughts/floods (1). Climate change can affect plant productivity either directly or indirectly, for example through changes in the incidence of plant diseases or insect pests (2,3). Higher temperatures could lead, amongst others, to faster development times and therefore more generations per year in aphids (4). On the other hand, drought can have positive, negative or no effects on the performance (e.g. survival, fecundity) of phloem-feeding insects such as aphids (5). The influence of elevated day/night temperature and water-deficit stress on the potato aphid

Macrosiphum euphorbiae was evaluated to determine the effects of an increase of 5°C and drought on survival and reproduction on potato. In general, the survival of the potato aphid declined at elevated day/night temperature (30°C/20°C) compared to ambient temperature (25°C/15°C). At ambient day/night temperature and in the absence of water stress conditions female aphids produced the highest number of progeny with a daily mean of 2.6. Progeny production was lowest with a daily mean of 1.4 at elevated day/night temperature (30°C/20°C) and under water stress conditions. The mean generation time was shortest for 30°C/20°C day/night temperature combined with water stress treatment. The overall population growth rates were higher at ambient than elevated temperature as well as for non-stressed than water-stressed plants. The results indicate that the growth rate of the potato aphid population used in the current study was negatively affected by an increase of 5°C in ambient temperature and drought.

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Landing patterns of aphids in commercial potato fields

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Aphids are vectors of *Potato virus Y* (PVY), one of the most economically important plant viruses in seed potato fields globally. To reduce virus incidence, crop borders consisting of a non-virus host plant species, where aphids purge their mouthparts of the non-persistently transmitted virus before moving into the field proper can be planted (1). However, the use of crop borders requires that aphid landing rates are higher at field edges than in the interior. To test whether edge effects (2,3) occur, four transects consisting of 16 green plastic bucket traps each were placed in cross-formation in three circular commercial potato fields (20-40 ha). The traps were positioned in pairs and placed at increasing distances (2, 7, 12, 17, 117, 122, 222 and 227 m) from the edge towards the centre. Traps were emptied weekly for 7 weeks. Thirty-six species were captured; a further two taxa could only be identified to species group. The majority of species recorded do not colonize potato but some non-colonizing species are able to transmit PVY. The most abundant known vector species were *Acyrthosiphon pisum*, *Aphis* spp., *Rhopalosiphum maidis* and *Rhopalosiphum padi*. Aphid landing rates tended to be higher at edges of fields for up to 7 m compared to the interior in some instances. The strength of edge effects was not the same at all sites and sampling weeks and depended on factors such as aphid abundance, aphid species and transect direction. Therefore, to enhance the edge effect crop borders should be identified that are more attractive to aphid vectors than potato.

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Role of major aphids in the propagation of PVY^{NTN} in Tunisian potato field

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In the context of an epidemiological study of Potato virus Y (PVY) spread, 14 aphid species were selected to investigate their relative transmission efficiency. These species were the most trapped ones in yellow water traps (YWT). Transmission efficiency was evaluated for both winged and wingless individuals in cages under controlled conditions. Tobacco, Nicotiana tabacum var. Xanthi, was used for the inoculation tests.

The transmission efficiencies obtained varied from 3 to 95%. Beside *Myzus persicae* (Sulzer), which is a highly efficient vector, another 13 aphid species were screened for their capability of transmitting PVY^{NTN}. Three aphid species, *Aphis spiraecola* Patch, *A. gossypii* Glover, and *Brachycaudus helichrysi* (Kaltenbach) seem important in PVY propagation since they have shown transmission efficiencies of 73%, 71% and 68% respectively. Nevertheless *Aphis fabae* Scopoli was less efficient with a moderate efficiency of 43%, it is also suspected to be implicated in PVY dissemination. In 60% of the cases, close results were obtained with wingless and winged forms. Consequently, 5 species seem to represent a real risk of virus spread given their abundance in traps. Their possible role in PVY spread is discussed.

Tuber necrotic strains of Potato Virus Y (PVY), an ongoing threat to the South African potato farmer

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Infections of potatoes with Potato virus Y (PVY^{O}) and Potato virus Y (PVY^{N}) strains have resulted in production losses since the 1950s and were considered as a managable problem in potato production world wide. However, since the 1980s these strains have exchanged genetic material to result in the PVY^{Wilga} and PVY^{N} tuber necrosis (PVY^{NTN}) strains. These strains have appeared in Europe and the USA, and due to their more severe pathology, have become one of the most serious threats to sustainable potato production. PVY^{Wilga} and PVY^{NTN} strains spread much faster than older strains resulting in a greater yield reduction. Frequently infections with the PVY^{NTN} strain result in necrotic tuber lesions which are unacceptable to the comsumer thereby effectively resulting in total crop failure. Consequently there has been an increased international thrust of research to understand the pathology of these strains, to detect them with greater sensitivity in order to eliminate them from potato stocks, and an emphasis on the planting of PVY resistant potato varieties. Due to increasing problems encountered with PVY^{NTN} infections in South Africa, Potatoes South Africa has funded a similar research program.

PVY infected potato samples were obtained from potato disease testing laboratories. Strain development has been assessed since 2004 using coat protein sequencing and whole genome sequencing. A highly sensitive realtime reverse transcriptase polymerase chain reaction (qRTPCR) assays was developed and used to screen potato tissue culture stocks.

Both PVY^{Wilga} and the PVY^{NTN} strains are present in South African potato stocks and have almost entirely replaced the PVY^{O} and PVY^{N} strains (1). Further modified strains have been identified. qRTPCR revealed that a small number of potato tissue culture stocks were infected and were eliminated.

We can conclude that PVY^{Wilga} and the PVY^{NTN} strains are continually mutating and adapting to local conditions thereby posing a severe threat to the South African potato producer. In order to overcome this, the use of routine qRTPCR as an additional detection tool to enzyme-linked immunosorbent assay

(ELISA) testing is currently being considered. The resistance of locally planted potato varieties to PVY^{NTN} strains will also be assessed.

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The use of fluorescent protein tags towards understanding the disease cycle and future management of soft rotting *Pectobacterium* and *Dickeya spp* in South Africa

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Pectobacterium and *Dickeya spp*. cause destructive soft rots and black leg diseases of potatoes. Combined, these soft rotting pathogens are responsible for significant crop losses equivalent to millions of USD worldwide. These soft rotting erwinia can survive in infected tubers in the soil, in roots of other host plants, or in streams and ponds subsequently used as a source of irrigation water. Within the rhizosphere, dissemination of bacteria can be facilitated by insects, insect larvae or alternative hosts such as plant parasitic nematodes. By understanding the dissemination and disease cycle processes of these pathogens, significant advances can be made towards implementing control measures targeted at various stages of the disease cycle. Fluorescent markers can be used for tagging and tracking of bacteria in plant tissues, soil and irrigating water. Thus, the aim of this project was therefore the 1) development and 2) application of fluorescent protein tagging systems to study the disease cycle of *Pectobacterium* and/or *Dickeya spp*. in South Africa. The potential use of two types of fluorescent proteins was investigated using *Pectobacterium carotovorum* subsp *brasiliensis* strain *Pbcb*1692. To this end, plasmids harbouring eGFP and mCherry genes were transformed to generate *Pbcb*-eGFP and *Pbcb*-mCherry respectively. Fluorescence of each transformant was quantified using a Zeiss Axiovert 200M inverted fluorescent microscope. All colonies showed a strong green or red fluorescence thus a single randomly chosen *Pbcb*-eGFPor *Pbcb*-mCherry colony was evaluated for plasmid maintenance on non selective media. In conclusion we have generated a tracking tool using two different fluorescent markers in *Pbcb*1692. These strains will be used to study colonisation of potato plants by *Pectobacterium* or *Dickeya spp*. The two different markers can also be used to study competition between *Pectobacterium* and *Dickeya spp*. Furthermore, the strains will be used to answer fundamental questions such as dissemination 1) in the soil between infected and non infected planting material, 2) by irrigation water, 3) survival in the soil between planting seasons and transmission from soil healthy planting material and 4) transmission by alternative plant pest hosts such as nematodes. Answers to these questions will facilitate development of control strategies and assist towards management of soft rot pathogens in South Africa.

***R* gene-mediated resistance to potato late blight**

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The late blight pathogen *Phytophthora infestans* continues to be the major biotic constraint in potato production worldwide. Current strategies to control this devastating disease include stacking of broad spectrum resistance genes isolated from wild potato relatives through transgenesis. The *RB, Rpi-Blb2* (isolated from *Solanum bulbocastanum*) and the *Rpi-vnt1.1* (isolated from *S. venturii*) genes are being transferred into susceptible varieties. In order to predict durability of an *R* gene stack it is essential to understand the spectrum and level of resistance provided by each individual gene to the different *P. infestans* isolates present in any given environment. Genetic transformation with the *RB* gene of Desiree, a variety with wide adaptability, was performed in three experiments and produced 9, 22 and 34 independent transgenic events. The first group was infected by whole-plant assay in fully contained greenhouse with five *P. infestans* isolates from Peru. Resistance was correlated to the level of gene expression prior to infection as well as the level of induction of gene expression after inoculation. Their reactions ranged from fully susceptible to fully resistant depending on the isolate. Hypersensitive reaction was observed for two of them with the most virulent isolate. However, all of them were susceptible to a strain isolated from diseased somatic hybrid of *S. bulbocastanum* and *S. tuberosum*. The presence of a compatible strain to the *RB* gene in Peru highlights the need to stack additional *R* genes before any deployment. The genetic transformation with *Rpi-blb2* gene of Desiree yielded 26 PCR-positive regenerants for the presence of the transgene. In case of *Rpi-vnt1.1* gene, 24 PCR-positive regenerants were obtained. Recently, a triple *R* gene construct has been obtained with a pyramid of *R* genes [*RB*, *Rpi-blb2*, *Rpi-vnt1.1*] and is used to transform Desiree at ABL in Peru and an important Kenyan variety, Asante, at BecA in Kenya. These single R gene and the 3*R* gene events from Desiree and Asante will be field trialed to determine their level of resistance to LB and other agronomical characteristics.

Ralstonia solanacearum **requires a** ***tad*** **system for root adherence and virulence** ***in vivo***

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Ralstonia solanacearum race 3 biovar 2 is a water- and soil-borne phytopathogen, and the causal agent of bacterial wilt or potato brown rot. This pathogen has a global distribution where it affects ornamental plants and food crops such as tomato and potato. There is no reliable control measure for this bacterium; it is therefore a zero tolerance quarantine pathogen in most European countries and limits profitable potato production. Proper understanding of *R. solanacearum* pathogenesis may help to overcome these impediments. A crucial step for disease development by *R. solanacearum* is attachment to the plant host, and both flagella and Type IVa pili (T4ap) have been implicated in this process. However, corresponding mutants were reported to still be able to adhere to plant tissues and cause wilting. Our *in silico* study identified two divergent gene clusters in the *R. solanacearum* GMI1000 chromosome and megaplasmid genomes, with homology to the *tad* locus. The *tad* locus is responsible for Flp biogenesis and secretion, and the Flp pili are known to be involved in adherence and virulence of various bacteria. The *R. solanacearum* chromosomal *tad* locus appears non-functional and redundant, while the megaplasmid *tad* locus has proteins exhibiting significant homology to

cognate proteins of *P. aeruginosa* and *A. actinomycetemcomitans*. To determine the importance of the *tad* system in *R. solanacearum* NB336 pathogenesis, a mutant strain NB336Δ*cpaF2* was generated in which ORF RSP1085 present in the megaplasmid *tad* locus, was insertionally inactivated. Comparative analysis of the wild-type *R. solanacearum* NB336 and mutant NB336Δ*cpaF2* strains revealed that the latter was fully impaired in adherence to potato roots and virulence *in vivo*. These properties were restored to wild-type levels in the complemented mutant strain NB336Δ*cpaF2*::*cpaF2.* The *R. solanacearum* mutant NB336Δ*cpaF2* was not growth-impaired *in vitro*, *in planta* or in the production of EPS I, flagella and T4ap. The results therefore indicate that the *tad* locus plays a role in *R. solanacearum* NB336 root adherence and virulence. These findings provide a milestone towards devising a reliable control strategy for this devastating pathogen of potatoes.

Discovery of novel gene expression in a "hot spot" for pathogen resistance located on potato chromosome V

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Quantitative resistance loci (QRL) in potato have a low genetic resolution. Typically, a QRL comprises several hundred kilobase pairs of genomic sequence containing a large number of candidate sequences for underlying the QRL including clustered families of disease resistance genes. This makes the choice of candidate genes for complementation analysis difficult. Analysis of transcription in specific genomic QRL regions may reduce the number of candidate sequences and reveal novel transcripts. One such region is located on potato chromosome V, where the *R1* locus for resistance to late blight co-localizes with a number of important QRLs. To comprehensively identify transcribed regions in a 400 kbp genomic sequences around the *R*1 locus having a potential role in resistance to late blight, we constructed genomic arrays using sub-libraries of a series of bacterial artificial chromosomes (BAC) representing 339,661 bp. Transcribed regions were located via hybridization of the genomic arrays to complementary DNA samples, reverse transcribed from polyadenylated (polyA$^+$) RNA obtained from infected and non-infected potato leaf tissue. In addition to some of the known and predicted genes, we found other transcribed sequences that are not detected by other methods. A large fraction of the uniquely transcribed regions are located in inter-genic regions of previously annotated genes.

A decision support system for Late blight of potato

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Late blight of potatoes, caused by *Phytophthora infestans*, is a constraint to potato production worldwide with global costs of billions of dollars annually. A web-based decision support system (DSS) for potato late blight has been developed in the US which links several models into a system that can be used to predict disease dynamics based on weather conditions and management tactics. Location

specific, observed and forecast, weather data are used by the DSS to drive disease forecast models, including Blitecast and Simcast. Additionally, the DSS utilizes a simulation model, LATEBLIGHT (LB2004 version), to provide a prediction of disease development up to seven days into the future as a function of future weather and future fungicide selected by the user. This interactive system enables users to make well-informed decisions about the use of fungicides which will lead to more effective and efficient use of fungicide. Decision support systems such as this could provide African potato producers with valuable tools to enhance their crop protection efforts.

Assessing nematode population levels in potato production soils

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Potato, ranked as the third biggest staple food crop in South Africa during 2008 in terms of production (2 098 581Mt), is parasitised by plant-parasitic nematodes (PPN). Root-knot nematodes (RKN; *Meloidogyne* spp.) are in particular the economically most important genus that causes significant quality losses to this crop in local production areas. This scenario exists despite the extensive use of synthetic nematicides on which more strict restrictions are progressively being enforced. Subsequently a tool to implement environmentally-sound strategies to manage RKN in potato-based cropping systems was initiated on request of seed potato producers from the Western Free State Potato Seed Association. The status of plant- as well as non-parasitic nematodes in terms of their nematode community structures and species composition in 31 fields where potato is planted once during an eight-year cycle was thus conducted during 2010. Subsequently nematodes were extracted from soil samples using both the sugar-flotation and the ellutriator methods. For root samples, the sugar flotation and mist chamber methods were used for extracting nematodes. At least 11 PPN genera were identified from soil samples for the elutriator method, while six were identified using the sugar flotation method. For root samples, the ellutriator extraction resulted in seven PPN genera being identified, while six were identified using the sugar flotation method. Calculation of prominence values (PV) indicated that *Meloidogyne* spp. was predominant in soil samples, followed by *Pratylenchus* and *Tylenchorynchus* spp. In root samples, *Meloidogyne* spp. dominated, followed by *Pratylenchus* spp. Individuals from the family Heteroderidae, excluding *Meloidogyne* spp., were also identified from two of the 31 fields. Although non-parasitic nematodes were present in soil and root samples, it mainly consisted of bacteriovores. Results from this study revealed that using only soil samples are not preferred to assess population levels of PPN in soils where potato will be planted. Should soil samples, however, be the only option to detect these parasites, more than one extraction method should be used to optimise the possibility of finding PPN. Data generated during this study will serve as a baseline and will be used to forecast the probability of RKN infection of potato to be planted during follow-up growing seasons.

Analysis of structure-conduct-performance of sweet potato marketing: the case of Nairobi and Kisumu, Kenya.

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Sweetpotato has the potential of contributing significantly to Kenya's national objective of enhancing food security, withstands drought, is easy to grow; plays an important role in the diets of many rural households. It is a source of raw material for agricultural industries. Despite this importance, sweetpotato is not adequately market-oriented and competitiveness of smallholder farmers is limited by low productivity and poor quality. The organizational structure of Kenya's sweet potato industry and its performance are not well documented. This study attempted to narrow this gap by examining the sweetpotato marketing system in Nairobi and Kisumu and provide new insights on how the performance may be enhanced to improve competitiveness. The study Identified, characterized the opportunities and constraints on market participants which influence its performance, characterized the sweetpotato marketing systems; assessed the structure, conduct and performance sweetpotato markets; identified and documented the existing and new opportunities for value-addition and also identified the Constraints faced by traders in the sweetpotato marketing.

Results indicated that the sweetpotato market is very concentrated with a Gini Coefficient of 0.71. Initial capital requirement was identified as a barrier to entry, with majority of the respondents using own source of capital. On average, 82.1% of traders had access to sweetpotato market price information. Greater than 70% of the traders relied on two market information sources, word of mouth from friends/ business colleagues/ relatives, and trader's own market observation. Analysis of market conduct indicated that not much of sweetpotato sales promotion was carried out apart from some sorting and grading. The formation of the sweetpotato prices mainly depended on the spontaneous regulation of the sweetpotato market; the setting of price among the actors mainly relied on free bargaining price. The most limiting factors were lack of standard measure, and lack of timely market information.

MOA (Ministry of Agriculture). (2007).

Laboratory evaluation of sweet potato cultivars for resistance to infection by *Alternaria bataticola*

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A leaf, petiole, and stem blight disease caused by *Alternaria bataticola* has been identified as one of the major yield reducing factors causing significant crop losses in sweet potato in South Africa. The disease is especially prevalent in orange-fleshed sweet potato and is a threat to future production to address vitamin A deficiency.

In an effort to identify sources of resistance to this disease, 30 cultivars obtained from the ARC-VOPI sweet potato breeding programme were inoculated with and evaluated for resistance to *A. bataticola.*

Studies were conducted under laboratory conditions using fungal spore suspensions adjusted to 5×10^4 conidia ml^{-1} and incubated at 20 ^{0}C – 25 ^{0}C. The detached leaf inoculation test, used in this experiment was found to be very suitable for screening large numbers of sweet potato genotypes as clear symptoms were observed on the leaves less than 48 hrs after inoculation. The tests effectively discriminated between the various levels of disease susceptibility among the cultivars. Based on the average disease severity index (DSI), a number of highly tolerant cultivars were identified.

The results also compared well with the preliminary observation of disease incidence among the cultivars under field conditions.

The use of fluorescent protein tags towards understanding the disease cycle and future management of soft rotting *Pectobacterium* and *Dickeya spp* in South Africa

Effect of extension intervention on commercialization of orange-flesh sweet potato in Kenya

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This study investigated whether participation in a value chain extension intervention programme increased commercialization of orange-flesh sweetpotato (OFSP) using participants (treatment) and non-participants (control groups) from a representative sample of 219 farmers in the Busia and Rachuonyo districts of Kenya in 2009. Percentages and simple means were used to evaluate differences between participants and non-participants. The study findings indicated that participation in the extension programme enhanced adoption and commercialization of OFSP, resulting in a high increase in the level of commercialization for participants compared to non-participants. The results also suggested that participation in the extension programme benefited farmers through improved awareness and consumption of OFSP. More participants (74%) than non-participants (44%) in the programme were also aware of the health benefits of consuming OFSP.

Genotype x Environment interactions for East African orange-fleshed sweetpotato clones evaluated across varying ecogeographic conditions in Uganda

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The understanding of GxE interactions, stability parameters, and genetic correlations for root yield and nutritional traits is needed for informed choice of appropriate breeding strategies for sweetpotato. The present study assessed i) the magnitude of GxE variation in orange-fleshed sweetpotato (OFSP) varieties of East African origin for yield and nutritional traits across ecogeographic zones of Uganda; ii) the "genetic correlations" (based on phenotypic correlations) among traits in the "OFSP dry and starchy" gene pool from East Africa; and iii) the breeding options for sweetpotato of the category "OFSP dry and starchy". Ten OFSP varieties including six farmer varieties, three modern varieties of African origin, and one modern check variety, 'Resisto' of American origin were evaluated at four sites for two seasons during 2006. The GxE analysis was conducted with regression, and additive main effects and multiplicative interaction (AMMI). The environment effects were significant ($p < 0.05$) for root yield, harvest index, and all quality traits except dry matter. The genotypic effects were significant ($p < 0.05$) for all traits except root yield, iron and magnesium. Accessions, 'Ejumula', 'SPK004/6', and

'SPK004/6/6' had high root yields than the check, Resisto, while 'Naspot_5/50' had lowest root yields. The former three varieties are released in Uganda, and represent the potential gains in breeding for OFSP with high root yields, dry matter and β-carotene. The σ^2_{GxE} components were not significant ($p>0.05$) for β-carotene and starch root content. The σ^2_{GxE} components were highly significant ($p<0.01$) for dry matter but fractional (0.4) compared to the corresponding σ^2_G component. These results suggest the possibility of improving the traits with high selection efficiency in the early stages of sweetpotato breeding program. The $\sigma^2_{GxE} : \sigma^2_G$ ratio was close to 1 for harvest index and sucrose content, and large (> 2) for storage root yields and all mineral contents. Like for yield, our findings suggest that breeding for elevated mineral levels in sweetpotato is complex and requires information about the causes of GxE interactions before the breeder can embark on enhancing these minerals. However, medium to high positive correlations among mineral traits are clearly in favor for selection aiming at elevated mineral contents in sweetpotato.

Screening methods appropriate to breeding vitamin A-enriched (orange-fleshed) sweetpotato

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Orange-fleshed sweetpotato (OFSP) is an excellent novel source of natural health-promoting compounds such as β-carotene, the major precursor of vitamin A. The crop is used in crop-based approaches to address vitamin A deficiency (VAD). Vitamin A is important for functioning of the immune system and for eye health and vision. In sub-Saharan Africa an estimated 42.4% of children aged 1-5 years were considered to be at risk of VAD.

Adapted, suitable varieties of OFSP are required for use in crop-based approaches. Important traits include tolerance to drought and stem blight, substantial β-carotene content, taste acceptability, and agronomic adaptation. Appropriate screening methods are required in selection procedures for biofortification programs and a number of such methods have been developed / identified at ARC-Roodeplaat.

Method 1: Following hybridization (by hand or polycross), seedlings with orange flesh can be identified as early as 2-3 months after sowing by sectioning the roots. Method 2: A leaf inoculation test can be used concurrently with field evaluations of the selected lines to screen for tolerance to stem blight. Method 3: In the intermediate evaluation phases, drought tolerance can be assessed through green house screening of clones in plastic boxes at the vegetative stage. Method 4: Color evaluations can be used as a quantitative measurement of β-carotene content. Method 5: Determination of discoloration, dry matter content, maltose content, instronforce firmness and sucrose equivalents can be used as quantitative indicators of taste acceptability. Method 6: Analysis and interpretation of genotype by environment effects through the GGE biplot (SREG analysis) was found to be easy to interpret and visualized the results of multi-location evaluation trials (advanced evaluation phases) well in order to identify adapted clones.

Utilization of these methods can lead to genetic gains in various traits towards developing of improved OFSP varieties.

Use of accelerated breeding scheme to cut the time in half to release 15 drought tolerant orange-fleshed sweetpotato clones in Mozambique

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Sweetpotato is the third most important crop in Mozambique after maize and cassava. It can be quite well adapted to drought. In the past most of the sweetpotato breeding work concentrated on adaptive trials with introduced clones from International research centers. In the year 2000 about 8 orange fleshed sweetpotato clones were released and massively multiplied and distributed to farmers. It was until 2005 that it was realized the need to start a breeding program within the country as some of these introduced clones proved to have poor performance in the drought prone areas. With financial support of Rockefeller and later AGRA, USAID and HarvestPlus a breeding program was initiated in 2006.and for 3.5 years 430 trials were planted in 4 sites (Umbelúzi, Chókwè, Gurué, and Angónia)

This paper describes the process used to select potential clones for release. About 198,000 seedling/clones were screened at early stages for orange-fleshed color roots, storage root yield and dry matter. After screening for 3 years 64 advanced clones were selected from 59 advanced yield trials and planted in multi-location trials in 4 sites. Data collected were submitted to ANOVA, index selection, GXE (AMMI) and cluster analysis.

To validate the results of on-station, 60 on-farm trials, 15 in each of the four sites were established. On the evaluation 79 farmers in Chókwè (69 women and 10 men) and 67 farmers in Umbelúzi (48 women and 19 men) participated. Both vines and roots were evaluated. Fifteen clones were selected for release.

P1

Occurrence of potato diseases in Algeria

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Symptoms of bacterial soft rot (*Erwinia carotovora* var *carotovora*), black leg (*Erwinia carotovora* var *atroseptica*), Ring rot (*Corynebacterium sepedonicum*), Brown rot (*Pseudomonas solanacearum*), Early blight (*Alternaria solani* and *Alternaria alternata*), Late blight (*Phytophthora infestans*), Powdery dry rot (*Fusarium solani*) and black scurf (*Pellicularia filamentosa* and *Rhizoctonia solani*) on different stages of potato development and intensity of their occurrence in the growing seasons are described.

The most harmful parasites in Algeria were *E. carotovora* var *carotovora, E. carotovora* var *atroseptica, A. solani* and *A. alternata.* .

Satisfactory artificial inoculation of some of these pathogens have been achieved

P2

Population dynamics of several species of *Aspergillus* and *Penicillium* in potato fields of Setif Region (Algeria)

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Program was carried out with the aims of studies the diseases and microflora of potato crops in Algeria. Isolation and identification of different species of fungi were determined during autumn and spring 2009 cultivation at Setif, El-Eulma and Ain trick agricultural station (Setif Region, North-East of Algeria).

Nine species of *Aspergillus* were identified, of which *A. terreus*, *A. niger* and *A. quercinus* were the most dominant with a high frequency was recorded during September (14232, 13621, 8245 propagules/g dry soil, respectively), seven species of P*enicillium* were isolated, of which *P. chrysogeremunm* and *P. funiclosoum* were dominant with a highest frequency was recorded in May and November (13271 and 7106 propagules/g dry soil, respectively).

The dominance of these groups of fungi, however, may prove to be useful, especially if a biological control study is adopted.

P3

Activities of the "International Potato Center - Sub Saharan Africa (CIP-SSA)" in supplying quality potato seed in Eastern Africa

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Inadequate supply of healthy, high-yielding planting materials ranks high among the factors that hamper potato production in countries of the Eastern Africa (EA) sub-region. The need to improve the quality and increase the quantity of seed potato available to farmers has been the basis of previous efforts in the EA sub-region. However, on-farm needs have remained largely unsatisfied as only about 1% of quality seed potato requirement is met in each of the EA countries. This situation is attributable to the following challenges

Poor approaches to scaling-up of nuclear planting material to curb rapid deterioration of premium seed potato from national institutes.

Poor technical and infrastructural capacity to implement quality-assurance practices.

Poor or lack of awareness that would cause substantiated price differential between seed and table potato to entice farmers to support seed as a commodity.

In recognition that informal seed systems provide most of the seed potato available to farmers in the ECA sub-region, it is of high importance that activities aiming both the formal and informal sector in view to making the systems more effective and sustainable.

Main CIP activities in the potato seed system sector are:

Reduction of seed tuber multiplication generations due to aeroponic systems to increase healthy minituber production by 6 to 10 times compared to conventional mini tuber production (In cooperation with the private and public sector).

Breeding for horizontal late blight resistance and the release of improved varieties.

Train seed- and ware-producing groups and change agents.

Improve seed production, storage and quality control capacity, laboratory and associated facilities.

Optimization and promotion of positive seed selection for ware potato growers

On-Farm research and dissemination of crop management measures.

Research in bacterial wilt management and identifying disease free areas for basic seed tuber multiplication.

P4

Effect of mineral oil on aphid PVY propagation

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Mineral oil sprayed on potato seeds production, reduced propagation of the potyvirus Y (PVY) by *Myzus persicae* (Sulz.) the most efficient vector. When potato leaves were covered with mineral oil (Citrol) there were inhibitory effects of PVY transmission. We have investigate PVY infection on untreated and treated healthy test plants inoculated by infected aphids *M. persicae*. The virus infection was reduced by the oil presence on the leaves; the percentage of PVY infection was 8% on untreated plants and 1% on treated plants. This fact confirms that PVY infection on untreated plants (without mineral oil) is higher. Three levels of mineral oil are used as following 3%, 6% and 10%. The PVY infection was 1%, 0% and 0% respectively and the untreated plots reached an infection level of 2%. The aphid transmission of PVY was strongly inhibited by coating potato with mineral oil. The use of mineral oil at 6% in our experience was the best way to improve the quality of potato seeds.

P5

Regional sweetpotato breeding in Africa under the Sweetpotato for Profit and Health Initiative

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Sweetpotato is playing an increasingly important role in African agriculture, combating food insecurity and undernourishment, particularly vitamin A deficiency. The Sweetpotato for Profit and Health Initiative (SPHI) aims to reposition sweetpotato in African food economies, and improve the lives of 10 million families by 2019. The SPHI works through diverse research and development partnerships and seeks to ensure that women and children benefit from its efforts. The Sweetpotato Action for Security and Health in Africa (SASHA), of SPHI, supports significant pre-breeding and capacity-building efforts from regional Sweetpotato Support Platforms (SSPs) in Uganda, Mozambique and Ghana. From these

locations, CIP breeders work with national and regional partners. Pre-breeding (population improvement) efforts at each location focus on key attributes of regional importance and use recurrent selection and an accelerated sweetpotato breeding (ASPB) method to advance populations rapidly. The ASPB method, which involves rapid multiplication of genotypes from seedlings, and early evaluation of the genotypes and families in multiple environments, is also used by partners for selecting new varieties. High dry matter and provitamin A content are a priority at each of the SSPs, with specific emphasis in southern Africa on drought tolerance, in eastern Africa on resistance to sweetpotato virus disease (SPVD), and in West Africa on non-sweet types. Near infrared spectroscopy labs at each SSP is used for rapid analysis of quality attributes. The relative efficiencies of controlled versus polycross methods and the use of heterosis are also being systematically assessed. Breeding efforts at SSPs are backstopped by germplasm and expertise from CIP headquarters and elsewhere. It is anticipated that outputs from each SSP may be useful to breeding programs outside of their region. Capacity building and breeding efforts in each region are undertaken in close collaboration with national programs and within regional structures, such as ASARECA, and support from various sources, including AGRA.

P6

Evaluation of local and newly introduced sweet potato germplasm under Egyptian conditions

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Sweet potato is promising crop in Egypt especially for export market. The aim of this work is to introduce new sweet potato germplasm and compared with local varieties to select the promising sweet potato germplasm under Egyptian conditions. Nine newly introduced sweet potato germplasm namely , CIP- 440189, CIP- 199026.1, CIP-400011, CIP- 400004,CIP- 420009, CIP-199015.14, CIP-CIP-199004.2, CIP-103031 and CIP-1999062.1 were tested comparison with two local varieties (Abees and Beauregard) under Egyptian conditions.The evaluation was based on high yield, flesh color and nutritional value (Beta carotene, total carbohydrates and reducing sugars). The experiment was carried out in two successive seasons 2008-2009, the nine newly germplasm were cultivated at agrofood farm in Nubaria region. Results showed that the four sweet potato germplasm namely CIP- 440189, CIP-199026.1, CIP-199004.2 and CIP- 103031 gave the highest yield, Beta carotene, total carbohydrates and reducing sugars comparison with others sweet potato germplasm in the first season. The four sweet potato germplasm which select from first experiment were compared with two sweet potato local varieties (Abees and Beauregard in the second season. Results showed that the CIP- 440189 sweet potato germplasm gave the highest yield and total carbohydrates comparison with the two local varieties. Whereas, the local variety Beauregard and germplasm namely CIP- 440189 superior in the Beta carotene compared with germplasm namely CIP199026.1, CIP-199004.2 and CIP- 103031.

P7

Tuber yield and quality of irrigated potato (*Solanum tuberosum* L.) as influenced by preceding green manure cover crops

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Green manure cover crops preceding potatoes have been reported to improve potato tuber yield and quality depending on the type of the preceding green manure crop. There is the need to document which green manure crops are most beneficial to a succeeding potato crop. Studies were conducted in Colorado, USA, to evaluate the effect of ten green manure cover crops on potato tuber yield, tuber size distribution, and quality of the variety Russet Norkotah, grown under irrigated conditions. Barley (B), barley + compost (B+C), sunflower (S), sordan 79 (SD), sordan 79 with the above ground biomass removed for hay (SDH), sorghum sudan (SS), canola (C), mustard (M), peas (P), and annual rye grass (RY), were the green manure crop treatments that preceded the 2008 potato crop. SS, C, and RY were replaced with radish (R), sordan mix (sordan 79 + radish) - SM, and winter wheat (WW), for the green manure cover crop treatments that preceded the 2009 potato crop. A wet fallow ground (fallow) was maintained as a control plot. In 2008, potato planted after SDH produced 20% higher total tuber yield compared to the average of all other treatments. Maximum marketable tuber (> 114 g) yield was obtained when potatoes were planted after SDH, B, and RY. Potatoes that followed fallow ground produced more tuber external defects. In 2009, maximum total and marketable tuber yields were produced when B, S, SDH, SM, WW, and fallow ground preceded potatoes. B, B + C, and R produced tubers with the highest percentage of external defects. Data from these studies indicate that green manure cover crops can be used to influence tuber yield and tuber size distribution in irrigated potatoes. When potato is preceded by sordan 79 with the above ground biomass removed for hay, or by sunflower, maximum tuber yields are obtained with less tuber external defects.

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P8

Sweet potato research and its impact in Limpopo Province, South Africa

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Overcoming hunger remains a serious challenge facing humanity today. The threat of starvation is most severe in Africa, where an estimated 138 million (33%) people, mainly woman and children, suffer from malnutrition. This emphasizes the need for introduction of more nutritious crops that can be produced with resources available in poor communities. Sweet potato is popular amongst local farmers and is used as a staple food by poor rural communities.

Limpopo Province is one of the poorest regions in South Africa. ARC-Roodeplaat and LDA partnered to conduct research trials to: 1) address food security and give local farmers an opportunity for commercialization; 2) introduce disease-indexed and drought tolerant cultivars to local farmers; 3) introduce orange-fleshed sweet potato to local farmers and communities; and 5) establishment of nurseries for healthy easily accessible cuttings.

The project commenced in the 2007/8-season. Local sweetpotato farmers were identified around Vhembe and Capricorn districts. ARC sweet potato varieties were evaluated against the locally used varieties. Farmers and community members were invited to Information Days to see, taste and select their preferred varieties amongst the best performers at harvest. Planting material of selected varieties was distributed to local nurseries to provide a steady supply of cuttings.

The selected ARC varieties included cream-fleshed Ndou, Monate and Phala (drought tolerant) and orange-fleshed lines 2000-10-7 and 2002-21-1. The sweet potato trials were successful in raising awareness in the area as more and more local farmers are now interested in planting the recommended varieties. Sweet potato Information Days are being held (even in new districts) with the help of local extension officers from LDA. The farmers are producing sweet potato and sell their produce in their communities. This project is making an impact on the food security and health status of the Limpopo rural communities.

P9

The performance of advanced sweet potato clones under sub-tropical conditions in KwaZulu-Natal Province, South Africa

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Sweet potato is an important crop in Africa due to the role it plays in food security and improved nutrition. Orange-fleshed sweet potatoes are particularly important in nutrition as these are rich in β-carotene and are used in crop-based approaches to address vitamin A deficiency.

The ARC-VOPI sweet potato breeding program has developed a number of new varieties and promising lines that are well suited to South African conditions and have good storage root quality and taste. These clones are cultivated under different climatic conditions in South Africa and evaluated for adaptability, yield performance and consumer acceptance. Evaluation trials are planted annually in different localities to assess the performance of these clones and to promote the production and consumption of orange fleshed sweet potato.

ARC-Roodeplaat has established sweet potato evaluation trials at Owen Sithole College of Agriculture (OSCA) at Empangeni in Kwazulu Natal (KZN) over a three year period. KZN is a frost free area suitable for sweet potato production during summer and winter seasons, therefore increasing the availability of the crop throughout the year. The trials were planted in a randomized complete block design (RCBD), with three replicates under sprinkler irrigation. Data was collected on yield, storage root shape, storage root quality, disease and insect occurrence, and β-carotene content. After harvesting, local farmers and community members were invited to evaluate the different clones on appearance and taste.

High yielding, cream clones (such as 199062.1 - an import from the International Potato Center; and Monate - an ARC variety) and orange-fleshed clones (such as Impilo – ARC variety) were identified as well adapted clones for the area. The sweet potato farmer's day that was conducted during harvesting, was attended by approximately 150 people from the area. Several processed products derived from orange-fleshed sweet potato were displayed. The selected clones will be released as new cultivars and included in recommendations to help increase food security and improve nutrition in the area.

P10

Development of a screening method for evaluating South African sweet potato varieties and breeding lines for tolerance against sweet potato feathery mottle virus

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Sweet potato (*Ipomoea batatas*) plays an important role as a food and cash crop in South Africa. The production potential of the crop is restricted due to sweet potato virus infections that lead to yield reductions of up to 30% in a single production season.

The ARC-Roodeplaat initiated a project in 2006 to develop a screening method for evaluating sweet potato varieties and lines for tolerance to *sweet potato feathery mottle virus* (*SPFMV*) in order to identify tolerant varieties and lines. These tolerant varieties and lines can be utilized in hybridization experiments of the ARC-Roodeplaat sweet potato breeding program to develop sweet potato varieties that are tolerant to *SPFMV*.

Germplasm with virus tolerance, originating from the USA, Uganda, Peru, China and Nigeria, were obtained from the International Potato Centre (CIP) and introduced into the ARC-Roodeplaat sweet potato research program. Pilot studies were conducted to evaluate different virus inoculation techniques to determine the most effective method: 1) grafting the infected sweet potato stem onto the test plant and 2) the use of a spray gun for mechanical inoculation. Confirmation for the presence of the virus was done by evaluation of symptoms, immunological tests, i.e. nitrocellulose enzyme linked immunosorbent assay (NCM-ELISA) and double antibody sandwich ELISA (DAS-ELISA). Both local and imported varieties were used in this investigation.

Grafting was selected as the method of choice for the inoculation of sweet potato plants, as persistent infection was achieved. Further efforts will focus on the screening of larger numbers of local lines and landraces.

P11

Landing patterns of *Liriomyza huidobrensis* (Blanchard) (Diptera: Agromyzidae) in potato fields

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The pea leafminer *Liriomyza huidobrensis* is an important pest of a wide variety of vegetable crops and ornamental plants in many parts of the world (1). However, in South Africa it is mainly a pest on potato plants (*Solanum tuberosum* L). *Liriomyza huidobrensis* is difficult to control due to its developing resistance to many insecticides. The objectives of this study were to determine the suitability of yellow bucket traps as a monitoring tool for *L. huidobrensis* by comparing landing rates (green bucket traps) with yellow bucket (attract leafminer) trap catches. In addition, landing patterns of *L. huidobrensis* adults in large (20-40 ha) potato fields were examined to test the hypothesis that they land more frequently at the edges of large circular fields to determine if crop border treatments, e.g. chemical control, trap plants, could be used for its management. Two trials were undertaken in the Christiana region in the western Free State (South Africa). In the first trial 48 green bucket traps were placed in a Y-formation within fields and 6 yellow bucket traps were positioned at equal distances around each of three fields. For the second trial, 64 green bucket traps were placed in an X-formation within the fields and 4 yellow bucket traps positioned around each of three fields. The results showed that the mean abundance of *L. huidobrensis* caught in the yellow bucket traps was approximately four times higher than in the green bucket traps. Overall, abundance of *L. huidobrensis* was influenced by site and sampling date. In general, wind direction did not influence the number of *L. huidobrensis* caught in the

traps. The landing pattern of *L. huidobrensis* in potato fields was random. A crop border treatment would, therefore, not be useful to manage leafminers. However, yellow bucket traps can be used as a monitoring tool provided that a threshold has been determined before management action is implemented.

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P12

ARC *In Vitro* Gene Bank: Securing the diversity of potato in South Africa

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The *In Vitro* Gene Bank (ARC-IVGB) of the Agricultural Research Council was initiated in the 1980s to establish an *in vitro* collection of potato (*Solanum tuberosum*) germplasm. Today, more than 1,000 different potato accessions are conserved *in vitro* under slow growth conditions.

The long-term objectives of the ARC genebank are to: 1) conserve and maintain accessions in accordance with established international plant genetic resource criteria; 2) develop and maintain a documentation system that will add value to accessions conserved and maintained in the ARC gene bank; 3) supply germplasm to ARC scientists for description, characterization, evaluation and breeding, and to 5) supply germplasm to other organizations and the potato industry in South Africa with a possibility of supplying germplasm for international exchange.

The potato material conserved is the source of material for potato cultivars that are bred in South Africa or that have become adapted to South African conditions. These accessions could be lost permanently if not conserved in the gene bank. Included in the collection are genetic resources that contain the genetic diversity which may be of value to overcome problems that potato producers could encounter in the future. The ARC-IVGB also houses disease-indexed mother material under contract agreement. The national cultivar collection and the contract collection (imported by private potato producers), provide authentic and disease-indexed material for use by the South African Potato industry for production of potato seed.

This presentation describes the conditions under which potato material is stored *in vitro* at the ARC-IVGB, the key activities performed in order to ensure the safety and genetic integrity of the *in vitro* collection, as well as plans for improving the services provided by the gene bank in future. The presentation will also outline the ways in which individual potato farmers can optimize their benefits from the ARC-IVGB, and how the ARC and farmers can best collaborate for the benefit of the potato industry.

P13

Aphid monitoring in seed-potatoes in South Africa

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Aphid monitoring using suction traps is a key component of management programmes to reduce virus transmission to seed potatoes (1). Aphids are vectors of potato viruses, such as *Potato virus Y* (PVY) and *Potato leafroll virus* (PLRV) (2). Both viruses can lead to downgrading of seed potatoes even if present at low levels. PLRV and PVY are usually transmitted to potato fields by immigrating winged aphids and are related to aphid flight patterns, species and abundance (2). The aim of the South African initiative is to develop a virus forecasting system, based on aphid monitoring in suction traps to support management decisions of seed potato growers. The monitoring network comprises eight standardized suction traps situated throughout major seed potato growing regions in South Africa. As a rule, the traps are emptied weekly and aphids are counted. Aphids are either identified locally or at designated laboratories. Results are posted on a centralized database on the internet to be immediately available to growers. The database serves as an early warning system to assist growers in making management decisions regarding location and timing of aphid control measures. The web-based database allows for retrieval of data in the form of graphs and summary statistics. The development of a national aphid monitoring programme is a combined effort of Potatoes South Africa, the Department of Agriculture: Western Cape and the University of Pretoria with the assistance of the regional laboratories. It is supported by the Technology and Human Resources for Industry Programme (THRIP).

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P14

Assessing the potential of applying phosphonate fungicides to enhance host tolerance in potato to late blight

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Kenyan highlands provide favorable conditions well suited for intensive cultivation of the potato crop. Control of late blight which has been a major constraint in production of potatoes has proven to be expensive to most of the small scale farmers and also the occurrence of the fungicide resistant strains of the fungal pathogen and negative impacts on health of the widely used metalaxyl and mancozeb products complicate the situation further. Applications of phosphonate products have been shown to be effective against oomycetes. Phosphorous acid has both a direct and an indirect effect on oomycetes. It inhibits oxidative phosphorylation in the metabolism of oomycetes. In addition, some evidence suggests that phosphorous acid has an indirect effect by stimulating the plant's natural defense response against pathogen attack. The research therefore intended to assess the potential of late blight control of products based on phosphorous acid neutralized with potassium together with the different levels (susceptible–highly resistant) of resistance to late blight of various varieties grown

in Kenya to reduce the disease damage in small scale holders who make the majority of potato growers. Results reveal that phosphonates a more efficient in disease control with higher levels of resistance in particular with varieties having multi-gene resistance where phosphonate application led to higher or same yield levels compared with the chemical control. However, with increasing varietal susceptibility disease control and yields where significantly lower compared with the chemical control.

Phosphonites showed a high level of late blight control with varieties having a certain level of resistance and thus can be considered in a package with varietal resistance as an alternative to chemical late blight control save to human health and with reduced risks of a buildup of pathogen resistance.

P15

Total starch, amylose and mineral content of South African sweet potato breeding lines

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Sweet potatoes are an important food crop and research shows that it plays an important role as an energy source in human nutrition. Sweet potatoes are not only rich in dietary fibre, naturally occurring sugars, complex carbohydrates and proteins, but also contains vitamins A and C, iron and calcium. However, information on differences with regard to nutritional value for this crop is scarce (1, 2). The overall objective of this study was to evaluate tubers of eight sweet potato cultivars harvested at three different locations, for total starch -, amylose - and mineral content. The determination of total starch was based on a modified Ewers polarimetric method involving the optical rotation measurement by means of a polarimeter after dissolving the starch in dilute hydrochloric acid. The amylose content was determined with an iodine based method where the starch sample is dispersed in alkali and a standard iodine solution is added resulting in a stable blue complex and then measured spectrophotometrically. For the total starch determination, the results found range from 42% to 58% of dry matter and the amylose content was found to be between 12% and 30%. Moreover, the tubers are a good source of minerals, including potassium, calcium, phosphorus and iron and a moderate source of zinc, copper and manganese and significant differences were found between the breeding lines in the study.

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The new problems of potato quality diseases in Tunisia with reference to the Black Scurf (*Rhizoctonia solani*)

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Quality diseases are considered as a new threat to the potato crop. During the last years, quality depreciation due to these diseases has become a serious problem in Tunisia, both for local and international markets. Black Scurf *Rhizoctonia solani* is the main quality disease and affects particularly

the emerging export market of the fall crop. Exclusion rates on potato plots due to this fungi raised suddenly during 2005-2007. Average seed quality, frost incidentals and low farmer skills are the main factors for *Rhizoctonia solani* spread.

Seed treatment against the black scurf has been recently introduced for the fall crop in Tunisia. In this presentation, a new pesticide based on Fludioxonil was evaluated as an alternative to classic fungicides based on the Pencycuron. Fludioxonil efficiency was studied according to the applied dose and the number of treatments. All seeds were treated by dipping. Dipping mixture was about 300l / ton of potato seeds. Preliminary results showed a better efficiency of the Fludioxonil than the Pencycuron. Harvested tubers from Fludioxonil-treated seeds were up to 50% less infested with black scurf than those from Pencycuron-treated seeds. With a second treatment during the crop cycle, black scurf infestation rate was still above 50% for Pencycuron treatment while it was about 10% for Fludioxonil treatment. No statistical difference was found between the 200 ml and 250ml doses of Fludioxonil used in the experiments.

Based on these results, Fludioxonil treatment against the black scurf seemed to be more efficient than the Pencycuron. Alternating these two fungicides may be a good option to decrease treatment costs and limit fungicide resistance risks.

Diagnosis, quantification and risk factors of soil-borne diseases on potatoes in South Africa

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Powdery scab, common scab, black scurf and black dot (anthracnose) are potato diseases that affect quality and marketability. Survival structures of the causal pathogens can persist in soil for many years, thus making control difficult, if not impossible. The ability to detect and accurately quantify the amount of initial inoculum in the soil, as well as an understanding of environmental conditions that promote disease development, will allow growers to better assess the potential risk of disease. This will give growers the opportunity to implement management measures, such as planting of resistant cultivars, removal of alternate hosts, field selection and irrigation scheduling, thus preventing large economic losses. Protocols for the detection and quantification of *Spongospora subterranea, Streptomyces scabiei* and *Rhizoctonia solani* propagules in soil using Real-time PCR have been optimised for South African isolates.

Field and pot trials have shown that initial inoculum concentration correlates positively with disease severity at harvest for both common scab and black dot. There was however, no correlation between initial inoculum and final disease severity for powdery scab.

Genetic characterisation of South African *S. subterranea* isolates from different potato growing regions indicated that all isolates from are of the same type, Group type II. *S. subterranea* populations are clones and do not undergo sexual recombination (1), which may explain our results. Morphological, physiological and molecular characteristics of scab-causing *Streptomyces* isolates from throughout South Africa were determined. These results revealed that the isolates differ substantially from one another. In addition investigations into the role of specific genes in pathogenicity of isolates have shown that there is a complex and unpredictable relationship between genes and pathogenicity.

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The potato pest complex in South Africa

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More than 60 arthropod pests attack potato in South Africa, representing 17 individual species and 22 pest groups. Most pests that occur on potato in South Africa are of minor importance and rarely damage the crop. Some of the minor pests include a few moth larvae, stinkbugs, ants, termites, mealybugs, blister beetles, crickets and grasshoppers. Some species may become more important under certain conditions, i.e. the African bollworm, loopers, snout beetles, white grubs and mites. At least four pests are perceived as key pests that may cause serious damage to the potato crop under most circumstances. They include the potato tuber moth, *Liriomyza* leafminers, aphids as virus vectors and nematodes. Aphids are more important for the seed producers while nematodes are more troublesome on lighter soils. Most potato farmers apply pesticides against these four pests on a weekly basis, usually at planting time (soil-applied) or starting from two weeks after plant emergence. Pest complexes play an important role when more than one similar pest simultaneously attack the crop.

Participatory innovation to enable small-scale farmers penetrate high-value potato market: A case of Nyabyumba United Farmers in Uganda

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An experiment was conducted in Kabale, Uganda, jointly by Nyabyumba United Farmers (NUF) and the national potato program to develop an agronomic package that would increase both total fresh tuber yield and the proportion of large (>60 mm diameter) potato tubers. This was in response to a demand by a potato processor for large-sized tubers for French fry processing with whom NUF had signed a contract supply factory-grade potato on a monthly basis. The first constraint to meeting this market requirement was a low proportion of client-preferred sized tubers from harvested ware potato. Consequently, two agronomic experiments were conducted by eight farmer research groups (FRG) such that each set of four FRG conducted different seed tuber spacing experiment. One set of FRG's tested varying inter-row spacing at fixed intra-row spacing. The other set tested varying intra-row spacing at fixed inter-row space. In both cases, six rates of compound fertilizer (NPK 17:17:17); 0, 40, 80, 120, 160 and 200 Kg ha^{-1} were tested in combination with the spacing treatments. The inter-row spacing treatments were 70 cm, 75 cm and 80 cm while the intra-row spacing treatments were 30 cm, 35 cm and 40 cm. Biological data and farmer qualitative technology assessment indicated that varying intra-row spacing did not increase the proportion of market preferred large-sized tubers compared to farmers' practice. Treatments involving inter-row spacing improved the proportion of large tubers. However, the 75 cm x 30cm was better and significantly differed from either 70 cm x 30 cm or 80 cm x 30 cm spacing in generating a high proportion of market-desired tuber sizes. Polynomial regression, economic analysis and farmer assessment indicated that 120-160 Kg ha^{-1} of NPK:17:17:17 fertilizer was more suitable than 80 Kg ha^{-1}, with the optimum at 132.7 Kg ha^{-1}. Assessment of technology uptake

one season after the end of the study indicated that 70% of the participating farmers had adopted the new technology and doubled the proportion of market-preferred tuber size per harvest. Ware potato delivery increased from 93 t in 2003 to 113 t in 2008, resulting in a corresponding increase in net profit from ≈US4,000 to ≈ US$5,000 in the same time. The dynamics of group marketing by farmers is discussed.

Participatory plant breeding is a complementary strategy to successful sweetpotato breeding in Uganda

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The sweetpotato (*Ipomoea batatas* L. (Lam.)) cultivar named, NASPOT 11 (Namulonge Sweetpotato 11), was officially released by the Ugandan Plant Variety Release Committee in April 2010. The National Sweetpotato Program (NSP) breeding cycle in Uganda takes 7-8 years to release a variety. In 2003 sweetpotato participatory plant breeding (PPB) was initiated in six farmer groups (3 each in Central Uganda and Northern Tanzania) with the objective of assessing the benefits of PPB, including the time it would take to deliver improved varieties to farmers, and other potential advantages of PPB. Segregating populations, 2,000-6,000 pre-germinated seed including, New Kawogo and Bunduguza families, were given to each group to select superior sweetpotato clones. Seven promising PPB advanced selections made by the farmers during 2006 were evaluated by the National Sweetpotato Program on-farm and on-station in 4 locations (four replications per site) in selected major agroecologies. NASPOT 11 was tested for five seasons on-farm during 2003 to 2008 and two seasons on-station during 2006/2007 to 2008/2009. NASPOT 11 was as good as or better than the local checks on-farm and on-station in the PPB trials, yielding on average 26.5 t/ha or about 16% higher storage root yield than the local check. NASPOT 11 combines moderate resistance to SPVD and high field resistance to *Alternaria bataticola* blight. Both diseases are devastating in Uganda, causing high losses (>90%) in susceptible clones. Farmers started growing and consuming NASPOT 11 and selling it in the third to fourth year. This would normally occur in year six to eight using a typical sweetpotato conventional breeding procedure. These PPB trials demonstrate the potential for significant rapid progress in sweetpotato breeding especially in specific target environments, with the PPB approach complementing conventional sweetpotato breeding.

Modelling water use of orange fleshed sweet potatoes using the aquacrop model

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Orange fleshed sweet potato is known to be an excellent source of naturally bio-available β-carotene and vitamin A. This crop is of particular importance to South Africa as vitamin A deficiency is a national public health problem. South Africa is a dry country and understanding of water use of such crops is essential particularly in areas where water is a limiting factor. Field experiments were conducted using a sprinkler irrigation system to evaluate the response of four orange flesh sweet potato cultivars to water stress. The experiments were carried out under a rainshelter at ARC-Roodeplaat, Republic of South Africa in the summer season of 2008/2009. Modelling crop growth and soil water balance of sweet potato using AquaCrop model was also included later in the study to understand its crop water use. Meteorological records, soil water content, crop growth measurements, biomass production and final harvestable yield were used to calibrate the model. Calibration was done using the data collected and few parameters were adjusted from experience as there were no measured values. The parameters obtained during calibration were then used to test AquaCrop against the independent data sets collected. The model predicted biomass, soil water content and the harvestable yield for both stressed and non stressed treatments reasonably well. Crops irrigated at full irrigation gave higher biomass and harvestable yield compared to the water stressed treatments. The model overestimated yield of sweet potato. The water productivity varied with irrigation treatments. The predicted water productivity (normalized for reference ET) ranged from 3.01 to 6.22 kg m^{-3}. Variations in crop water use ranged from 195 to 650 mm per season and water stress across the irrigation regimes were effectively captured by the model. The model was simple to parameterize and results were useful to understand water use and soil water balance of sweet potato. This suggests that the model could be used to simulate different irrigation scenarios for decision making in irrigation schemes and water use associations in South Africa. The AquaCrop model was successfully calibrated and validated and can be used to explore irrigation management options to improve sweet potato water productivity in South Africa.

Potential of contract farming between smallholder farmers and commercial buyers: a case of potato in Dedza, Malawi

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During a potato sub-sector analysis in Malawi by International Potato Center (CIP) and Department of Agriculture Research services (DARS) of the Ministry of Agriculture and Food Security (MoAFS), marketing was identified as one of the key challenges hindering the development of the sub-sector. Marketing was therefore incorporated in a CIP-led potato improvement project as one of the intervention areas. Contract farming was identified as one of the promising remedies to the marketing challenges that farmers were facing. Beginning 2007/2008, a Public-Private Partnership (PPP) was established. Partner organizations were CIP, DARS and Department of Agricultural Extension Services (DAES), Concern Universal, an NGO, and a private sector company, Universal Industries Limited (UI). These organizations set-up a marketing system whereby potato farmer groups were linked to UI for seed supply and purchase of potato for their crisps factory. In year 1, UI provided contracted farmers with seed, fertilizer and guaranteed them with market for their produce. In subsequent years, UI only guaranteed market for the produce without providing any inputs. In year 1, three farmers' associations with 32 members were contracted by UI to grow potatoes with technical support from the above organizations. In 2007/2008, the mean plot size planted per farmer varied from 0.10ha to 0.30ha. Of the three farmers' associations, the most successful was Titukulane Farmers' Group in Dedza district

with a mean net return on farmer's labor of 67,303 Malawi Kwacha (USD481) from a mean plot size of 0.18ha during a 4-month cropping season. This corresponded to a mean net daily return on farmer's labor of 4USD. In the summer crop of 2009/2010, the farmers' plots sizes ranged from 0.1ha to 0.8ha with a mean of 0.35ha. The group realized around MK1, 000,000 (approximately USD6,600) from about 20tonnes of potatoes. In addition to incomes from potato, farmers had potatoes for home consumption and seed tubers selected through positive selection technique. The success of this group needs to be replicated with more groups of farmers.

Farmer-to-Farmer experts help African potato growers enhance food security

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The United States Farmer-to-Farmer (FTF) program provides technical assistance to agricultural people in developing countries. FTF volunteers respond to local needs of host-country farmers and organizations with the mission of enhancing food security. The Biriwiri Farmers and Marketing Cooperative Society (BIFAM) in Ntcheu, Malawi provides a case study of how the program can impact African potato grower cooperatives. Recent FTF efforts have focussed on post-harvest storage, processing and marketing for the 80 potato growers who belong to BIFAM. Future efforts will include irrigation development to increase potato supplies during the dry season. Anecdotal evidence suggests that US potato industry experts are willing to go to Africa on short-term volunteer assignments to help potato growers. The BIFAM case study indicates that FTF volunteers can enhance food security through potato industry development.

Mentorship program & its challenges to small holder potato farmers in Limpopo Province: Case study on RESIS projects under potato production.

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Potato is classified as a horticultural crop and is an important role player in South African economy. It is used for table, processing and seed potato. Limpopo province is the largest producer of table potatoes in South Africa and its production region stretches from Settlers in the south to Pontdrif in the north. The province takes a lead regarding emerging farmer development and BEE projects which operate through mentorship programs of well established commercial farmers. Production in the province is under irrigation mostly from boreholes and the average annual rainfall is about 350 mm. There are nine (Elanskraal, Ikageng, Setlaboswana, Krokodil, Phetwane, Straykraal, Grootfontein, Mbahela and Makuleke) RESIS (Revitalization of Smallholder Irrigation Schemes) projects under potato production under the mentorship of strategic partner who provide market access and production expertise to the farmers. These projects were established and funded by the Department of Agriculture through installation of irrigation systems for the whole project and identification of a mentor. Despite the intervention of the strategic partner farmers are still experiencing major challenges for example skill

transfer from mentor to beneficiaries, commitment and conflict amongst beneficiaries and undefined succession plan. In addition to challenges there are notable successes such improved livelihood through job creation in the community, sponsorship of post matric studies and market access. This paper seeks to indentify gaps and intervention ways in assisting the potato smallholder farmers to be competitive in the potato industry especially after the contract between the farmers and the strategic partner has come to an end.