

WORLD POTATO CONGRESS 2022

Ireland, considered by many to be the potato's natural home, was host to the 11th World Potato Congress, held earlier this year. Over 1,000 delegates from 60 countries came to Dublin to enjoy an extensive trade show and talks ranging across every aspect of production, processing and consumption.

By Jenny Ekman, with help from Georgia Thomas



Left to right: Michael Hoey (President IPF, Ireland), Georgia Thomas (Potatoes WA), Dr Tom Arnold (Chair, Irish 2030 Agri-Food Strategy Committee), Lauren M Scott, (Chef Strategy Officer, International Fresh Produce Association), Romain Cools (President / CEO WPC Inc.) Tara McCarthy (Chief Executive, Bord Bia), Cedric Porter (Managing Editor, World Potato Markets)

With Adelaide set to host the next Congress (23-26 June 2024), it was an excellent prequel for the 16 or more Australian growers, researchers, agronomists and suppliers who were able to make the trek to the Emerald Isle, with its rolling hills, rich soil, high quality potatoes and tasty pints of Guinness.

The Congress was formally opened by Charlie McConalogue, Ireland's minister for Agriculture, Food and the Marine. The plenary session that

followed featured many distinguished speakers, including Dr Qu Dongyu, Director General of the FAO (Food and Agriculture Organisation) and Mr Janusz Wojciechowski, Commissioner for Agriculture in the EU.

POTATOES TO FEED THE WORLD

According to Mr Wojciechowski, "As a staple food, the potato carries deep social and historical significance in Ireland, as it does in my home country

of Poland, and continues to nourish populations around the world today."

Indeed, food security was a consistent thread throughout the congress, with many speakers noting the potato's importance as a productive, nutritious and sustainable food. There was much talk of expanding populations, shrinking resources, and the ways that potatoes could help to avert calamity.

World consumption of potatoes already provides some jaw dropping

figures. In 2020, 360 million tonnes of potatoes were produced worldwide. Divided by a world population of 7.7 billion, this suggests that each person on the planet eats around 130g, or one small-medium potato, daily. Belarusians are the champions, consuming around 175kg annually per person; Australians need to lift their game – a mere 18kg!

While China is far and away the world's largest potato producer (782 billion tonnes), followed by India (513 billion tonnes), the next two largest producers are Ukraine and Russia. While both produce large volumes, these are mostly from small, relatively low technology family farms.

According to Professor Damien McLoughlin (UCD Smurfit Business School), it can cost five times more to grow a hectare of potatoes than a hectare of wheat. Despite this, potatoes are more carbon, water and land efficient than almost any other food.

Potato production in western Europe, like Australia, generally averages around 40t/ha. The USA and New Zealand are even more productive, averaging around 50t/ha. However, average yields globally are closer to 20t, with many countries only achieving around 17t/ha (including Russia, Ukraine and China).

Moreover, gains in productivity have not kept up with other crops. "Since 1960, wheat yields have increased 220%, corn by 195%, rice by 150% but potatoes have only increased by 80%," commented Professor McLoughlin.



Left: Lauren Scott (Chief Strategy Officer, International Fresh Produce Association); Tara McCarthy (Chief Executive, Bord Bia) and Georgia Thomas (WA Potatoes) at the conference opening

Bottom: DUG potato milk promotion (*we preferred the creamy potatoiness of the 'Barista' blend*)



Professor McLoughlin also discussed sustainability, and what that means. "Consumers demand all sorts of things, but are often unwilling to pay for it. They have been conditioned to expect that food is cheap," he said. "While there is widespread eco-anxiety, most are looking to industry to take a lead. This means we need to find ways to resonate with consumers so that they will pay for sustainability goals."

POTATOES TO NOURISH THE WORLD

Potatoes do not provide calories alone, but also nutrients vital to health.

In a fascinating presentation, Dr Gabriela Burgos from the International Potato Centre (IPC) in Peru explained how they have been developing a high iron potato. Iron deficiency is extremely common in women around the world, and a particularly serious problem in less developed countries.

Iron is more bioavailable in yellow fleshed potatoes than many other foods, meaning it is readily absorbed by the body.

The IPC breeding programme has developed biofortified potatoes with 40 -70% more iron than common varieties. Lines have been selected that are also productive, disease resistant and tolerant of heat and dry conditions.

These fortified potatoes have been promoted in Rwanda, Ethiopia and Peru. "Mothers of young children visiting health clinics were given vouchers they could exchange for the

5 things for the future

- Proactive consumers
- Sustainable consumption
- Digitised agriculture
- Food Systems
- New Capital



Of the major carbon producing sectors, agriculture might be the only industry to survive

- Where are the opportunities?
- What are the potential benefits of faster and bigger commitments to carbon reduction?



Slides by Professor D. McLoughlin



Biofortified seed potatoes. Photo by World Potato Centre, Peru

high-iron variety potato seeds. We also made cartoon videos promoting high-iron potatoes to children," explained Dr Burgos.

"So far, there has been good acceptance of the varieties. The next step is to conduct a follow-up study to demonstrate improvement in health status for these women," Dr Burgos added.

There seems little doubt that high-iron potatoes would have great appeal for many women, not just those in less developed countries. Increasing iron content seems particularly timely as many people seek to reduce their red meat intake, adopting a more 'flexitarian' diet.

This presentation was followed by what was surely one of the conference highlights – our own Georgia Thomas from WA Potatoes outlined some of the findings from the Hort Innovation funded project, PU19002 *Educating health professionals about Australian potatoes*.

The project was developed to address the perception that, unlike other vegetables, potatoes are fattening due to their carbohydrate content. Diabetics, in particular, may avoid potatoes due to concerns about blood glucose spikes.

However, tests of six different varieties have shown that they are an excellent

source of fibre, as well as potassium and other nutrients. Analysis also demonstrated that cooling cooked potatoes promotes conversion into resistant starch. Resistant starch has been shown to have significant benefits for gut health and glycaemic control as well as helping people 'feel full'. If cooled potatoes are then reheated, resistant starch levels rise even higher, further reducing their GI (glycaemic index) value.

Georgia also mentioned the low GI certified Carisma potatoes, a variety which appeared new to many in the audience.

The PU19002 study showed that nutritional value was maximised by:

1. Keeping the skin on
2. Choosing coloured varieties
3. Steaming or microwaving
4. Eating cooked potatoes after cooling.



50% more iron than conventional potatoes

500gr meet half the iron needs of a woman of reproductive age

More accessible **iron** than most crops

Under evaluation for release as varieties in Peru, Ethiopia, Rwanda, India, etc.

High iron potatoes. Image by the International Potato Centre, Peru

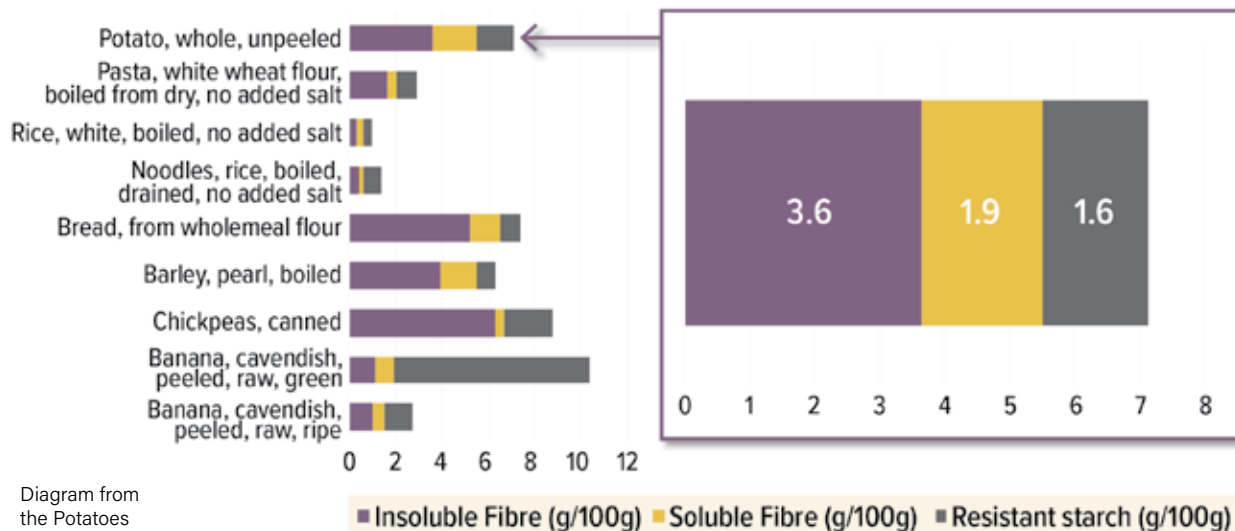


Diagram from the Potatoes and Resistant Starch fact sheet (PU19002)

Data source for foods other than potatoes: Food Standards Australia New Zealand (FSANZ)
The project data was tested using cooked, then cooled whole, unpeeled potatoes.

“We have been using these results to promote potatoes through a website, social media and in schools,” explained Georgia. “Providing potato seeds and growing guides for school gardens has proven incredibly popular. It has really improved understanding of, and liking for, potatoes, thanks to WA grower investment.”

The sea of hands for questions following Georgia’s presentation attested to the interest in her findings, particularly, achieving so many outcomes for a local industry with such a limited marketing budget.

BREEDING A BETTER POTATO

Breeding new potato varieties is a key component in responding to consumer preferences, climate change and pest and disease pressures. Unfortunately, producing new varieties has been slow and imprecise, often taking 10 years or more to reach commercial reality.

However, according to Dan Milbourne (Teagasc), “Potato breeding is in the midst of a sea change that will transform the speed and precision with which new varieties will be developed. Genomic techniques

similar to those that have transformed cattle breeding are now widely used by potato breeders.”

Central to this is the development of diploid potato varieties. Current potato varieties are tetraploids – that is, they have four copies of every gene. Diploids have only two copies. Using diploids makes breeding a lot easier, as the outcome from crossing two varieties is far more predictable.

Diploids are produced by using the pollen from a true-to-type, desired variety to fertilise a flower of the same variety. This means that the true potato seeds produced are essentially ‘fatherless’.



Diploid potato varieties are created by crosspollinating flowers of the same variety.

The true potato seeds produced are an ‘F1’ hybrid, which often increases vigour as well as meaning all seeds are essentially the same. However, they still often need to be inbred to ensure they are genetically uniform. One major advantage of using true potato seed is that most potato pathogens are not internalised, so the chance of disease transmission is reduced by around 95%.

The other breeding method much discussed related to CRISPR (clustered regularly interspaced short palindromic repeats). CRISPRs are stretches of DNA which act like molecular scissors. They can selectively remove, or duplicate, parts of the plant genome.



Potatoes on Prince Edward Island

Because CRISPR techniques do not introduce foreign DNA, the resulting plants are not considered 'genetically modified' in most countries of the world, including Australia.

Essentially, CRISPR just means that breeding can be faster and more targeted than breeding using traditional techniques – "like GPS for DNA," explained Dr Haven Baker.

Dr Baker, co-founder of the biotech company Pairwise, gave a fascinating presentation on the applications of CRISPR technology. Examples included corn with 22 kernels around the diameter instead of the normal 16, increasing yield by nearly 38%. They have also developed thornless, seedless blackberries and salad leaves with the texture and flavour of lettuce but the nutritional qualities of kale.

"Three years ago, it took us a whole year to make three gene-edited berry plants, none of which was commercially viable. Now we can create 100s of new varieties in only

six months, including several with commercial promise," explained Dr Baker.

But it's not that easy for potatoes. "Potatoes are more challenging than other crops. It is difficult to assess traits below ground. Moreover, trials must be done in the field rather than in greenhouses. And starting with tetraploid varieties makes the process more technical and more time consuming as testing requires a minimum four years rather than 6-12 months for other crops. All this makes potatoes a difficult commercial prospect."

However, factors in potatoes' favour include the good genomic data already available. This helps them to be transformed relatively efficiently with excellent potential to breed for higher yields and disease resistance. Combining CRISPR with diploid varieties could also speed the process.

With billions being poured into CRISPR research, high acceptance of

the technology (especially by young people), and major potential advances in variety improvement, expect a CRISPR potato near you soon!

GROWING POTATOES SMARTER

It has already been noted that potatoes are an expensive crop to grow. With input costs rising sharply around the world, it's no surprise that there were numerous presentations on precision agriculture. These focussed on variable rate planting, precision spray equipment for weeds and disease, as well as improved efficiency of fertiliser application.

One standout presentation by agronomist Evan MacDonald described trials on Prince Edward Island in Canada. Intensive mapping of soil, water, topography and EC at three very different sites was combined with different planting rates. Areas were classed as low, medium or high productivity, then planted at normal density +/- 15%.

Crop value/acre including seed costs and size profile

Trial site	Productivity index	Seed spacing		
		tight	normal	wide
Site 1	low	\$3,610	\$4,726	\$4,473
	medium	\$4,035	\$4,341	\$4,232
	high	\$4,878	\$4,412	\$4,726
Site 2	low	\$5,933	\$6,618	\$6,885
	medium	\$6,788	\$6,414	\$6,445
	high	\$6,695	\$6,713	\$7,917
Site 3	low	\$5,417	\$5,307	\$6,026
	medium	\$5,023	\$4,231	\$4,840
	high	\$5,019	\$4,842	\$4,744

Data presented by agronomist Evan MacDonald on the effects of seed spacing in different productivity zones of the paddock on total profitability at three different sites on Prince Edward Island, Canada

What set this work apart was the focus on net returns, rather than simply yield and quality.

While results were highly variable and, it was noted, relate to only one season, the value of changing planting density according to productivity index was quite site specific.

Site 1. Planting seed more densely in the most productive areas of the paddock increased returns, whereas increasing density in the low productivity areas of the paddock significantly reduced returns.

Site 2. The normal planting density may be too tight; returns tended to increase by spacing seed more widely, regardless of productivity index.

Site 3. Profitability could be maximised by reducing planting density in the low productivity areas and increasing density in the medium and high productivity areas.

The take home message from this was that there is no one-size-fits-all approach to increasing or reducing seed planting density, and that only by monitoring yield by productivity index can growers make informed decisions about optimising plant spacing.

To give a commercial perspective, Mark James from John Deere presented an overview of some of the new spray technology that the company is developing.

While it is common for spray systems to have GPS based sector control, the new units also feature individual nozzle control. These recognise when the boom is turning and compensate by changing flow rate, thereby

reducing underspray/overspray on headland areas. These systems also reduce overlaps on the boom width and allow spot spraying of individual areas.

“Images made using a drone or robotic scout can be put into the controls on the tractor. This can be used to target weeds selectively, or address areas of high pest pressure,” Mark said. “We also attach an additional nozzle at



See and Spray unit from John Deere

the end of each boom, which ensures there are no gaps in crop coverage."

While the gains from reduced overspray are relatively slight (around 1%), increasing costs increase their significance. Other trends noted were:

- Reduced nozzle spacing from 50cm to 25-35cm, allowing lower height settings while reducing drift.
- 'ExactApply' nozzles with remote control of droplet size and pressure.
- 'See and Spray' with high-definition cameras installed on the spray boom:
 - Identifying plants vs soil as well as plants vs weeds and adjust



Ruby Daly and Lelani van der Merwe examine potato varieties, and other images from the potato field day

spray accordingly, all while travelling at 19kph.

- Estimates of up to 77% reduction in herbicide use across an average crop with medium weed density.
- Available now for corn, soybeans and cotton, still under development for potatoes.
- Cost is approximately double a normal spray unit.

THE FIELD DAY

With our brains full after more than two days of talks, field trips were the focus of day three. The key attraction was the 'Potato Field Event' at Maple Lodge farm just outside Dublin. Maple Lodge Farm not only grows potatoes, but is home to one of the best

collections of vintage farm machinery in Europe, all lovingly restored to showroom condition.

Field displays included plot trials of growth stimulators, showcasing of potato varieties and an impressive display of gleaming new farm machinery. A neighbouring field was used to demonstrate the machinery in action, to the delight of onlookers, equipment reps and large numbers of gulls.

It was interesting to see that many of the planters, harvesters, balers and other machines were self-propelled. This is because field conditions in Ireland are often wet, limiting use of tractors, particularly at harvest.

In fact, most Irish potato farms do not use irrigation at all, water being supplied regularly from the sky. Despite this, local yields average 40-45t/ha and sell for approximately €265 to €300/tonne (AUD 390-450).



WORLD POTATO CONGRESS 2024

The next World Potato Congress is to be hosted by Potatoes Australia in Adelaide from 23-24 June 2024.

This congress gathers potato professionals from all over the world to meet and share ideas and knowledge, promoting the potato.

Get involved

Potatoes Australia are calling for Expressions of Interest from those who would like to be involved. Please contact:

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SAM DENNIGAN AND CO.

With the support of partial funding from PotatoLink (PF20000), a small but select group of growers and agronomists, together with the author and AuSPICA board member Jonathan Eccles, conducted some pre-conference investigations.



Left to right: Jenny Ekman, Lachlan Heyson, Anna Young, Ruby Daly, Lelanie van der Merwe, Joe Dennigan, Tom McDonnell, Jonathan Eccles.

At Sam Dennigan and Co. we were hosted by co-owner Joe Dennigan, together with manager Tom McDonnell.

Dennigans handle 50,000t of potatoes annually, mainly sourced from local growers. The ware potatoes they were packing on the day of our visit (30 May) had been stored since last September. Stored at 3°C, the potatoes are then warmed to 10-12°C before packing. They had been treated with the new anti-sprouting treatment 1,4Sight (dimethylnaphthalene) due to the withdrawal of CIPC (chlorpropham) by the EU.

The Irish industry is dealing with the same personnel issues as we are in

Australia and is similarly seeking to automate wherever possible. To my eye, the packing lines were so clean they looked almost brand new! They also featured the latest high tech vision systems for automatic grading and bagging. Impressive.

Dennigans does not just pack potatoes; they also act as a distribution centre for all fresh and frozen produce for a large Irish supermarket chain. Their 35,000m² storage and cold rooms hold everything from bananas to cheese and meat to icecream. A fully computerised pick and pack system feeds a fleet of refrigerated trucks which service the whole of Ireland.

One of the key challenges facing the business is finding ways to reduce its carbon footprint. This is not just an altruistic move to help meet the EU meet its goal of a 50% reduction in emissions by 2030; a carbon tax is in place and increases every year.

Dennigans have a large solar array in place, which provides 20% of the distribution centre energy needs – clearly the Irish sun has more power than we thought! There are also plans for a wind farm. However, there is still no viable alternative to diesel, so trucks represent a real challenge.

The company has made progress on reducing waste. Cardboard and soft plastics are all accumulated and recycled. While there are labour costs involved, sale of materials has made this cost neutral or even slightly profitable.

Another aspect the company is very proud of is its wastewater treatment system, which was designed by VESI Environmental. After initial treatment, wash water and sewage is fed through a series of three ponds. These artificial wetlands have been planted with reeds, sedges and other species selected for their capacity to remove nutrients from the water.

The water is tested for nitrates, phosphorous, etc., before flowing into the local creek, and demonstrated clean. While this system was the first of its kind in Ireland, its success has seen it adopted more widely.

With abundant birdlife, it even makes a pleasant picnic spot for employees to have lunch!

Anti-clockwise from top: Lelanie Van der Merwe, Ruby Daly, Anna Young and Tom McDonnell examine packed spuds; the company's wastewater treatment ponds; Joe Dennigan explains their recycling program



TOMRA

At TOMRA the group was generously hosted by Marco Giovanni Colombo (Global Category Director Potatoes), together with John McGloughlin (Head of Innovation), and Eamonn Cullen (Market unit manager).

TOMRA was founded in Norway on April 1, 1972 by brothers Petter and Tore Planke. After seeing a local grocer struggle with the manual collection of empty bottles in their store, the brothers developed the first fully-automated reverse vending machine (RVM) in their family's garage. This means TOMRA is now celebrating its 50th Anniversary!

The sorting technology they developed for collection and processing of recyclables, as well as for the mining industry, has proven readily transferable to food. Although involved for only 10 years, TOMRA already represent around 25% of food processing technology.

Potatoes are a key area with the company making sorting, grading and processing equipment.

For example, 85% of peeling worldwide is now done using TOMRA equipment. Their new steam peeling technology was previously featured in PotatoLink (Spring 2021).

However, on this visit we were most interested in their new optical sorters.

TOMRA is currently developing a portable optical sorter which could be fitted to a harvester. A row of LEDs analyses the potatoes as they fall from a top belt onto a 'trampoline' belt below. Clods and rocks are flicked out the back using a bank of 'fingers'.

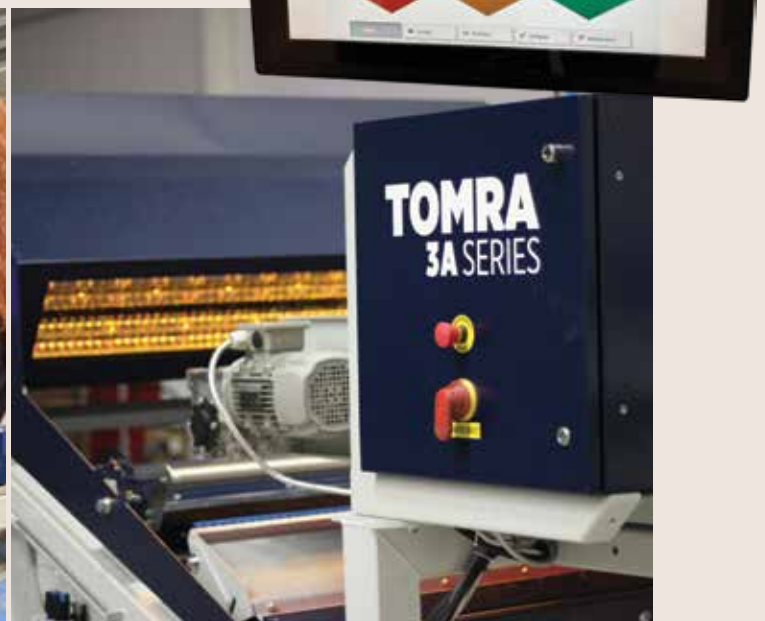
Although the unit is limited by 'seeing' only one side of the potato, it still has potential to be used to reject green or rotten tubers. It could also be used to estimate yield in real time, while removing the need for human sorters on the back of the harvester.

A similar device developed for packing lines has two banks of LEDs, thus 'seeing' all sides of each tuber. Again, analysis occurs – impressively – as the tubers fly through the air. In this case they can be sorted three ways: Good;

Repurpose e.g. green, marked, small rot; or Full rejection e.g. clods, foreign objects (see image below).

The units are 90-95% efficient and can process up to 100t/hour, reducing labour requirements by as much as 70%. Adding NIR (near infrared) detectors could potentially allow the machine to detect internal defects, such as blackspot or hollow heart.

Videos showing the operation of the TOMRA 3A for both washed and unwashed potatoes, and other sorting technologies, can be viewed at <https://video.tomra.com/tomra-3a-potato-sorting>



Marco Combo explains air sorting technology to Anna Young and Lelanie van der Merwe, and the new TOMRA 3A air sorter at their Dublin development facility.