eapr 2024

22nd EAPR Triennial conference
Oslo, Norway, July 7-12, 2024

Program

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22nd EAPR Triennial conference
Oslo, Norway, July 7-12, 2024

Program book

Content

Welcome to EAPR2024 in Oslo!

I am very happy to welcome you all to EAPR2024 – the 22nd Triennial conference of EAPR.

The headline for this conference is: **Sustainable Potato production: advances and applications of Potato Research**. Potato is still the third most important food crop in the world in terms of human consumption. There are several constrains for the potato growers. Some challenges are worldwide like threats from pests and diseases, causing need for more pesticide treatments than in most other crops. Climate changes, with higher temperatures and more unpredictable rainfalls are making the potato production more vulnerable during the entire growing season including the harvest time. Obviously, these and other challenges give the pressure for breeders to release more robust cultivars and the need for new technology.

All these and other challenges covering a broad specter of subjects related to the potato crop are covered in the nine scientific sessions of the conference by 12 keynotes, 87 oral presentations and 93 posters. At the end of the conference, we will also discuss how to bring new knowledge from the scientific community into practical application.

The organizer of the conference is the Norwegian Institute of Bioeconomy Research (NIBIO), which is the main institute for potato research in Norway including both agronomic and plant health research. This is the first time for Norway to host an EAPR conference and I, and the organizing committee, am eager to make “the best Triennial conference ever” (in Norway). However, you, and every participant in the conference, have a part in the responsibility for making the conference successful, by sharing your scientific findings in oral and poster presentations and by mingling with colleagues from Europe and beyond. We will be approx. 280 participants from 35 nations present at the conference!

I would like to thank the organizing committee and the scientific committee for all good work preparing this conference. And I must admit, preparing a conference is much more work than expected.

I hope you all will enjoy EAPR2024: The scientific contents, but also the full day of excursions to visit potato growing areas including visits of farmers, companies and institutes. And not to forget to make the scientific community stronger by social activities together with old and new friends.

Arne Hermansen
President of EAPR

Potato production in Norway

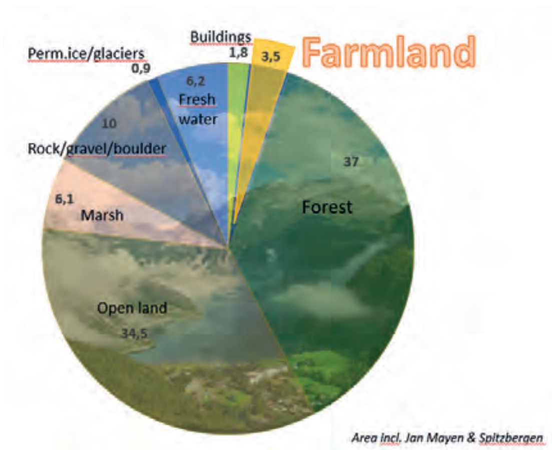
About 3,5 percent of Norway is cultivated land, and potatoes are grown on 1,17 percent. In total Norway grow potatoes on 11.895 ha (2023). There are 1438 potato farmers in the country.

Norway is a long country, and potatoes are grown from Kristiansand in the south (58°17) to Alta in the north (69°57). This makes for a great variation in the growing conditions. Potato varieties reaction to day light hours is quite unpredictable. Because of the midnight sun a variety grown in northern Norway may respond very differently to what is normal in the middle of Europe. North of the polar circle you find 2,3% of the potato production. Graminor (breeding company) has their own hobby breeding in Målselv in the north, to find new varieties that grow well under the midnight sun.

The average yield is ca. 31 tons per ha, and the total yearly production is between 315 and 400 thousand tons. Half of the potatoes are grown in the county Innlandet. The first early potatoes come on the market from beginning of June. In addition to the early potatoes Norway produce table potatoes, chips/crisps (5 factories), French fries (3 factories), peeled potatoes, flakes etc. but the starch production is very small.

Norway does not import seed potatoes. All partners in potato production are afraid of bringing in new pests and diseases, and therefore protect our own production. Certified seed potatoes are mainly grown by four companies and their potato farmers, starting from a meristem production situated in Overhalla, in the middle of the country.

Some Norwegian varieties are: Juno and Hassel (very early varieties); Rutt (half early); Beate, Gulløye, Knallfiffi, Nansen (table potatoes), Berle, Bruse, Gullflaks (chips), Peik (French fries).



Potato growing on the west coast of Norway. Photo: Frode Grønmyr

Nice to know about the program

On Sunday: Country representative meeeting, 18.00 in meeting room Nautilus
In the evening there will be a "Get together" from 19.00 on the terrace outside the hotel, or in the restaurant if the weather does not cooperate. Serving of wraps and 2 drinks of beer/wine or soft drinks are included.

Monday evening has a Reception on a sightseeing boat in the Oslo fjord. The boat departs from the Seaplane harbour, see map at p. 38., at 17.00, don't be late! Serving of drinks and snacks on the boat.
After the boat trip, a Tapas menu including 2 drinks of beer/wine or soft drink is served at the hotel.

Tuesday morning section meetings from 11.00 to 12.00
- Agronomy & physiology: Atlantis 3
- Breeding & varietal assessment: Atlantis 1
- Pathology & pests: Atlantis 2
- Post harvest: Nautilus
- Virology: Hydra

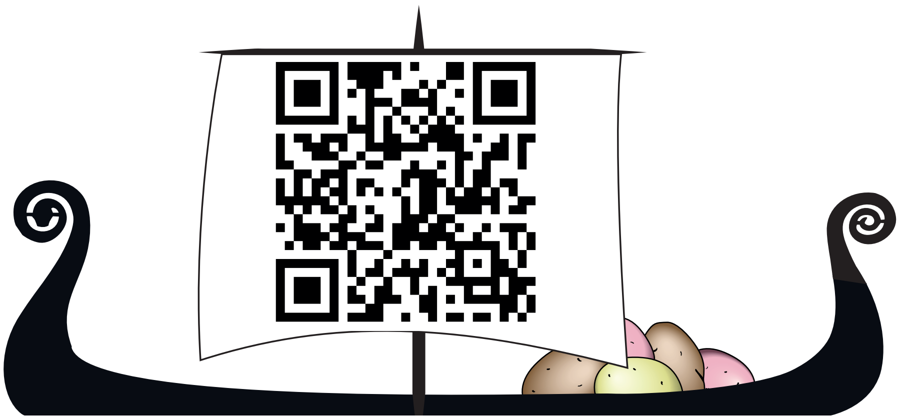
Wednesday morning has an early start for the excursion day. Breakfast starts at 06.30. The buses leave at 07.30 from the Seaplane harbour. There are 5 different tours, buses will be marked, please note your tour number in due time, notified by email, lists are available in our help desk. Meals: Packed lunch during the day, dinner in the afternoon. Returning to the hotel approximately at 20.00.

Thursday evening Conference dinner time. Meet outside the hotel entrance at 17.15 for a sightseeing in Oslo before the dinner at Sjømagasinet at 19.30. If you are not joining the sightseeing tour, you can meet directly at the restaurant at 19.30. The restaurant is at Aker brygge near Oslo city centre, Tjuvholmen Allé 14, 0252 Oslo. We will go back to the hotel by boat at 23.30 from Sjømagasinet.
The bar at the hotel is open after midnight.

Abstracts: We decided not to print a book of all abstracts for the conference. However, all abstracts are available online in one file, allowing you to access each abstract by searching the talk or poster codes from lists provided in this book.

The book of abstracts has its own link:
https://nibio.pameldingssystem.no/auto/1/EAPR2024/EAPR2024-bookofabstracts.pdf

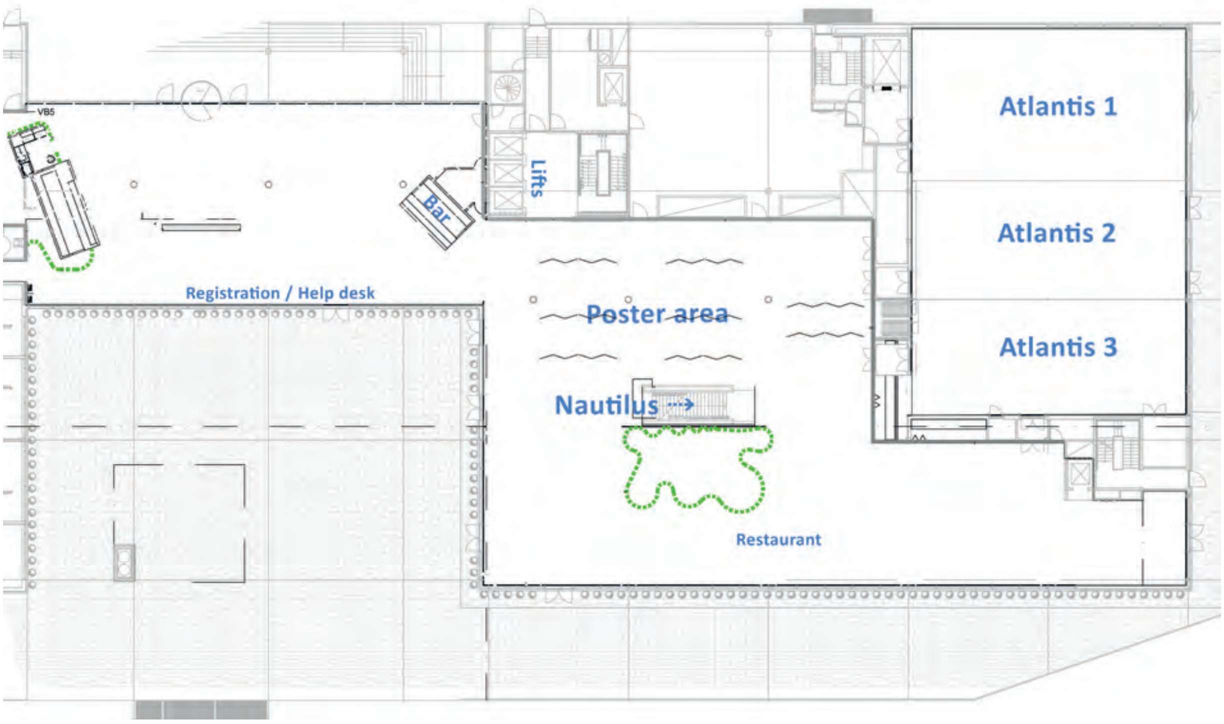
Program The last and most updated program for EAPR2024 is always available at the Conference homepage:
https://nibio.pameldingssystem.no/eapr2024#/program
https://shorturl.at/z8iov



Program at a glance

	Sunday July 7	Monday July 8				Tuesday July 9				Wed. 10.7	Thursday July 11				Friday July 12	
7.30		Conference hall Atlantis 1 + 2				Conference hall Atlantis 1 + 2					Conference hall Atlantis 1 + 2				Conference hall Atlantis 1 + 2	
9.00		Opening ceremony				Keynote 6b				Excursion day	Keynote 3				Keynote 10a	
9.30		Keynote: Food security				Keynote 7					Keynote 4				Keynote 10b	
10.00		Coffe break				Keynote 1					Keynote 8				Coffe break	
10.30		Keynote 2				Coffe break					Coffe break				Atlantis 1 Session 1	Atlantis 3 Session 10
11.00		Keynote 5				Section meetings see page 4					Atlantis 1 Session 1	Atlantis 2 Session 3	Atlantis 3 Session 4	Nautilus Session 8	122	Workshop
											113	307	401	801	123	
11.30		Keynote 6a									114	308	402	802	124	
											115	309	403	803	Closing session	
12.00		Lunch				Lunch					Lunch				Lunch	
13.00	Registration opens	Atlantis 1 Session 1	Atlantis 2 Session 2	Atlantis 3 Session 5	Nautilus Session 6	Atlantis Session 1	Atlantis 2 Session 3	Atlantis 3 Session 5	Nautilus Session 7		Atlantis 1 Session 1	Atlantis 2 Session 3	Atlantis 3 Session 5/7	Nautilus Session 8	Goodbye	
		102	201	501	601	107	301	507	701		116	310	513	804		
		103	202	502	602	108	302	508	702		117	311	514	805		
		104	203	503	603	109	303	509	703		118	312	515	806		
14.00		105	204	504	604	110	304	510	704		119	313	707	807		
		106	205	505	605	111	305	511	705		120	314	708	808		
		101	206	506	606	112	306	512	706		121	315	709	809		
15.00		Poster presentations in sessions				Poster presentations in sessions					Poster presentations in sessions					
15.15		Coffe break				Coffe break					Coffe break					
15.45																
16.00		Poster session				Poster session					Poster session					
17.00	Council meeting	Reception /Boat trip														
18.00	Country representative meeting					EAPR General Assembly in Atlantis 1					Guided tour of Oslo & Conference dinner					
19.00																
20.00	Get together									Back at hotel						

Hotel overview



Monday July 8

Conference hall Atlantis 1 + 2

9.00	Opening ceremony and plenary session Chair: Arne Hermansen and Ian Toth			
9.30	Keynote: Food security. Potato: the smart crop for food security. Monica Parker, International Potato Center, Vancouver, Canada			
10.00	Coffe break			
10.30	Keynote 2: Insects as vectors of pathogens. May Bente Brurberg, NIBIO and NMBU, Ås, Norway			
11.00	Keynote 5: New insight in seed tuber physiology. Paul Struik, Wageningen University and Research, The Netherlands			
11.30	Keynote 6a: Towards data-driven precision crop management of potato. Corné Kempenaar, Wageningen University & Reserach, The Netherlands			
12.00	Lunch			
	Atlantis 1	Atlantis 2	Atlantis 3	Nautilus
13.00	Session 1: Breeding robust cultivars Chair: Mehmet Çalişkan	Session 2: Improved potato health Chair: Carl Spetz	Session 5: Agronomy and tuber physiology Chair: Dominika Boguszewska-Mańkowska	Session 6: Precision technology in potato cultivation Chair: Corné Kempenaar
	102 - Phenotypic and genotypic screening for nitrogen and phosphorus efficiencies in potato genetic resources. Klaus J. Dehmer, Germany	201 - Aggressiveness and behavior of different pectinolytic bacteria species involved in potato blackleg disease. Jérémy Cigna, France	501 - Is plant maturity a reliable indicator of bruise susceptibility? Michael Thornton, USA	601 - Risk maps in VIPS deliver late blight warnings at high spatial resolution. Berit Nordskog, Norway
	103 - Innovative potato breeding through fixation and restitution – the happy medium between conventional tetraploid and diploid F1 hybrid breeding. Corentin Clot, The Netherlands	202 - A microscopic examination of potato root infection by *Pectobacterium atrosepticum*. Ian Toth, United Kingdom	502 - Environmentally triggered russeting – an overview. Idit Ginzberg, Israel	602 - Potassium management strategy in starch potatoes. Malte Nybo Andersen, Denmark
	104 - Development of new potato varieties for north of Norway. Hans Arne Krogsti, Norway	203 - Bacterial wilt of potato: a threat to food security in sub-saharan Africa. Kalpana Sharma, Kenya	503 - Quantifying differences in source-sink relations between hybrid potato plants grown from two types of propagules. Jiahui Gu, The Netherlands	603 - Using drone-retrieved multispectral data for phenomic selection in potato breeding. Alessio Maggiorelli, Germany
14.00	105- Transcriptomic dynamics and biochemical insights into anthocyanin-enhanced tolerance to *Rhizoctonia solani* in potato. Vincenzo D'Amelia, Italy	204 - Pepper ringspot virus (PepRSV), the latest threat to the South African potato industry. Lindy Esterhuizen, South Africa	504 - Agronomy of field transplanted hybrid potato crops. Olivia Kacheyo, The Netherlands	604 - Screening a breeding program for nitrogen use efficiency using drone imagery. Laura M. Shannon, USA
	106 - Predictability of breeding further improved by doubled haploid technology. Wessel Holtman, The Netherlands	205 - Losses from seedborne Potato Virus Y infection dependent on strain and variety. Mark Pavek, USA	505 - Promoting international collaboration in potato breeding to transfer frost tolerance from *Solanum commersonii* into native potato cultivars from the Andean region and the Altiplano. Alfonso H. del Rio, USA	605 - In-season potato crop nitrogen status assessment from satellite and meteorological data. Jean-Pierre, Belgium
	101 - The role of Yip1 proteins in membrane trafficking and potatoes' resistance to stress. Zainab M. Almutairi, Saudi Arabia	206 - Operator influence on roguing efficacy for control-ling potato virus Y in seed potato fields. Brice Dupuis, Switzerland	506 - Revolutionizing Seed Potato Production System in Africa and Asia. Kalpana Sharma, Kenya	606 - Combining remote sensing and crop growth model for better decision support on water and nitrogen management in potato. Fedde D. Sijbrandij, The Netherlands
15.00	Poster presentations in sessions			
15.15	Coffe break			
15.45	Poster session			
17.00	Reception /Boat trip			

Tuesday July 9

Conference hall Atlantis 1 + 2
Plenary session – Chair: Paul Struik

9.00	Keynote 6b: Next generation of more efficient fertilizers. Søren Husted, University of Copenhagen, Denmark
9.30	Keynote 7: The impact of climatic change on potato production: a focus on water management. Anne Gobin, K University of Leuven, Belgium
10.00	Keynote 1: Renseq: a fast-track method for development of potato pests and disease resistance markers from genome sequences. Ingo Hein, The James Hutton Institute and the University of Dundee, United Kingdom
10.30	Coffe break
11.00	Section meetings, rooms, see page 4
12.00	Lunch

	Atlantis 1	Atlantis 2	Atlantis 3	Nautilus
13.00	Session 1: Breeding robust cultivars Chair: Marielle Muskens	Session 3: Integrated pest management Chair: Brice Dupuis	Session 5: Agronomy and tuber physiology Chair: Borghild Glorvigen	Session 7: Sustainability in a changing climate Chair: Laura Grenville-Briggs
	107 – Identifying potato cyst nematode resistance gene, Gpa5, with SMRT-AgRenSeq-d. Yuhan Wang, United Kingdom	301 – Investigating the causal organisms involved with potato early dying in South Africa. Rene Sutherland, South Africa	507 – Effect of reduced N-fertilization on nitrogen use efficiency and selected quality parameters in starch potatoes and outlook on the POTENZION project. Marcel Naumann, Germany	701 – Unravelling the molecular mechanisms of heat-induced decrease in starch content in potato tubers. Sophia Sonnewald, Germany
	108 – Diversity analysis of Rpi genes in potato. Paulina Paluchowska, Poland	302 – Patat'Up: towards the production of a low-input potato. Vincent Berthet, Belgium	508 – Impact of in-row nitrogen fertilization on potato crop. Kürt Demeulemeester, Belgium	702 – Characterizing the Stsp5g a Stsp5g b double mutant as a partial remedy for heat stress. Akiva Shalit-Kanehx, Israel
	109 – Metabolite diversification and fate of bioactive metabolites in backcrossing lines of wild and cultivated potato for resistance breeding. Karin Gorzolka, Germany	303 – Benefits of click beetle monitoring for wireworm control. Katharina Wechselberge, Austria	509 – Assessing the relationship between nitrogen use efficiency and proteins concentration in potato genotypes. Ilze Dimante, Latvia	703 – Efforts to model crop response to hot and dry environments. Jian Liu, The Netherlands
14.00	110 – Fusarium dry rot control through host encoded broad spectrum resistance in potato. Daniel Monino Lopez, The Netherlands	304 – The good, the bad and the ugly: wireworm pests and the cover crops conundrum in potato production. Bruno Ngala, France	510 – Assessing regional potato yield response to phosphorus fertilization in high-phosphorus legacy soils. Lincoln Zotarelli, USA	704 – Effects of climate change on late blight and early blight of potato. Roman Valade, France
	111 – RNAseq expression analysis of potato tubers differing in resistance to soft rot caused by *Dickeya solani*. Renata Lebecka, Poland	305 – Extension education on herbicide injury in potato. Andrew Robinson, USA	511 – Alternative herbicides for desiccation of potatoes in Norway. Kirsten S. Tørresen, Norway	705 – Investigations on nitrogen efficiency and nitrous oxide emissions under reduced N-fertilisation in starch potato cultivation in northern Germany. Hubertus Blanke, Germany
	112 – ScabEomics: *Spongospora subterranea* effectoromics for resistance breeding to powdery scab in potato. Maria de la O Leyva-Pérez, Ireland	306 – *Streptomyces* secondary metabolite effects on *Pythium*, *Colletotrichum* and *Helminthosporium*. Brad Geary, USA	512 – Test of alternatives to diquat in desiccation of potatoes. Lars Bødker, Denmark	706 – Comparison of the carbon footprint of potato cultivation and processing with other crops and products: What contribution can the potato make to sustainable production? Marcel Naumann, Germany
15.00	Poster presentations in sessions			
15.15	Coffe break			
15.45	Poster session			
17.00	EAPR General Assembly - Atlantis 1			

Wednesday July 10 Excursion day
Separate programs for each excursion, buses depart 07.30 from the Seaplane harbour.

Thursday July 11

Conference hall Atlantis 1 + 2

Plenary session – Chair: May Bente Brurberg

9.00	**Keynote 3:** Prevention and control of late blight. Alison Lees, The James Hutton Institute, Dundee, United Kingdom
9.30	**Keynote 4:** Perspectives of biocontrol of soil borne pathogens and their microbiome interactions in potato. Laura Grenville-Briggs Didymus, the Swedish University of Agricultural Sciences, Alnarp, Sweden
10.00	**Keynote 8:** Preserving potato qualities in stores in a future with increasing constraints. Nora Olsen, University of Idaho, USA
10.30	Coffe break

	Atlantis 1	Atlantis 2	Atlantis 3	Nautilus
11.00	Session 1: Breeding robust cultivars Chair: Mallikarjuna Rao Kovi	Session 3: Integrated pest management Chair: Julie Pasche	Session 4: Improved soil health Chair: Solveig Haukeland	Session 8: Post harvest Chair: Michel Martin
	113 - Salicylic-acid mediated defence against the powdery scab disease. Samodya Jayasinghe, USA	307 - Variety screening for tolerance against Candidatus Phytoplasma solani and Candidatus Arsenophonus phytopathogenicus. Benjamin Klauk, Germany	401 - Geconem: How to collectively manage genetic resistance to potato cyst nematodes? Marie-Claire Kerlan, France	801 - Towards smart potato storage: using CFD modeling and simulation to realize optimized and efficient ventilation within potato storage buildings. Petro Demissie Tegenaw, Belgium
11.30	114 - Engineering of transgene-free potato late blight resistant plants through base editing. Jack Vossen, The Netherlands	308 - Using machine learning as a predictive tool to improve potato black dot management. Marta Sanzo-Miro, United Kingdom	402 - Effects of organic amendments and cover crops on soil characteristics and potato yields. Tatiana Francischinelli Rittl, Norway	802 - Developing automatic tools in the assessment of potato qualities. Fadi El Hage, France
	115 - Field trials in Sweden of potato with changed expression of resistance and susceptibility genes. Erik Andreasson, Sweden	309 - Effect of mulch cover on wilt symptoms and rubber tubers caused by *Candidatus* Phytoplasma solani and *Candidatus* Arsenophonus phytopathogenicus. Benson Kisinga, Germany	403 - Comparing the effectiveness of real-time PCRs to simultaneously detect and identify viable *Globodera pallida* and *G. rostochiensis*. Debastiaan van Kessel, The Netherlands	803 - Effect of water stress in potato crop on post-harvest sprouting. Margot Visse-Mansiaux, Switzerland
12.00	Lunch			

	Atlantis 1	Atlantis 2	Atlantis 3	Nautilus
13.00	Session 1: Breeding robust cultivars Chair: Domenico Carputo	Session 3: Integrated pest management Chair: Alison Lees	Sessions 5 and 7 continued Chair: Sophia Sonnewald	Session 8: Post harvest Chair: Andreas Meyer
	116 - Genomic prediction in potato breeding: status and outlook from the Nordic region of Europe. Rodomiro Ortiz, Sweden	310 - Adoption of an early warning system for the integrated management of potato late blight in Chile. Ivette Acuna, Chile	513 - The influence of late season evapotranspiration replacement rate on potato yield, quality, and economic return. Jacob Paul Meeuwsen,USA	804 - OptiGERM: a French online Decision Support System to help the industry on tuber sprout control management in stores. Michel Martin, France
	117 - Towards selection of more durable resistance to *Globodera pallida*. Julien Leuenberger, France	311 - Creating a synergy between farmers, gardeners, and other stakeholders to eradicate late blight primary inoculum and adopt IPM control strategies. Pierre Deroo, France	514 - Potato cultivation without tillage using straw mulch for sustainable agricultural intensification in Asian rice-based systems. Jan Kreuze, USA	805 - Sprout inhibitors combination for a better efficacy and rates modulations. Morgane Flesch, France
	118 - Marker type and density in tetraploid potato genomic prediction and GWAS – does it matter? Trine Aalborg, Denmark	312 - Aggressiveness of *Phytophthora infestans* isolates from four genotypes widespread in Europe. Mirella Ludwiczewska, Poland	515 - Effects of soil salinity and drought on potato production. Ke Shan, The Netherlands	806 - 1,4-Dimethylnaphthalene performance in temperature-controlled shipping containers. Henning Bergmann, United Kingdom

14.00	119 - Producing a potato pan-NLRome. Thomas Adams, United Kingdom	313 - Rating potato varieties: 30 years of experiments reanalyzed to explicit resistance and explain its variability. Delphine Chauvin, France	707 - Can drought tolerant potato genotyped be selected based on phenotypic traits? Karin I Köhl, Germany	807 - Transcriptomic changes induced by DMN exposure in dormant tubers of three potato cultivars. Emily P. Dobry, USA
	120 - Genomic selection for late blight resistance in tetraploid potato: preliminary results and impact of the minor allele frequency on predictions. Charlotte Prodhomme, France	314 - Global solutions for sustainable late blight management: Evaluating the success of 3 R-gene potatoes in Asia and Africa. Phillip S. Wharton, USA	708 - Does glasshouse trials enable to estimate drought resistance in the field? Maverick Gouerou, France / Switzerland	808 - Greening of potato tubers in grocery stores can be reduced by appropriate storage and packaging. Hanne Larsen, Norway
	121 - Targeted genotyping-by-sequencing of potato Jeffrey Endelman, USA	315 - New mutations in Alternaria solani affect disease management using SDHI / FRAC group 7 fungicides. Julie S. Pasche, USA	709 - Predicting the tolerance of potato genotypes to drought stress based on root/shoot relationship in early plant development. Dominika Boguszewska-Mańkowska, Poland	809 - Glycoalkaloids in processing potatoes and fried potato products: formation and stability. Christina Meyeers, Germany
15.00	Poster presentations in sessions			
15.15	Coffe break			
15.45	Poster session			
17.00 19.30	Guided tour of Oslo & Conference dinner			

Friday July 12

Conference hall Atlantis 1 + 2

Plenary session – Chair: Kürt Demeulemeester

9.00	Keynote 10a: Success factors for transferring knowledge from science to growers. Borghild Glorvigen, Norwegian Agricultural Advisory Service, Norwegian Potato Forum, Norway	
9.30	Keynote 10b: Linking science and industry. Ian Toth, The James Hutton Institute / University of Glasgow, United Kingdom	
10.00	Coffe break	
	Atlantis 1 + 2	Atlantis 3
10.30	Session 1: Breeding robust cultivars Chair: Pawel Chrominski	Session 10 Chair: Jean Pierre Goffart
	122 - Comparing yield stability of tetraploid and diploid potato. Mariëlle Muskens, The Netherlands	**Workshop: Connecting research to practice** Short introduction to the workshop: Global coordination of potato research through the International Potato Partnership. Iain Kirkwood, Potatoes New Zealand Connecting research to practice in Wallonia. Pierre Le Brun, FIWAP, Belgium
	123 - A universal potato research reference set - Simplifying research on a complex crop. Stan Oome, The Netherlands	
	124 - SNP-based assessment of unique and duplicated accessions in genetic resources of Nordic potatoes. Morten Rasmussen, Norway	

Conference hall Atlantis 1 + 2

11.30	Closing session
12.00	Lunch

Keynote: Food security

Potato: the smart crop for food security

Monica Parker

Consultant at International Potato Center, Vancouver, Canada

Potato is the crop for micro to macro investment to support food security from household to national levels. Increasingly, governments and private sector are realising the potential of potato to deliver on food security and financial growth. There is much untapped potential waiting to be realised from closing the yield gap in much of the potato producing world and developing seed systems to enable production to meet demand to provide affordable and nutritious food. International donors are investing in potato projects throughout Africa and MENA. Particularly in the MENA region, the private sector is investing in potato, governments are prioritising potato and supporting subsequent enabling environment programs. Potato can support food autonomy for MENA countries. Potato is versatile, in adaptation, production systems and uses. Potato can be grown from sea to sky, Kwale on Kenya coast to the desserts of northern Africa and the high Andes of Peru. Productions systems are adaptable to a large field, at industrial scale, or in a barrel in a refugee/IDP camp or slum, or at the household level, adapting even to humanitarian situations. Technologies enable production in diverse production systems, with one or two seasons a year with accompanying seed autonomy within commercial, rural and humanitarian conditions. When evaluating crops for prioritisation and investment at large scale, potato produces more nutritious food and calories per unit resource than the other major staple crops. Potato provides many essential nutrients and is adaptable to diverse cultural diets. Giving many reasons why potato is a smart crop for the future of food security, especially in food insecure regions.

Keynote session 2: Improved potato health

Insects as vectors for potato pathogens

May Bente Brurberg[1,2], Simeon Rossmann[1,2]

[1] Division of Biotechnology and Plant Health, NIBIO, Ås, Norway
[2]Department of Plant Sciences, Faculty of Biosciences (BIOVIT), Norwegian University of Life Sciences (NMBU), Ås, Norway

In addition to the ability of many insects to damage and destroy plant crops by direct feeding, insects may act as vectors that transmit pathogenic microorganisms between host plants. It has been estimated that insects contribute to 30 – 40% of losses caused by plant diseases, either by transmission or by indirect effects (e.g. weakening or wounding the plant). Examples of insect vectors include aphids, thrips, leafhoppers, whiteflies, and beetles. These vectors can transmit a wide range of plant pathogens, including plant viruses, phytoplasmas, bacteria, and some fungi. For viruses in particular, the importance of insects in transmission is well documented. For bacterial diseases, however, the role of insect transmission has generally been underestimated, and only few systems have been studied in detail. Herbivorous insects graze on plant tissues that are colonized by microbial communities, including plant pathogenic bacteria, and in addition, the insects have their own microbiome, inhabiting external and internal body parts. The interaction between the specific bacteria and insect can be mutualistic, parasitic or commensal, whether they are plant pathogens or not. For some bacterial diseases such as phytoplasma diseases, insect vectors are necessary as intermediate hosts, and the vectors are often specific. Other bacterial diseases may be transmitted by a broad range of insect species. Pathogenic soft rot bacteria (SRB) belonging to the genera *Pectobacterium* and *Dickeya* cause diseases in potato and numerous other crops. Seed potatoes are the most important source of infection, but how pathogen-free tubers initially become infected remains an enigma. Since the 1920s, insects have been hypothesized to contribute to SRB transmission. We have investigated the occurrence of SRB in insects present in potato fields and identified the species of these insects to better understand the potential of this suspected source of transmission. In all tested potato fields, a large proportion of diverse insects were found to carry SRB. This suggests a need to give more weight to the role of insects in soft rot ecology and epidemiology to design more effective pest management strategies that integrate this factor.

Keynote session 5: Agronomy and tuber physiology

New insights in seed tuber physiology

Paul C. Struik[1], Chunmei Zou[1,2], Willemien J.M. Lommen[1], Martin K. van Ittersum[2]

[1]Wageningen University and Research, Centre for Crop Systems Analysis, Wageningen, The Netherlands
[2]Wageningen University and Research, Plant Production Systems, Wageningen, The Netherlands

A seed tuber starts its life as a swollen stolon tip when tuber induction at that tip is strong enough to change the cell division plane, induce starch and patatin accumulation, and initiate tuber growth. It ends its life after having produced a cluster of stems, although it might live until the end of the bulking of its progeny tubers. Meanwhile, it has multiplied its cell number manifold, accumulated starch, proteins and nutrients, and developed a vascular system to supply the eyes with resources. It has gone through periods of active growth and development, dormancy, periderm formation, maturation, and sprouting. During sprouting it transforms and reallocates reserves to allow sprouts to develop into autotrophic stems. These different stages require both the mother plant and the tuber itself to perceive many kinds of environmental and intrinsic signals and to demonstrate an orchestrated response to all of them. In this keynote, we highlight recent insights in the physiology of seed tubers from their initiation, through their growth, maturation, storage and use. We do so at different levels of biological organisation: tuber (or stolon tip), stem, plant and crop.

A seed tuber shows different sensitivities to intrinsic and environmental factors during each event in its life. Environmental factors, plant nutrition and physiological events have strong legacy effects on what is happening later in the sequence and even on at least two generations of progeny.

Tuberization is under strict control of many internal and external factors, including light, atmospheric composition, availability of assimilates, phytochromes, gene expression, transcription factors, hormones (or hormonal balances), and metabolite availability. However, tuberization is not a status of the entire plant, but an event specific for a certain tuber site. Nevertheless, most research has focused on mechanisms at the plant level.

Molecular genetics helps unravelling tuberization mechanisms of seed tubers at the plant level. This is illustrated by the role of phytochrome. Phytochrome F (StPHYF) plays an important role in the response of tuberization to photoperiod. Genotypes that require short days to tuberize form tubers under long days when the StPHYF gene is suppressed. This is associated with degradation of the CONSTANTS protein StCOL1 and modulation of two FLOWERING LOCUS T (FT) paralogs. Grafting experiments confirm the function of StPHYF. Key proteins involved in regulating tuberization also include StCDF1, StSP6A, POTH1, StBEL5, StPHYB, StCONSTANS, StSUT4 and StSP5G.

Tuberization has a large effect on sink-source relations and carbon partitioning at the stem, plant and crop level. The signal to tuberize results in the accumulation of photosynthates, phloem loading, phloem transport and unloading of sucrose in the swelling stolon tip, followed by the conversion of sucrose into starch. Although the initial tuberization processes are triggered by a push of sucrose, gradually, the tubers become strong sinks, inhibiting further growth of above-ground biomass. These sink-source relations manifest themselves at the stem level, but are affected by competition between stems of the same plant and between plants.

How many tubers are formed per stem is highly controlled by conditions during stolon formation. Adequate moisture is essential for tuber set, but the quantity of photosynthates is important in determining how many tuber incipients will grow or be resorbed. Once the number of tubers per stem is fixed the tuber size distribution is very much a function of yield, although in specific cases leaf-tuber interactions and tuber-tuber interactions may still affect the hierarchy among tubers. This hierarchy, growth and development are also partly influenced by the micro-environment to which the tuber is exposed as determined by its position in the ridge and the rank of the stolon or stolon branch on which it is formed.

After tuber harvest, we employed GC–MS and LC–MS to examine changes in metabolite compositions in different parts of seed tubers of four contrasting cultivars during storage at different temperatures and for different durations. This approach yielded a wealth of information on changes in metabolite compositions that help identify which dynamics of specific compounds are predictive of dormancy break and various stages of physiological ageing or can describe genotype-by-storage temperature-by-storage duration interactions. Other researchers tried to monitor seed physiology by evaluating how the seed's respiration changed over time, how apical dominance of eyes or sprouts developed, which hormones were produced, how cell membranes aged, or which genes were activated.

When used as planting material, a seed tuber takes its life history with it. Taking this history into account during storage, planting and subsequent crop husbandry will enable farmers to optimize the performance of their crops.

Keynote session 6a: Precision technology in potato cultivation

Towards data-driven precision crop management of potato

Corné Kempenaar[1,3], Fedde Sijbrandij[1], Thomas Been[1], Koen van Boheemen[1], Johan Booij[2], Frits van Evert[1], Misghina Goitom Teklu[1], Geert Kessel[2], Jos Tielen[1], Tamme van der Wal[1]

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Precision farming is responding to temporal and spatial variation in crops. In the last decade, several sensor systems and digital tools have become available to capture variation in soil conditions, crop growth and/or pests and diseases. In addition, smart planters, sprayers and spreaders can be used for variable rate or spot application of inputs. Data from sensors in combination with decision support models and smart machines allow for more sustainable production. And more and more, we see science based data-driven strategic decisions on farms. In this key note, we present progress in precision planting, fertilization, irrigation, disease, pest and weed control and harvesting in potato crops. The WUR data service platform farm**maps** plays a key role in bringing the knowledge to farmers via apps. Each app consists of a model that can be accessed by API and an interface how to use it via the platform. Over 20 apps are now available in the store of the platform, including apps for scenario studies and evaluation of environmental performance of farming. A digital twin linked to farm**maps** is developed to study nitrogen dynamics in crops and between arable and diary farms. Data assimilation and crop growth models are part of the digital twin. How all these tools are used and integrated in a Farm of the Future, will be presented, including how the data can be used to report on key performance indicators and other mandatory proofs of compliance to regulations now set for Dutch farmers. Future outlook will be discussed.

Keynote session 6b: Precision technology in potato cultivation

The next generation of more efficient fertilizers in potatoes

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Potato (*Solanum tuberosum*) is a highly phosphorus (P) demanding crop, and adequate P supply throughout the entire growth period is crucial to ensure optimal yields and product quality. In the early growing season during the tuber initiation stage, P has a significant effect on tuber setting. The highest quantity of P is taken up during tuber bulking in the mid- to late growing season, and continues in the tuber maturation phase, where it improves tuber maturity. During tuber bulking, P has a critical role in carbon partitioning and starch synthesis, where several key enzymes are tightly regulated by the phosphate concentration in amyloplasts. In order to ensure optimal yield and quality of potato, it is therefore important to avoid P deficiency during the growing season. However, potatoes have a sparse and shallow root system, with up to 90% of roots located in the uppermost 25 cm of the soil. This reduces their access to nutrients with limited mobility in soil, not least P. As a result, the P use efficiency (PUE) of potatoes are generally low, and the excessive application of P used to compensate for the low PUE, results in environmental damage and economic losses. Thus, a foliar fertilization strategy where the soil is bypassed seems obvious from agronomic, environmental and economic reasons.

In the presentation I will show that potato leaves, in contrast to cereals, has a high capacity to acquire foliar P via the leaf surface and assimilate into the photosynthetic active tissue. Moreover, I will show that nanotechnology has a range of interesting perspectives to lower the risk of scorching and provide fertilizers with a range of smart properties. We have found that P ions and P containing nanoparticles (citrate coated hydroxyapatite, 25-30 nm) penetrated the leaf surface of potato through different pathways. Approximately 80% of a [33P] labeled phosphate solution were taken up within 7 days after foliar application, regardless which leaf side it was applied to, or the surface tension of the solution. In contrast, less than 20% of applied [33P] in hydroxyapatite nanoparticles were taken up when applied to the abaxial (lower) leaf side, while more than 50% were taken up from the adaxial (upper) leaf side when a trisiloxane super spreader surfactant was included to lower the surface tension. Fluorescence labelled hydroxyapatite nanoparticles were found to penetrate the leaf surface solely via stomata on the adaxial side, which is a striking observation, as this leaf side contained 25-50 times fewer stomata per unit area compared to the abaxial leaf side. However, the contact area between leaf and applied droplets were larger on the adaxial leaf side, suggesting a significant effect of leaf surface hydrophilicity (wettability) on nanoparticle uptake.

Keynote session 7: Sustainability in a changing climate

Climate adaptive water management for potato production

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Extreme events, which are attributed to climate change, are at the tail end of statistical distributions and tend to be sporadic and infrequent. Climate model simulations indicate that in a warmer climate, the likelihood of heat waves and excessive rainfall increases due to the increased intensity of the hydrological cycle. The increased frequency of adverse weather events allows more definitive statements to be made about escalating trends in temperature and precipitation intensity. Droughts in the spring and summer have led to water shortages and even to the subsequent abandonment of irrigation. Conversely, excess rainfall leads to waterlogged fields and associated yield losses (Van Oort et al., 2023). Each of these adverse events exceeds the 20-year return period, highlighting the evolving climate dynamics, and higher regional potato yields were attributed to a longer period of rainfall during the growing season (Gobin and Van de Vyver, 2021). Technological advances, including new and better adapted varieties, have resulted in increased yields but yield remains high within individual fields and across farms and regions owing to factors such as soil heterogeneity, microclimatic variations and management practices. The objectives are to assess the impact of extreme weather on potato production at the field to farm scales, and evaluate the effectiveness of climate-smart water management strategies to improve resilience and yields in potato production under varying climate and environmental conditions.

Most crop development research has focused on the soil-water-nitrogen dynamics in relation to crop phenology driven by calendar or thermal days. The crop's growth and development is closely linked to environmental conditions, making it particularly vulnerable to fluctuations in weather patterns. The crop stages with a large impact on yields include early establishment, mid-season stages around tuber setting, and harvest. The time series fraction of absorbed photosynthetically active (fAPAR), a Copernicus Sentinel-2 (S2) derived vegetation indicator at a 10 m resolution, proved successful in the retrieval of BBCH potato phenological stages, verified using field observations using digital hemispherical photography (Gobin et al., 2023). Additional evidence was provided using the Canopeo app., which was tested on fields between 2020-2023. The spatial and spectral resolution of Sentinel satellite imagery in conjunction with meteorological data, enables farmers and the agricultural sector to gain spatio-temporal insights into crop development, crop growth patterns, health status and environmental conditions affecting potato production.

Potatoes, a global staple crop, are highly sensitive to extreme weather events, presenting growers with a complex challenge. Elevated temperatures, prolonged droughts and erratic rainfall can disrupt the delicate balance required for optimal potato growth. Extreme heat can inhibit tuber formation and reduce overall yield, while prolonged drought can exacerbate water shortages and affect key growth stages. Conversely, excessive rainfall can lead to waterlogging, which adversely affects root health and creates conditions conducive to disease. Given the current pace of climate change, understanding and mitigating the impact of these extreme weather events on potato growth and yield within and across fields helps develop climate smart agricultural practices, thereby ensuring production security.

Adapting potato production to the challenges of climate change and extreme weather requires the implementation of climate-smart water management strategies. The use of time-series satellite imagery and meteorological data for crop monitoring provides the necessary spatio-temporal data space and knowledge for predicting yields under varying environmental conditions and improving agricultural water management. Results of time-series analysis and geo-processing help growers to detect changes in vegetation indices, pinpoint growth stages and identify stressors and anomalies, enabling them to implement precision farming practices. Supplemental irrigation and climate-adaptive drainage are emerging as promising practices to mitigate water related stress and ensure consistent yields, although their effectiveness depend on timely application in line with crop phenological development. Field-level practices such as plastic mulching, climate-adaptive drainage and strategic irrigation are complemented with farm-level strategies such as insurance coverage, cooperative farming initiatives and renewed contract agreements. As extreme weather events increasingly influence yield variability, understanding the spatio-temporal dynamics is essential for efforts to build resilience within potato production systems.

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Keynote session 1: Breeding robust cultivars

Renseq: a fast-track method for development of potato pests and disease resistance markers from genome sequences

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Sequencing the potato genome has provided unprecedented insights into the organisation of disease resistance genes in the third most important food crop. We developed RenSeq, a genome reduction technology tailored to re-sequence members of the nucleotide-binding, leucine-rich-repeat (NLR) family of disease resistance genes, comprising less than 0.2% of the genome.

RenSeq is instrumental in identifying and genetically characterising novel functional NLRs sourced from wild germplasm collections, offering new defences against threats such as potato cyst nematodes, viruses, and late blight. Employed as a diagnostic tool, dRenSeq enables precise identification of known functional disease resistance genes within established cultivars and breeding clones.

Our analysis of over 1000 cultivars and breeding clones has underscored the limited deployment of currently effective resistances, while also highlighting the persistent use of less effective resistances susceptible to pathogen variations. Importantly, these findings inform parental selection in breeding programmes and enable association studies for resistances effective against potato cyst nematodes and late blight. Notably, our research has identified strong candidates for H1 and Gpa5 resistance, among others.

Leveraging the wealth of data, and by contrasting sequences from functional genes and candidate genes with non-functional homologues, we have developed highly specific markers for many important disease resistance genes including those effective against potato cyst nematode, viruses, and late blight. These markers are now fully integrated into commercial breeding. Informed parental selection with these markers has expedited the breeding of new varieties, with early successes including selected clones successfully trialled internationally within five years of the initial cross. Currently, these markers are utilised to enable the stacking of complementary resistances to increase the durability of resistances.

Keynote session 3: Integrated pest management

Prevention and Control of Potato Late Blight

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Potato late blight, caused by the oomycete pathogen Phytophthora infestans, remains a significant threat to potato crops worldwide. The disease is managed predominantly though the repeated prophylactic application of fungicides during the growing season, often at intervals of 7 days or fewer during severe epidemics. This is unsustainable for social, economic and environmental reasons. The population of P. infestans is dynamic, evolving over time in response to management practices. The implications of population change are twofold: new populations have traits that differ from the previous population (e.g., aggressiveness, virulence and fungicide resistance) and therefore influence blight management, and there is risk that both pathogen mating types interact to form long-lived soilborne inoculum (oospores).

Effective late blight management relies on knowledge of the source of inoculum and the conditions under which disease occurs, in combination with the efficacy of fungicides and host resistance. The population of P. infestans has recently undergone significant changes and resistance to commonly used fungicide active ingredients has been reported. Highly effective fungicides risk being lost as their repeated use drives selection for insensitivity in rapidly evolving pathogen populations, causing management failures and wasted treatments. Given the potential for increasing pathogen diversity in the future and concerns about further emergence and spread of fungicide insensitivity, Integrated Pest Management (IPM) strategies are more important than ever and must adapt according to the traits of the contemporary population.

Here we explore the key components of such an IPM strategy for late blight and the development and testing required to enable their successful implementation in the field. With a current emphasis on sustainable agricultural production, biological control of plant pathogens is increasingly attractive. Several tools have emerged in the last decade, but to date, biocontrol strategies remain difficult to use in practice due to their unpredictable field performance and difficulties with their integration into current cropping systems. Thus, sole reliance on biocontrol approaches in potato crop protection is considered high-risk and, at present, conventional fungicides remain the cornerstone of disease management strategies. However, there are clear opportunities to reduce the dose and application frequency of conventional fungicides through the integration of tools including biocontrol agents, plant resistance inducers, decision support systems and improved deployment of durable sources of host resistance. Forecasting and Decision Support Systems (DSS) to optimise the timing, choice, and rate of fungicide application for the control of late blight have been developed and are currently used in practice to a varying extent; the reasons for this will be discussed.

In this paper we describe how knowledge of the structure of the contemporary population of P. infestans in the UK and across Europe is being used, in combination with studies of host resistance and pathogen traits to improve decision making for the prevention and effective management of late blight.

Keynote session 4: Improved soil health

Perspectives of biocontrol of soil borne pathogens and their microbiome interactions in potato

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Biocontrol of plant diseases in open field settings remains challenging, yet alternatives to synthetic pesticides and integrated pest management approaches utilising such approaches are sorely needed, particularly in potato. Very few studies have investigated manipulation of the plant rhizosphere microbiome with the amendment of a Biological Control Agent (BCA), which is of importance for our understanding of the function of BCAs in the environment, their overall impact on soil and plant health and to ensure that such strategies are safe and sustainable. We therefore conducted a series of field trials to investigate whether amendment of *P. oligandrum* induces growth promotion in potato and further induces dynamic and temporal changes of the rhizosphere microbiome of the starch potato CV. Kuras, whilst at the same time offering protection from infection by the soil borne disease early blight. *P. oligandrum* induced significant changes in the fungal and bacterial diversity in the potato rhizosphere microbiome in a transient manner, indicating that potato rhizosphere microbial communities are highly resilient. The minor changes seen, indicate that *P. oligandrum* does not have a major impact on microbial diversity when used as an augmentative biocontrol agent. It also had a biostimulatory effect in potato in a cultivar-dependent manner, which may help to increase yield whilst at the same time lowering inputs such as fertilisers. Since cultivars respond differently to this oomycete under controlled conditions, this provides an opportunity to identify *P. oligandrum* responsive genes in the plant that might help the plant better host this or other biocontrol agents, thus improving efficacy under field conditions. Thus, there are strong indications that breeding for better hosting of biocontrol agents will be possible in the future. *P. oligandrum* was also able to suppress early blight during early disease development at the onset of plant senescence and thus may be a useful addition to the IPM toolkit in potato. Further work will investigate microbiome changes in more details and the effects of *P. oligandrum* on other soil borne diseases as well as host plant genetics that may be linked to better biocontrol or biostimulation by microbial biocontrol agents.

Keynote session 8: Post harvest

Preserving potato quality in storage in a future with increasing constraints

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The primary objectives of storing a potato crop are to extend crop availability beyond harvest, minimize losses, and maintain the desired quality. There are increasing external constraints putting pressure on the ability to reach these objectives and necessitating proactive responses in cultivar selection, storage design, technology and management, and industry expectations. Constraints generate innovation but it may also be accompanied by higher costs. The economy of problem solving can put further constraints on what is necessary to store potatoes. Constraints will differ depending upon growing region and market, but primary issues affecting the potato storage sector include climate change, energy demand, sprout suppression capabilities, and availability and cost of resources and labor. Variability in traditional weather patterns will necessitate adjustments in storing for quality. This can prompt changes in storage design and use of insulation, ventilation capacity, supplemental refrigeration, and evaporative cooling or drying capabilities. The evolution and sophistication of climate-controlled storages will help integrate weather forecasting and intuitive prediction with decision-support monitoring to further manage the crop. Crop data at harvest combined with in-pile and storage sensors will feed into the decision-support system to help store the crop efficiently and effectively. Having interpreted data will help a storage manager make a science-based decision on setting control parameters of the storage, especially early in the storage season when decisions are critical to minimize losses due to disease and evaporation. Using environmental sensors within the storage to preemptively respond to an issue before further loss arises will be another tool to utilize. Unfortunately, responding to a change in climate or weather may put greater dependency upon power and electricity to store for quality. Energy initiatives and optimizing the use of ambient cooling, variable frequency drives, solar, wind, and other innovative means to minimize the impact of high energy costs and demands will need to be further incorporated into management decisions. Constraints in the application of agrichemicals, in particular sprout inhibitors, will force the use of cultivar selection with extended dormancy length, colder store temperatures, and novel and program approaches to suppress sprouting. Breeding and identifying resilient cultivars to withstand the demands and conditions of postharvest handling, defect and disease tolerance, desired dormancy, and market quality maintenance under stress-inducing environments will help respond to current and future constraints. The necessity of storing potatoes cold will further dictate the need for cold resistant sweetening cultivars for the process markets. Cultivar breeding and selection will be a vital solution to preserving quality under increasing constraints and attributes of storability may play a greater role in cultivar selection and acceptance. Knowing the quality and storage limitations of a cultivar will avoid situations of unmet expectations if the cultivar is not inherently suited for storage.

Keynote session 8: Post harvest, cont.

Loss in storage comes in multiple forms: direct losses due to defect damage and disease development and water and carbon loss due to evaporation and respiration and indirect losses due to not meeting the acceptable quality specifications. Regardless of the type of loss, both create a reduction in a marketable and consumable crop. External constraints will place further pressure on the potential for crop loss, which will force an evolution of a systems approach to minimize loss and maintain the volume of potatoes needed for food production. The principles of storage design and management will become more robust. Innovation, research, and technology will continue to be relied upon as the industry moves forward with identifying solutions to these emerging constraints.

Keynote session 10a: Connecting research to practice

Success factors for transferring knowledge from science to growers

Borghild Glorvigen

Norwegian Agricultural Advisory Service (NLR), Aas, Norway

The area of Norway is 323,806 square kilometres, and cultivated land constitutes 3.5% of this area. Potatoes are cultivated on 11,505 ha, which is 1.17% of the cultivated area. Total potato yield is 305,000–385,000 tons per year. Norway has a total of 37,561* farmers. About 64% of them are members and owners of the Norwegian Agricultural Extension Service (NLR). Of a total of 1,336* potato farmers ca. 77% have an ownership share in NLR.

Transferring knowledge from science to growers in a way that turns the results into practical use is a challenge. The message may be unclear or explained in a difficult way, it may be very complicated, or the receiver is not able to accept or understand the message. This discussion of knowledge transfer is based on the fact that the farmer is a member of NLR.

Research must be open to issues raised by growers or industry partners. Advisors are the spokespeople for the farmers and the challenges they face in their daily work. It is more likely for a researcher to receive support and interest from farmers and industry when the issues are relevant and interesting to them. Ownership of the project through reference groups, hosting field experiments and being involved in a project facilitates the transfer of the results from research to the growers.

A good relationship with the farmers is valuable for the advisors when they convey the results. It is easier for the advisor or the research team to get the message through to the grower if she trusts the spokesperson. Good connections can be attained by facilitating physical meetings and thereby generating good opportunities for discussions.

Get the trailblazers on your side. In all societies there are always people that are in front of the development. A trailblazer is a person within the farming community that other farmers look to and listen to. This person can host a field experiment or test a new model in the forecasting system etc., and thereby become involved in a project. Field days, seminars, or meetings with news from the research, together with good conversations over a cup of coffee, are good arenas for transferring knowledge from science to growers.

Publish new knowledge in a way that is easily receptive. Translate difficult scientific language to a language easy to understand. Transform new knowledge into practical use which can be implemented in agriculture directly. Show calculations with economic or biological positive effects.

* www.ssb.no = Statistics Norway, 2023

Keynote session 10b: Connecting research to practice

National Potato Innovation Centre (NPIC) for the UK and beyond

Ian Toth

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Potato is a major crop in the UK and throughout Europe and is key in government strategies worldwide (including in China, India and Sub-Saharan Africa) to attain food security by ensuring a reliable and sustainable supply of healthy food. The climate and biodiversity crises require rapid development of crop cultivars adapted to warmer environments to be grown in low input sustainable systems, while loss of plant protection products mean that new solutions to pest and disease control become ever more important.

We are proposing to establish a National Potato Innovation Centre (NPIC) at the James Hutton Institute in Dundee, Scotland, which will comprise a state-of-the art innovation facility managed in partnership with stakeholders across academia, industry and government, both nationally and internationally. The NPIC will be part of a creative cluster that will deliver solutions for industry, generating new findings, innovative products and highly skilled jobs in new industries.

We are meeting with academic partners, as well as industry and government to identify major industry challenges where science can offer a potential solution, both now and in the future. Challenges to potato cultivation are often similar between nations and the Centre is looking to work with scientists and industries in other countries to coordinate efforts to ensure the best research and knowledge delivery to the global potato industry.

We are currently in discussions with the International Potato Partnership (IPP) and the International Potato Centre (CIP) to see how a more joined up approach globally can help potato growers, from subsistence farmers to those that work with large multi-nationals. Information being collected about the main needs of industry through the IPP show a remarkably similar list, helping to identify major targets for international collaborative research and knowledge exchange.

We see this as the beginning of a longer process and would welcome involvement from other interested academic and industry groups.

In this presentation, we will describe our vision for a Potato Innovation Centre and how working with international partners will help to coordinate global scientific endeavours and potato industry resilience.

Posters

NO	Title	Author	Country	Day
1-01	Variety identification in the seed certification process using SSR markers– improvement of the official method in France	Sylvie Marhadour	France	Monday
1-02	Superior resistance to late blight in novel breeding clones – a helpful source for sustainable potato production	Thilo Hammann	Germany	
1-03	Preliminary assessment Ukrainian Potato Cultivars for Resistance to Potato Wart pathotypes spread in Ukraine and Georgia	Avrelia Zelya	Ukraine	
1-04	SustainPotato: Nordic-Baltic public-private partnership to breed more resistant potatoes for high latitudes	Muath Alsheikh	Norway	
1-05	Combining 11 genetic markers into three multiplex protocols for testing pathogen resistance in Estonian potato breeding material	Kai Ilves	Estonia	
1-06	Investigating key genes involved in potato anthocyanin biosynthesis and under stress conditions	Riccardo Aversano	Italy	
1-07	Understanding potato endodormancy to develop strategies for reducing waste during postharvest storage	Fabian Villamil	UK	
1-08	Expanding Late Blight resistance: characterization and functional analysis of a novel R3a homologue in wild potato species	Virkrant Singh	UK	Tuesday
1-09	Unveiling Potato Resistance: State-of-the-Art computational approaches for Identifying Resistance Genes against Diverse Diseases	Yuk Woon Cheung	UK	
1-10	Efficiency of molecular markers associated to H1, a major gene to control Globodera rostochiensis	Sylvie Marhadour	France	
1-11	Comparative analysis of R-genes expression and transcriptomic profiles in potato tubers of selected potato genotypes after inoculation with virulent and avirulent races of *Phytophthora infestans*	Jaroslaw Plich	Poland	
1-12	Establishment of an SNP catalogue for potato	Jose Ignacio Ruiz de Galarreta	Spain	
1-13	GWAS Analysis of resistance of potato to Common Scab using historical phenotypic values	Fatima Latif Azam	Ireland	
1-14	QTL discovery for agronomic and quality traits in a panel of diploid potato clones using PotatoMASH amplicon sequencing	Dan Milbourne	Ireland	
1-15	GBS and SPUD-SPET genotyping for advancing genetics and breeding applications in potato	Sanjeev Kumar Sharma	UK	
1-16	Modelling G x E interaction using unbalanced tetraploid Potato (*Solanum tuberosum* L.) data and pedigree information from Scandinavian and Mediterranean environment	Muhammad Farhan Yousaf	Denmark	Thursday
1-17	In vitro evaluation of host defense peptides for antimicrobial activity and successful introduction in *Solanum tuberosum* for disease resistance engineering	Nick Schimpf	Canada	
1-18	Gene editing in tetraploid potato to enhance PVY resistance	Jean Eric Chauvin	France	
1-19	PMR4 is a susceptibility gene for soft rot disease in potato	Pichaya Cheewapoonphon	NL	
1-20	Identification of duplicates in Nordic potato collections	Pawel Chrominski	Sweden	
1-21	Variance and covariance components of agronomic and quality traits assessed in tetraploid potato and implications on practical breeding	Kathrin Thelen	Germany	
1-22	Potato genetic resources at CGN	Lana de Bruijn	NL	

NO	Title	Author	Country	Day
2-01	Using the CRISPR-Cas system to localize plant viruses	Carl Spetz	Norway	Monday
2-02	Using the CRISPR-Cas system to localize plant viruses	Guro Bukaasen	Norway	
2-03	*Tobacco Rattle Virus* and Trichodoridae: building blocks of a systemic and sustainable approach to disease control	Roberto Miglino	NL	
2-04	Dynamics of potato virus Y infection pressure and strain composition in State of Colorado, USA	Mohamad Chich-Ali	USA	
2-05	Evolution of the prevalence of potato virus Y (PVY) and potato leafroll virus (PLRV) in Switzerland between 2016 and 2023	Cecile Thomas	Switzerland	
2-06	Mineral oil to control Potato virus Y transmission in seed potato production	Mounia Khelifa	France	
2-07	Potato & the French post-entry quarantine station	Lorene Belval	France	
2-08	Evaluation of a cryopreservation method for virus elimination in potato	Florence Esnault	France	
2-09	7-hydroxytropolone and analogs to control potato blackleg.	Euphrasie Munier-Lépinay	France	
2-10	Potato soft rot – as an economically important disease for Georgia	Maka Muradashvili	Georgia	
2-11	Detection of *Ralstonia solanacearum* in different environmental samples.	Włodzimierz Przewodowski	Poland	
3-01	Biofumigation with sorghum and brown mustard: a sustainable solution to control wireworm damage in Swiss potato production	Geoffrey Darbon	Switzerland	Tuesday
3-02	Trial results on wireworm control in potatoes using chemical, biological and arable methods	Michael Zellner	Germany	
3-03	Management tools to reduce wireworm damage in potatoes in Canada.	Christine Noronha	Canada	
3-04	Horizontal and vertical movement of wireworms, *Agriotes sputator* (Coleoptera: Elateridae) through soil in Canada	Christine Noronha	Canada	
3-05	Weeds control in potatoes under agro-climatic conditions of Barsa Country, Romania	Manuela Hermeziu	Romania	
3-06	Importance of soilborne inoculum of *Colletotrichum coccodes* and assessment of potato cultivar resistance to black dot and in France	Roman Valade	France	
3-07	Optimizing Fungicide Timing for Effective Management of *Colletotrichum coccodes* in Potatoes	Phillip S. Wharton	USA	
3-08	Potato black dot caused by *Colletotrichum coccodes* in Inner Mongolia of China	Limin Xu	China	
3-09	Inhibition of the development of *Rhizoctonia solani* by plant secondary metabolites – a laboratory study	Maximilian Koch	Norway	
3-10	Weeds as alternative hosts of *Spongospora subterranea*, the causal agent of potato powdery scab, in Finland	Lea Hiltunen	Finland	
3-11	The influence of a preparation based on hydrogen peroxide and silver colloids and a preparation containing grapefruit extract on reducing fungal and bacterial diseases of Gardena variety seed potatoes during storage	Aleksandra Bech	Poland	
3-12	High-resolution analysis of effector genes in 394 *Phytophthora infestans* isolates using amplicon sequencing	Simeon Rossmann	Norway	Thursday
3-13	Virulence and fungicide susceptibility of *Phytophthora infestans* isolates collected in Belgium in the years 2021-2023	Vincent Cesar	Belgium	
3-14	Diversity and complexity of virulence races of *Phytophthora infestans* in the Baltic Sea region	Helina Nassar	Estonia	
3-15	Long term changes in late blight development in Estonia	Mati Koppel	Estonia	

NO	Title	Author	Country	Day
3-16	Reaction of some potato genotypes to the action of *Phytophthora infestans* in different environmental conditions	Nichita Negruseri	Romania	Thursday
3-17	Insights into the metabolic responses of potato cultivars infected with *Phytophthora infestans*	Portia D. Singh	India	
3-18	Mutations conferring fungicide resistance in Alternaria from potato in South Africa	Elsie Cruywagen	S. Africa	
3-19	Mileos®, the French potato diseases DSS: a new module to control early blight.	Denis Gaucher	France	
3-20	Fusarium species causing potato dry rot in France: identification, pathogenicity and sensitivity to fungicides	Karima Bouchek-Mechiche	France	
3-21	Dryocrassin ABBA is an effective inhibitor against potato dry rot caused by *Fusarium oxysporum*	Wenzhong Wang	China	
3-22	Functional verification of endophytic *Bacillus subtilis* WZ10 and its control efficiency on potato Fusarium wilt of China	Yuanzheng Zhao	China	
3-23	Control effect of potato *Fusarium* wilt by co-culture of *Trichoderma asperellum* PT-29 and *Bacillus subtilis* S-16 and the comparative analysis of non-targeted metabolomics	Hongyou Zhou	China	
3-24	PATAFEST: Horizon Europe-funded Research Project Paving the Way for Sustainable Potato Protection and Postharvest Excellence	Amaia Ortiz Barredo	Spain	
4-01	Status of potato cyst nematodes in Norway	Solveig Haukeland	Norway	Thursday
4-02	Surveillance of *Meloidogyne chitwoodi* og *Meloidogyne fallax* in Norway (2019-2023)	Marit Skuterud Vennatrø	Norway	
4-03	Steaming as a tool to reduce the risk of spreading key nematode pests in infrastructure projects	Marit Skuterud Vennatrø	Norway	
4-04	Efficacy of *Bacillus subtilis* strain ZWZ-19 and associated volatile substances in inhibiting nematode of *Ditylenchus destructor*: an evaluation of control performance	Dong Wang	China	
4-05	Comparison of virulence of pathotype 38 (Nevsehir) isolates from different EPPO member countries	Jaroslaw Przetakiewicz	Poland	
4-06	Experiments in controlled conditions provide beneficial information on the applicability of biochar in potato production	Matti Salmela	Finland	
4-07	Exploration of plant growth-promoting rhizobacteria (PGPR) in potatoes	Rene Sutherland	S. Africa	
5-01	The effect of Smartblock, a sprout suppressant, on the physiological growth of potato (*Solanum tuberosum*)	Nomali Ngobese	S. Africa	Monday
5-02	Metabolomics – a promising tool to assess the physiological age of seed tubers of potato (*Solanum tuberosum* L.)	Chunmei Zou	Germany	
5-03	Assessment the suitability of potato breeding lines for cultivation in an organic production system	Krystyna Zarzyńska	Poland	
5-04	Variety and terms of potato planting in a summer seed production in the Republic of Moldova	Petru Iliev	Moldova	
5-05	Assessment of gene expression changes in relation to meristem position in eco-dormant tubers.	Michael Campbell	USA	

EAPR 2024 committees

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General information

Registration and "help desk": Daily 8.30–11.00, 12.00–13.30 and 15.00–17.00, except Wednesday.
for questions outside opening hours, Cathrine: +47 974 78 016.
Personnel in the technical staff will have orange badge-band.

Name badges:
Conference badges with your name must always be worn during the conference.

Breakfast: 07.00–10.30, (except Wednesday: 06.30–10.30).

Payment: Rooms and other hotel services must be paid by the participants when checking out from the hotel.
Gym room: A small gym-room for max. 10 persons is available at the hotel.
Swimming: Every morning at 07.00 you may join the morning swimming in the sea at a public beach near the hotel.

Public transport:
Bus: You have to use Norwegian currency (NOK) for payment on buses. Fornebu to Oslo city center is 42 NOK, but costs 62 if you pay directly on the bus. See Ruter, https://ruter.no/en for help on efficient payment and travelling in Oslo.

Taxi: approx. 300,- NOK going to Oslo city center.

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