ISRR
International Society
of Root Research

Roots to the Future
Full Programme

8th Symposium of the International Society of Root Research

26-29 June 2012

Dalhousie Building, University of Dundee

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Roots to the Future

8th Symposium of the International Society of Root Research

Contents

Welcome to the ISRR Meeting in Dundee

Dear Colleagues

It is a great pleasure to welcome you all to the 8th Symposium of the International Society of Root Research. We have fellow root researchers from over 35 countries attending the meeting, so many of you will have travelled considerable distances to be present.

In arranging the programme the organising committee has tried to accommodate the huge spectrum of interests shared by members of our community ranging from molecular to crops and Arabidopsis to mature trees. We hope that you will find the science stimulating and benefit from the "corridor" discussions that often lead to new lines of enquiry and new collaborations. We have also included in the programme important elements of life in Dundee such as the old plant-based industries of flax and jute, the famous Antarctic exploration in the ship Discovery, and contemporary cultural aspects of Scottish life including golf, whisky and ceilidhs.

Research on roots and root systems is thriving at the James Hutton Institute (formerly the Scottish Crop Research Institute, SCRI) in Dundee and I am most grateful to the staff there for their support and hard work in organising this conference. I'm sure that we are to have a fantastic week.

I look forward to seeing you at the various lectures and events.

Peter Gregory

President of ISRR

Roots to the Future

8th Symposium of the International Society of Root Research

We were encouraged greatly by the huge interest and kind support received for the "Roots to the Future" Conference, the 8th Symposium of the International Society of Root Research. The excellent scientific contributions received shows that root research is both vibrant and increasingly addressing the global environmental challenges of food and resource security.

There are many people to be thanked for making this event a success: Peter Gregory for initiating the conference and offering continued support and wise counsel, and our impressive list of sponsors for their generous support. An active local organising committee did all of the groundwork, ranging from finding a venue to organising social events such as the Civic Reception at Discovery, a Whisky Tasting, and the trips around the local area planned this week. Karen Tocher and Debbie Burton from the Dundee and Angus Convention Bureau, Anne Rendall from the James Hutton Institute, and Anne Walker from Congrex offered highly professional support and advice to keep the scientists on the right track!

The International Programme Committee, Keynote Speakers, and Session Chairs are thanked for initially shaping and subsequently helping to deliver the scientific programme. We were delighted and impressed by the quality of the submissions received and by the widest-yet global representation of any ISRR meeting. This promises to be a fascinating week, which we very much hope you will enjoy.

Glyn Bengough

Chair, International Programme Committee, & co-Chair, Organising Committee

Practical information

WiFi and use of University computers

Please complete the registration form for your User-i.d. if you require computer access or WiFi access during the conference. We have access to an IT-suite of computers on the ground floor (IT suite 3)

Lecture theatres, poster rooms, and "Talking Posters"

All talks are in the lecture theatres 2, 3, and 4: Lecture theatre 3, one floor above the foyer, is the largest where the Plenary Lectures will be held. Posters are either in room 1.F.06 or 1.F.01, situated one floor above the main foyer. "Talking Posters" are simply posters that will be displayed throughout the conference, and that additionally have a short associated talk (on Wednesday or Thursday in Lecture theatre 2).

Talk upload & poster mount

Please upload and check your talk as early as possible in the IT-suite – ideally at registration on the Monday evening, when most helpers are available. Please mount your poster for Poster Session 1 either on the Monday evening or Tuesday morning before 10:30, and remove it before 13:00 on Wednesday. Posters for poster session 2 should be mounted during Wednesday lunchtime, after 13:00. "Talking Poster" posters should remain on display throughout the meeting.

Lunch marquee, tea/coffee breaks, Sponsor stalls

Tea and coffee breaks will be served on both upper and lower foyers of the Dalhousie building. For speed, we have arranged "take away" deli-bags of food for lunch, served in the marquee on the University Campus Green, 2 minutes walk south of the Dalhousie building. There are tables and chairs to eat your lunch there, or else bring it back to Dalhousie to look at the posters, and visit the stalls of our sponsors.

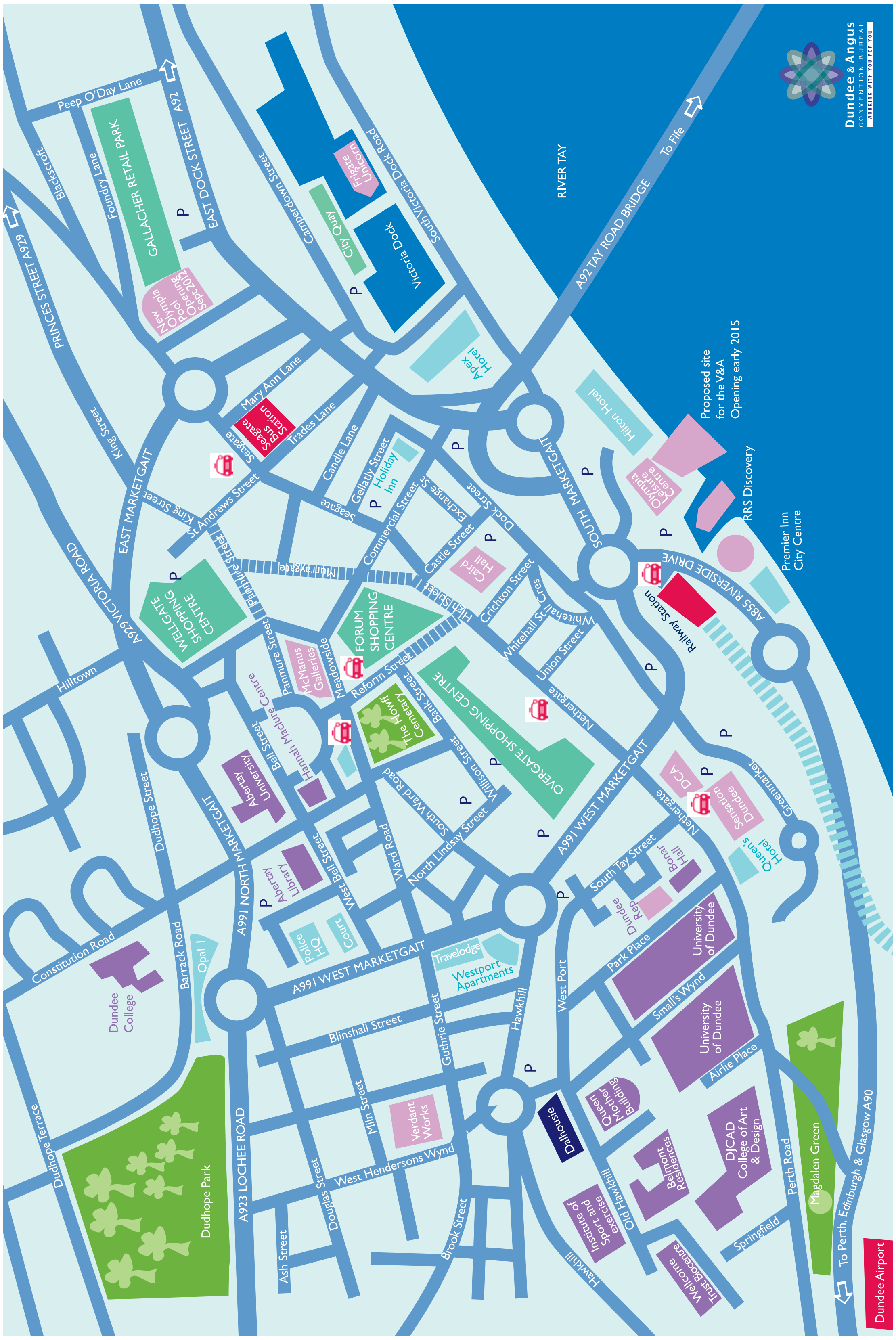
Dundee city map & book of discount vouchers – all inside your "Dundee Passport" folder

In your delegate bag, you will find a small folder (your "Dundee Passport"). This includes a map of the city centre, to help you find your way to and from the hotel. This is full of special offers available only for conference delegates. We encourage you to use it, as it includes discounts at visitor attractions and restaurants (please take the vouchers with you when you visit).

Conference Reception Desk and Conference Help Volunteers

The Conference Reception Desk is located in the Dalhousie Building foyer, and will be manned during the conference sessions. Please ask any of our Conference Helpers (identified by their "ISRR-Team" T-shirt) for assistance in finding a venue, loading talks, mounting posters or for recommendations on activities in the local area. The Reception Desk can also assist with information on bus transfers to conference events, airport transport and tourist activities.

Dundee City and Campus map



Programme Overview

The **Author Index**, at the back, refers to the abstract code of each presentation.

Plenary Keynote Lectures (abstract code **PLK**) are in Lecture Theatre 3.

Plenary Session lectures (code **PL**) are in Lecture Theatre 3 on Tuesday and Friday mornings, to open and close the conference.

Split Sessions: (code **SS**) The programme is split into 3 parallel strands – these deal with Root Function (**Function 1, 2, 3, 4**, all in Lecture Theatre 3), Root Interactions (**Interactions 1, 2, 3, 4, 5** initially in Lecture Theatre 4), and Environment (**Environment 1, 2, 3** initially in Lecture Theatre 2). Each of these split sessions will normally start with a **Split Session Keynote** (code **SKN**).

There is an additional session on **Emerging Methods** (code **EM**), and several sessions of brief presentations for "**Talking Posters**" (code **TP**) – aimed to raise the profile of the poster sessions.

Posters (code **P**) are ordered by subject area strand (Function, Environment, Interactions).

Poster numbers	Day	Room	Poster subject group
Poster Session 1			
TP01-26	Tuesday-Friday	1.F06	"Talking Posters" on display
P001-P062	Tuesday afternoon	1.F06	Function 1
P067-P080	Tuesday afternoon	1.F06	Function 2 (split between rooms)
P084-P106	Tuesday afternoon	1.F01	Function 2 (split between rooms)
P109-P111	Tuesday afternoon	1.F01	Interactions 1
P113-P120	Tuesday afternoon	1.F01	Environment 1
P122-P132	Tuesday afternoon	1.F01	Environment 2
Poster Session 2			
TP01-26	Tuesday-Friday	1.F06	"Talking Posters" on display
P203-P241	Thursday afternoon	1.F06	Function 3
P244-P272	Thursday afternoon	1.F06	Interactions 3
P273-P282	Thursday afternoon	1.F06	Interactions 4
P285-P290	Thursday afternoon	1.F01	Interactions 5
P293-P308	Thursday afternoon	1.F01	Environment 3
P309-	Thursday afternoon	1.F01	Function 4 and Others

Monday 25 June

17:00-20:00	Registration, the Dalhousie Building
	Welcome Reception with light refreshments
	Opportunity to load/test powerpoint presentations and mount posters

Tuesday 26 June

08:00-09:00	Last Minute Registration		
	Poster Mounting, Main Area		
	Lecture Theatre 3	**Lecture Theatre 4**	**Lecture Theatre 2**
09:20	Conference Welcome		
09:30	Plenary Keynote, J. Lynch *Roots of the second green revolution: exploiting the root phenome*		
10:30	Coffee		
11:00	Plenary Session		
12:40	Lunch		
13:45-15:00	Posters (TP01 to TP26; P001 to P083 Room 1.F.06; Posters P084-P132 in Room 1.F.01),		
14:00-14:20	CID Biosciences, Lecture Theatre 3		
15:00	Plenary Keynote, M. Bennett *Root gravitropism: providing a sense of direction*		
Split Session			
15:45	Function1: Genes, traits and the environment	Interactions 1: Root-soil structure interactions	Environment 1: Environmental impact and carbon cycling
17:35	Depart for Civic Reception, RRS Discovery (starts at 18:00)		

Wednesday 27 June

	Lecture Theatre 3	**Lecture Theatre 4**	**Lecture Theatre 2**
09:00	Plenary Keynote, B. Sharp *Root growth under water deficits: physiological complexity and coordination*		
Split Session			
09:45	Function 2: Root function and uptake	Interactions 2: Exudates	Environment 2: Hostile Conditions
10:30	Coffee		
11:00	Function 2: Root function and uptake	Interactions 2: Exudates	Environment 2: Hostile Conditions
12:40	Lunch		
14:00	Plenary Keynote, P. Hinsinger *The roots of our soils*		
14:45	Function 3: Evolution and function of root structures	Interactions 3: Root-microbe interaction	Talking posters
15:30	Coffee		
16:00	Function 3: Evolution and function of root structures	Interactions 3: Root-microbe interaction	Talking posters
17:30	Leave for visit to Verdant Works (optional)		
18:45	ISRR Business Meeting, Verdant Works (Buffet Served)		

Thursday 28 June	Lecture Theatre 3	Lecture Theatre 4	Lecture Theatre 2
09:00	Plenary Keynote, M. Watt *Speeding up the delivery of root system improvements to farmers to increase crop productivity*		
09:45	Function 4: Roots in the field	Interactions 4: Water	Talking Posters
10:30	Coffee		
11:00	Function 4: Roots in the field	Interactions 4: Water	Talking Posters
12:40	Lunch		
13:45-15:00	Posters (P201-P283 and TP01 to TP26 in Room 1.F.06; P284-P323 in Room 1.F.01)		
14:00-14:20	Lemnatec		
15:00	Plenary Keynote, J. Abe *Morphology and anatomy of rice roots*		
15:45	Environment 3: Roots and changing environments	Interactions 5: Root sensing of the environment	Emerging methods
17:35	End of session		
18:45	Leave for Conference Dinner - Fairmont Hotel, St. Andrews (please be aware of your bus pickup point)		
24:00	Return to Dundee		

Friday 29 June	Lecture Theatre 3	Lecture Theatre 4	Lecture Theatre 2
	Plenary – Roots for sustainable production		
09:10	Plenary Keynote, H-S Helmisaari *Fine roots and soil carbon in boreal forests*		
09:50	Plenary Keynote, F. Zhang *Maximizing root/rhizosphere efficiency for improving crop productivity and nutrient use efficiency*		
10:30	Coffee		
11:00	Plenary Session		
12:20	Plenary Keynote and Conference Synopsis, P. Gregory, ISRR President *Roots to the future and routes to sustainability*		
13:00	Lunch (please remove any remaining posters)		
14:00	Optional visits to the James Hutton Institute or the Old Course, St. Andrews (Course Superintendent Tour), or Botanic Gardens		

Session Sponsors

We are very grateful to the following Sponsors, who are associated with the following sessions.

CID Bioscience – Sponsors of the "Roots in the Field" session

British Society of Soil Science – Sponsors of the "Root-soil structure interactions" session

New Phytologist Trust – Sponsors of the "Root function and uptake" session

Centre for Plant Integrative Biology, University of Nottingham – Sponsors of Plenary Keynote by Professor Fusuo Zhang

Euroot – Sponsors of the "Roots for sustainable production" session

Regent Instruments – Sponsors of the Poster Session Prizes

Social Programme – a warm Scottish Welcome!

We like to boast that there is nowhere as welcoming as Scotland – and not just because of the whisky – though it does help!

We want you to enjoy the conference as much as possible and have lined up several social events where you can network over a glass – or two! – and enjoy our hospitality.

Civic Reception – Discovery Point Visitor Centre

Tuesday June 26 2012 Discovery Point 18:00-20:00 (leave on foot with guides by 17:40)

Dundee is home to the historic ship RRS Discovery, which was built here for the 1901 British National Antarctic Expedition - the vision of Sir Clements Markham, President of the Royal Geographical Society. After being rescued from imprisonment in the ice, the ship went on to make two more journeys to the Southern Seas. The ship then came back to be the namesake and centrepiece of a major tourism campaign for Dundee in 1986. The Lord Provost of Dundee, Bob Duncan, will welcome delegates to the city and the James Hutton Institute's Chief Executive, Professor Iain Gordon, will also give a short welcome. Thereafter, a buffet reception, whisky tasting and optional tour of the ship and visitor centre will follow. We will walk from the Dalhousie Building to the ship, which should take around 15 minutes.

Tour of Verdant Works – Scotland's Jute Museum

Wednesday June 27 2012 18:00-20:00 (leave on foot with guides by 17:40)

A wine reception and tour of this fascinating piece of Dundee's industrial history, will take place immediately after the conference on Wednesday. The museum is only five minutes walk from the conference venue. Verdant Works is the sister visitor experience to Discovery Point, telling the tale of Dundee's years as the centre of the world jute industry, so much so that it was given the nickname Juteopolis. For those not familiar with it, this coarse fibre, gown mainly in India was indispensable during the 19th and early 20th centuries for sacking, ropes, boot linings, aprons, carpets, tents, roofing felts, and much much more.

Conference dinner, Fairmont Hotel, St Andrews

Thursday June 28 2012 (leave by coach at 18:45 sharp, check your pickup point at registration: coaches can not wait)

St Andrews, home of golf, is our venue for the conference dinner. This contemporary hotel is just a couple of miles outside the medieval town. We look forward to an evening of dining followed by a Scottish ceilidh: dress code is smart casual.

Optional Friday Afternoon Tours

Friday June 29 2012

Scottish weather is very unpredictable – please bring a jumper, raincoat or umbrella, and strong shoes (in case of rain and wet paths).

The James Hutton Institute

(leave by coach at 14:00 from Dalhousie)

The James Hutton Institute brought together over 600 scientists from the Macaulay Land Use Research Institute and SCRI on 1 April 2011. The new organisation combines existing strengths in soils, crops, land use and environmental research, and will make major, new contributions to the understanding of key global issues, such as food, energy and environmental security, and developing and promoting effective technological and management solutions to these.

Root research is a key topic for the institute. This tour will show a selection of laboratory/glasshouse facilities and field experiments.

The Old Course, St. Andrews – Sponsored by Aquatrols

(leave by coach at 14:00 from Dalhousie)

Gordon Moir, Director of Greenkeeping at St. Andrews, and his team will demonstrate the skilled agronomy behind maintaining the oldest and most famous golf course in the world. The Links Soil beneath St. Andrews is mimicked globally to produce an 'ideal' root zone for golf. Considerable effort and science lies beneath the maintenance of a premier golf course. The practices and technologies used to improve soil conditions for grass and golf play will be presented. Also on display will be instruments to monitor root zone properties and equipment to ameliorate problems.

University of Dundee Botanic Garden

(2 km walk from Dalhousie, no transport provided: leave on foot from Dalhousie at 14:00, to arrive at the garden in time for 14:45)

Alasdair Hood, the Garden Curator, has kindly agreed to show up to 25 delegates around the garden at 14:45 (note – **this must be pre-booked directly with the garden** by emailing j.e.forbes@dundee.ac.uk by the evening of Thursday 28th June). Delegates wishing to look around the garden themselves, unaccompanied, may obtain free entry by handing in their delegate badge at the Botanic Garden Visitor Desk.

Tuesday 26 June

Lecture Theatre 3

Time	Ref	Talk/Event	Presenter
08:00-09:00		Last-minute Registration	
		Posters: mount first set of 100 posters	
09:20		Welcome Peter Gregory and Shigenori Morita	Gregory Morita
09:30	PLK1	**Plenary Keynote** **Chaired by Gregory & Morita**	
		Roots of the Second Green Revolution: Exploiting the Root Phenome	Lynch
10:30		tea/coffee (30 mins)	
11:00	PL1.1	**Roots of the Second Green Revolution** **Chaired by Gregory & Morita**	
		Root systems and crop improvement in rice	Price
11:20	PL1.2	The genetic architecture of the maize root system	Hund
11:40	PL1.3	The deeper rooting gene Dro1 enhances drought avoidance in rice	Uga
12:00	PL1.4	Strigolactones activate different hormonal pathways for root development regulation in response to phosphate conditions	Koltai
12:20	PL1.5	Aeroponics as a tool for high throughput root phenotyping	Ligeza
12:40		End of session: Conference Photograph in Lecture Theatre	
12:40		Lunch	
13:45 **14:00**		Poster Session 1 & tea/coffee (first set of posters, swap over on Wednesday lunchtime). CID Sponsors talk in Lecture Theatre 3 at 2pm - Tools and techniques for imaging and analysis of fine roots in soil	
15:00	PLK2	**Plenary Keynote** **Chaired by Humphreys & Sharp**	
		Root gravitropism: providing a sense of direction	Bennett
Split Session			
15:40		**Function 1. Genes, traits and environment** **Chaired by Humphreys and Sharp**	
15:45	SKN1.1	Exploring the intertwined genetic bases of root and shoot growth response to soil water deficit in Arabidopsis	Muller
16:15	SS1.11	Relationships between root development, P acquisition, crop establishment and yield of potato (Solanum tuberosum L.)	White
16:35	SS1.12	An ATP-binding cassette (ABC) transporter is required for formation of suberin lamellae at the hypodermis in rice	Shiono
16:55	SS1.13	High throughput imaging and analysis of Brassica rapa root system architecture in response to [P]	Adu
17:15	SS1.14	"Methodological approaches to evaluate chemicals enabling root growth in crops"	Screpanti
17:35		END	
17:35		Leave for Civic Reception, Discovery (2h max) – light refreshments, Whisky tasting, visit Discovery ship. Start at 18:00. Address from Prof Iain Gordon, James Hutton Institute, and the Lord Provost of Dundee at 18:30	
19:30		Evening free	

Lecture Theatre 4

Time	Ref	Talk/Event	Presenter
Split Session			
15:40		**Interactions 1. Root-soil structure interactions** **Chaired by Kirkegaard & Whalley**	
15:45	SKN1.2	How does variation in root traits affect barley cultivar responses to agriculturally relevant soil physical constraints?	Valentine
16:15	SS1.21	Can soil hydraulic properties be managed by cover crop roots?	Bodner
16:35	SS1.22	Rhizosphere plasticity – dynamic alteration of rhizosphere biophysical and chemical properties and the role of mucilage	Vetterlein
16:55	SS1.23	Role of root development in conferring soil strength	Dumlao
17:15	SS1.24	New transparent soil sheds light on 3D biological structures in the rhizosphere	Downie
17:35		END	
19:30		Evening free	

Lecture Theatre 2

Time	Ref	Talk/Event	Presenter
Split Session			
15:40		**Environment 1. Environmental impact and carbon cycling** **Chaired by Kell & Acuna**	
15:45	SKN1.3	Age-related changes in carbon allocation to root growth and respiration in a temperate beech forest	Epron
16:15	SS1.31	Influence of plant roots on the physical behaviour of soils	Hallett
16:35	SS1.32	Contribution of root and rhizomicrobial remains to subsoil organic matter – assessed in a loess-paleosol sequence	Gocke
16:55	SS1.33	Do differences in root distribution of rhizomatous and non-rhizomatous Miscanthus genotypes affect carbon sequestration?	Richter
17:15	SS1.34	Breeding plants with deep roots for carbon, water and nutrient sequestration: what may be achievable?	Kell
17:35		END	
19:30		Evening free	

Scientific Programme, ordered by Day and Location

Note that only the "Contents Snapshot" is printed here, with full abstracts on the memory stick provided by the Annals of Botany.

Tue 26 — Lecture Theatre 3

Plenary Keynote

Tuesday, June 26, 2012
09:20 - 10:30
Lecture Theatre 3
Chair: P Gregory, UK
Co-chair: S Morita, Japan

09:30

Roots of the Second Green Revolution: Exploiting the Root Phenome

Lynch, J.P.
The Pennsylvania State University, United States

Genotypic variation for root traits related to soil resource acquisition is being harnessed in crop breeding programs, with benefits for both poor and rich nations.

PLK1

10:30 Coffee

Roots of the Second Green Revolution

Tuesday, June 26, 2012
11:00 - 12:40
Lecture Theatre 3
Chair: P Gregory, UK
Co-chair: S Morita, Japan

11:00

Root systems and crop improvement in rice

Price, A.H.
Institute of Biological and Environmental Sciences, University of Aberdeen, Cruickshank Building, Aberdeen, AB24 3UU, United Kingdom

Examples in rice will be given of: Conventional and marker assisted breeding to improve the root systems, Meta-analysis of root QTLs, Identification of genes underlying root growth or root function QTLs, The promise of association mapping, Low cost, high throughput root phenotyping approaches.

PL1.1

11:20

The genetic architecture of the maize root system

Hund, A.[1;] Reimer, R.[2]; Messmer, R.[2]; Walter, A.[2]
[1]Department of Environmental Systems Science, Institute of Agricultural Sciences, Universitaetstrasse 2, Zurich, 8092, Switzerland; [2]ETH Zurich, Switzerland

We present a consensus map of quantitative trait loci (QTLs) controlling root length of maize. The map includes QTLs detected in 9 mapping populations and can be considered the current "world map" concerning this trait. A total of 161 QTLs was grouped into 24 meta-QTLs and 16 individual QTLs.

PL1.2

11:40

The deeper rooting gene Dro1 enhances drought avoidance in rice

Uga, Y.[1]; Sugimoto, K.[1]; Ogawa, S.2; Rane, J.[2]; Ishitani, M.[2]; Kitomi, Y.[3]; Inukai , Y.[3]; Ono, K.[1]; Kanno, N.[1]; Hara , N.[1]; Wu, J.[1]; Matsumoto, T.[1]; Okuno, K.[4]; Yano, M.[1]
[1]National Institute of Agrobiological Sciences, 2-1-2, Kannondai, Tsukuba, Japan; [2]International Center for Tropical Agriculture, Colombia; [3]Nagoya University, Japan; [4]University of Tsukuba, Japan

A deeper rooting QTL Dro1 was cloned in rice. Dro1 was involved in root gravitropism. The yielding capacity of a near-isogenic line for Dro1 was significantly higher than that of original variety in upland field with drought stress, demonstrating that Dro1 contributes to drought avoidance.

PL1.3

12:00

Strigolactones activate different hormonal pathways for root development regulation in response to phosphate conditions

Koltai, H.[1]; Kapulnik, Y.[2]; Resnick, N.[1]; Mayzlish-Gati, E.[1]; Kaplan, Y.[1]; Wininger, S.[2]
[1]Ornamental Horticulture, ARO, Volcani Center, POB 6, Bet Dagan, 50250, Israel; [2]Agronomy and Natural Resources, ARO, Volcani Center, POB 6, Bet Dagan, 50250, Israel

Strigolactones (SLs) are a new group of plant hormones. Using physiological and genomic approaches, Koltai et al. demonstrated that SLs, ethylene and auxin converge for regulation of root development under different phosphate growth conditions, suggesting new components of the SLs response pathway.

PL1.4

12:20

Aeroponics as a tool for high throughput root phenotyping

Ligeza, A.; Draye, X.
Earth and Life Institute, Agronomy ELI-A, Université catholique de Louvain, Place Croix du Sud 2 - L7.05.11, Louvain-la-Neuve, 1348, Belgium

Methods of root phenotyping are characterized by low throughput or fail to address the dynamics of root growth. We present phenotyping platform based on aeroponics. Image analysis allows to capture dynamic features of RSA. The validity of aeroponics data as indicators of field variables is discussed.

PL1.5

12:40 Lunch followed by Poster Session 1

CID Sponsors Talk

Tuesday, June 26, 2012
14:00
Lecture Theatre 3

14:00-14:20

Tools and Techniques for Imaging and Analysis of Fine Roots in Soil

Dr. Reidel, CID

Plenary Keynote

Tuesday, June 26, 2012
15:00 - 15:40
Lecture Theatre 3
Chair: M Humphreys, UK
Co-chair: R Sharp, US

15:00

Root gravitropism: providing a sense of direction

Bennett, M.
School of Biosciences, University of Nottingham, Sutton Bonington, Loughborough, LE12 5RD, United Kingdom

Roots employ directional signals like gravity to explore the soil environment and acquire anchorage and resources. I will describe the molecular and cellular mechanisms underpinning gravitropism and describe how novel tools and systems approaches are revealing new insights.

PLK2

Function 1: Genes, traits & environments

Tuesday, June 26, 2012
15:45 - 17:35
Lecture Theatre 3
Chair: M Humphreys, UK
Co-chair: R Sharp, US

15:45

Exploring the intertwined genetic bases of root and shoot growth response to soil water deficit in Arabidopsis

Muller, B.; Bouteillé, M.
LEPSE, INRA, 2 place Viala, Montpellier, 34060, France

Using the model plant Arabidopsis and various genetic resources, we show (i) that the regions of the genome that control root and shoot growth show large overlap and (ii) that water deficits tend to weaken these links suggesting root growth shifts from source to sink limitation under drought.

SKN1.1

16:15

Relationships between root development, P acquisition, crop establishment and yield of potato (Solanum tuberosum L.)

White, P.J.[1]; Brown, L.K.[1]; George, T.S.[1]; Ramsay, G.2; Subramanian, N.K.[2]; Thompson, J.A.[1]; Wishart, J.[3]; Wright, G.M.[1]

[1]Ecological Sciences, The James Hutton Institute, Invergowrie, Dundee, United Kingdom; [2]Cell and Molecular Sciences, The James Hutton Institute, Invergowrie, Dundee, United Kingdom; [3]University of St Andrews, St Andrews, Fife KY16 9TS, United Kingdom

Genotypes that acquire and utilise P more efficiently can be used to reduce P-fertiliser inputs. We identified genetic loci affecting agronomic P-fertiliser use efficiency and observed significant relationships between early root system development, P acquisition, crop establishment and yield.

SS1.11

16:35

An ATP-binding cassette (ABC) transporter is required for formation of suberin lamellae at the hypodermis in rice

Shiono, K.[1]; Ando, M.[2]; Nakamura, M.[2]; Matsuo, Y.[2]; Yasuno, N.[2]; Takahashi, H.[3]; Nishiuchi, S.[3]; Fujimoto, M.[2]; Takanashi, H.[3]; Ranathunge, K.[4]; Franke, R.[4]; Shitan, N.[5]; Nishizawa, N.K.[2]; Takamure, I.[6]; Tsutsumi, N.[2]; Schreiber, L.[4]; Yazaki, K.[7]; Nakazono, M.[3]; Kato, K.[8]

[1]Fukui Prefectural University, Japan; [2]The University of Tokyo, Japan; [3]Nagoya University, Japan; [4]University of Bonn, Germany; [5]Kobe Pharmaceutical University, Japan; [6]Hokkaido University, Japan; [7]Kyoto University, Japan; [8]Obihiro University of Agriculture and Veterinary Medicine, Japan

Suberin is a constituent of apoplastic plant interfaces. So far there is no direct evidence that suberin forms an apoplastic barrier at the hypodermis in rice. Here, we show that a rice mutant that does not form suberin lamellae has a defective apoplastic barrier and poorly tolerates waterlogging

SS1.12

16:55

High throughput imaging and analysis of Brassica rapa root system architecture in response to [P]

Adu, M.[1]; White, P.J.[1]; Dupuy, L.[1]; Hammond, J.[2]; Bennett, M.[2]; Broadley, M.[2]

[1]The James Hutton Institute, Invergowrie, Dundee, DD2 5DA, United Kingdom; [2]School of Biosciences, University of Nottingham, Sutton Bonington, LE12 5RD, United Kingdom

Root system architecture (RSA) determines plant phosphorus (P) acquisition and crop P-fertiliser use efficiency. We have built a high-throughput phenotyping platform to quantify the development of RSA with high spatial and temporal resolution. We will describe, and contrast, the RSAs of Brassica rapa genotypes in response to P availability.

SS1.13

17:15

Methodological approaches to evaluate chemicals enabling root growth in crops

Fonné-Pfister, R.[1]; Boehler, M.[1]; Faysse, C.[1]; Peter, N.[1]; Simonin, M.[1]; Ward, K.[2]; Lind, R.[2]; Gaume, A.[1]; Nina, M.[1]; Lecoeur, J.[1]; Screpanti, C.[1]

[1]Syngenta Crop Protection, Schaffhauserstrasse, Stein, 4332, Switzerland; [2]Syngenta Crop Protection, Jealott's Hill, Bracknell, RG42 6EY, United Kingdom

Roots represent an important agronomical trait. Among the different strategies for improving this trait there are those based on the use of chemicals or microorganisms. In this context, an ad-hoc screening to evaluate chemicals with root promotion effects has been developed.

SS1.14

Interaction 1: Root-soil structure interactions

Tuesday, June 26, 2012
15:45 - 17:35
Lecture Theatre 4
Chair: J Kirkegaard, Australia
Co-chair: R Whalley, UK

15:45

How does variation in root traits affect barley cultivar responses to agriculturally relevant soil physical constraints?

Valentine, T.[1]; Binnie, K.[1]; Squire, G.R.[1]; Hawes, C.[1]; Hallett, P.D.[2]; Bengough, A.G.[1]
[1]Ecological Sciences, The James Hutton Institute, Errol Road, Invergowrie,, Dundee, DD2 5DA, United Kingdom; [2]Environmental and Biochemical Sciences, The James Hutton Institute, Errol Road, Invergowrie,, Dundee, DD2 5DA, United Kingdom

Soil strength and pore space structure were major limitations to root elongation in arable soils. Potential differences in root traits linked to responses to soil physical constraints are assessed.

SKN1.2

16:15

Can soil hydraulic properties be managed by cover crop roots?

Bodner, G.; Scholl, P.; Loiskandl, W.; Kaul, H-P.
Department of Crop Sciences, University of Natural Resources and Life Sciences, Gregor Mendel Straße 33, Vienna, Austria

Soil hydraulic properties in the structural range are subject to high spatio-temporal variability. Roots of cover crops showed effects in the large macropore range and contribute to pore stabilization. Environmental factors however are the main drivers of temporal dynamics.

SS1.21

16:35

Rhizosphere plasticity – dynamic alteration of rhizosphere biophysical and -chemical properties and the role of mucilage

Vetterlein, D.
Soil Physics, Helmholtz Centre for Environmental Research - UFZ, Theodor-Lieser-Str. 4, Halle, 06120, Germany

Rhizosphere plasticity mediated by the presence or absence of mucilage enables plants to dynamically adapt rhizosphere biophysical and biochemical properties in order to optimise the acquisition of water and nutrients on a whole plant scale.

SS1.22

16:55

Role of root development in conferring soil strength

Dumlao, M.R.[1]; Silk, W.K.[1]; Goyal, V.[1]; Ramananarivo, S.[2]; DeJong, J.T.[3]
[1]Land, Air, and Water Resources, University of California, Davis, One Shields Avenue, Davis, 95616, United States; [2]École Normale Supérieure, France; [3]Department of Civil and Environmental Engineering, University of California, Davis, One Shields Avenue, Davis, 95616, United States

A developmental perspective was used to study the effects of root growth on soil stability. Soil strength increased during plant growth, which was associated with increased root abundance and increased root mechanical strength.

SS1.23

17:15

New transparent soil sheds light on 3D biological structures in the rhizosphere

Downie, H.[1]; Holden, N.[2]; Otten, W.[3]; Spiers, A.J.[3]; Valentine, T.A.[1]; Dupuy, L.X.[1]
[1]Ecological Sciences, The James Hutton Institute, Invergowrie, Dundee, DD2 5DA, United Kingdom; [2]The James Hutton Institute, Invergowrie, Dundee, DD2 5DA, United Kingdom; [3]The SIMBIOS Centre, University of Abertay Dundee, Bell Street, Dundee, DD1 1HG, United Kingdom

Transparent soil is a growth substrate that mimics the heterogeneity and chemical properties of soil and allows imaging of roots and microorganisms using established microscopy methods.

SS1.24

Environment 1: Environmental impact and carbon cycling

Tuesday, June 26, 2012
15:45 - 17:35
Lecture Theatre 2
Chair: D Kell, UK
Co-chair: T Acuna, Australia

15:45

Age-related changes in carbon allocation to root growth and respiration in a temperate beech forest

Epron, D.

Lorraine University - Nancy, Faculté des Sciences, Vandeuvre les Nancy, 54506, France

Combining a mass-balance approach and ecosystem CO_2 flux measurements, changes in carbon allocation to root growth and respiration with stand age were reported in a temperate beech forest, reflecting shifts in resource limitations.

SKN1.3

16:15

Influence of plant roots on the physical behaviour of soils

Hallett, P.[1]; Barre, P.[2]; Bengough, A.G.[1, 3]; Loades, K.W.[1]; Duckett, N.R.[3]; Knappett, J.A.[3]; Paterson, E.[4]; Daniell, T.[1]; Caul, S.[1]; Zhang, B.[5]

[1]The James Hutton Institute, Invergowrie, Dundee, DD2 5DA, United Kingdom; [2]Geology Laboratory, CNRS-ENS, Ecole normale supérieure, 24 rue Lhomond, Paris, 75005, France; [3]Division of Civil Engineering, University of Dundee, Dundee, DD1 4HN, United Kingdom; [4]The James Hutton Institute, Craigiebuckler, Aberdeen, AB15 8QH, United Kingdom; [5]Key Laboratory of Plant Nutrition and Nutrient Cycling of Ministry of Agriculture of China, Institute, CAAS, Beijing, 100081, China

How plant roots influence the physical properties of soil has been quantified using a range of approaches adopted from materials science. This includes how root exudates enhance interparticle bonding, dispersion and aggregation processes, in addition to roots acting as fibre reinforcing rods in soil.

SS1.31

16:35

Contribution of root and rhizomicrobial remains to subsoil organic matter –assessed in a loess-paleosol sequence

Gocke, M.; Wiesenberg, G.L.B.

Department of Agroecosystem Research, University of Bayreuth, Universitätsstr. 30, Bayreuth, 95440, Germany

Based on lipid molecular proxies, amounts of root and rhizomicrobial OM were assessed in the subsoil which contains highly abundant rhizoliths. An extension of several cm of the former rhizosphere indicates a significant contribution of deep-rooting plants to the subsoil organic carbon pool.

SS1.32

16:55

Do differences in root distribution of rhizomatous and non-rhizomatous Miscanthus genotypes affect carbon sequestration?

Richter, G.; Agostini, F.; Barker, A.

Sustainable Soils and Grassland Systems, Rothamsted Research, West Commons, Harpenden, AL5 2JQ, United Kingdom

Rooting density, soil organic carbon and δ13C profiles under Miscanthus showed genotypic differences in terms of absolute accumulation and distribution. C4-roots clearly caused a strong shift of δ13C in topsoils due to RLD distribution and yield of the genotypes with only small shifts in subsoils.

SS1.33

17:15

Breeding plants with deep roots for carbon, water and nutrient sequestration: what may be achievable?

Kell, D.

BBSRC & School of Chemistry and MIB, The University of Manchester, United Kingdom

An extra 1m depth of roots deployed over existing croplands and grasslands (ca 2300 Mha each) can have a very substantial impact in mitigating CO_2 increases (see also http://dpkgroup.org/carbonsequestration/rootsystem.html); we need to breed plants that can produce them.

SS1.34

Wednesday 27 June

Lecture Theatre 3

Time	Ref	Talk/Event	Presenter
09:00	PLK3	**Plenary Keynote** **Chaired Brown & Draye**	
		Root growth under water deficits: physiological complexity and coordination	Sharp
Split Session			
09:40		**Function 2. Root function and uptake** **Chaired Brown & Draye**	
09:45	SKN2.1	Genetically enhanced root suberin levels regulate shoot ion accumulation and confer improved drought tolerance	Franke
10:15	SS2.11	Arabidopsis root nutrient acquisition responses to changing water and nitrate supply	Chapman
10:30		tea/coffee (30 mins)	
11:00	SS2.12	Modeling zinc uptake via ZIP transporters	Claus
11:20	SS2.13	Phosphate uptake by Brassica napus from nutrient solution is limited by diffusion and not by membrane transport	Santner
11:40	SS2.14	Where do roots take up water? A technique to quantify local root water uptake	Zarebanadkouki
12:00	SS2.15	Auxin is involved in the responses of cluster root formation and citrate exudation to P limitation in white lupin	Shen
12:20	SS2.16	Model-based analysis of resource capture by lettuce roots exposed to temporally or spatially dynamic stress	Kerbiriou
12:40		End of Split session	
12:40		Lunch	
		Swap posters to posters for Poster Session 2	
14:00	PLK4	**Plenary Keynote** **Chaired by Price & Eshel**	
		The roots of our soils	Hinsinger
Split Session			
14:40		**Function 3. Evolution and function of root structures** **Chaired by Price and Eshel**	
14:45	SKN3.1	Anatomical aspects of angiosperm root evolution	Seago
15:15	SS3.11	Four Dimensional Phenotyping of Gravitropism in Rice Roots and Potential Impacts on Phosphate Acquisition	Zappala
15:30		Coffee	
16:00	SS3.12	Auxin dual action paradox and its possible role in root system shaping	Dubrovsky
16:20	SS3.13	The cell wall: defense reactions to abiotic stress in the root apoplast/apoplasm	Lux
16:40	SS3.14	Differential protein expression among shoot-borne roots and their laterals	Zobel
17:00	SS3.15	Root morphological and architectural characteristics of T. repens × T. uniflorum interspecific hybrids	Nichols
17:20		END	
17:30		Leave for optional visit to Verdant works light refreshments, with ISRR Business meeting at 18:45 -19:30 (provide Buffet for those attending meeting. Meeting room at Verdant Works for up to 80)	
19:30		Evening free	

Lecture Theatre 4

Time	Ref	Talk/Event	Presenter
Split Session			
09:40		**Interactions 2. Exudates** **Chaired by Hinsinger & Neumann**	
09:45	SKN2.2	Contrasting roles of cluster roots and carboxylate exudation in nutrient cycling in young and old ecosystems	Lambers
10:15	SS2.21	Rhizosheath as a future breeding target for improved abiotic stress tolerance in cereals	George
10:30		tea/coffee (30 mins)	
11:00	SS2.22	Aluminium tolerance of root hairs underlies genotypic differences in rhizosheath size of wheat grown on acid soil	Delhaize
11:20	SS2.23	Roots as source of fatty acids in soil traced in a triple $13CO_2$ pulse labeling experiment	Wiesenberg
11:40	SS2.24	Detection of pH gradients in between acidifying and alkalizing roots with a novel camera/pH-sensor system	Schreiber
12:00	SS2.25	Intercropping system output relies on rhizosphere modification differing in species and soil pH	Zhang
12:20	SS2.26	Benzoxazinoids in root exudates of maize attract Pseudomonas putida to the rhizosphere	Neal
12:40		End of Split session	
12:40		Lunch	
		Swap posters to posters for Poster Session 2	
Split Session			
14:40		**Interactions 3. Root-microbe interaction** **Chaired by Baggs and Wissuwa**	
14:45	SKN3.2	Phosphate transporter genes in mycorrhizal Brachypodium distachyon	Grønlund
15:15	SS3.21	"Influence of barley root exudates on community structure of ammonia oxidisers and nitrification rates in soil"	Skiba
16:00	SS3.22	Constraints on colonisation by arbuscular mycorrhizal fungi in pasture species in south-western Australia	Orchard
16:20	SS3.23	Role of auxin signaling in the interaction of Arabidopsis with the plant growth-promoting bacterium Azospirillum	Bossuyt
16:40	SS3.24	Improving rice yield and quality through inoculation with mycorrhiza and plant growth promoting rhizo-bacteria in India	Berset
17:00	SS3.25	Nano LC-MS analysis on root secreting proteins	Shinano
17:20		END	

Lecture Theatre 2

Time	Ref	Talk/Event	Presenter
Split Session			
09:40		**Environment 2. Hostile conditions** **Chaired by Lux and Smucker**	
09:45	SKN2.3	Lipoamide dehydrogenase is a primary target for arsenic toxicity in plants	Finnegan
10:15	SS2.31	Root system distribution and root morphology of energy crop Erianthus	Shiotsu
10:30		tea/coffee (30 mins)	
11:00	SS2.32	Testing the Ability of Bacteria to Colonize the Rhizosphere of Salix caprea Grown in Contaminated Soil	Fallmann
11:20	SS2.33	The adaptive responses of tall Fescue (Festuca arund-inacea) growing in sand contaminated with naphthalene	Balasubramaniyam
11:40	SS2.34	Metal and water transport in plant roots: modelling and multiscale analysis	Ptashnyk
12:00	SS2.35	Genetic programs involved in root meristem activity or exhaustion: Lessons from a Sonoran Desert Cactaceae	Shishkova
12:20	SS2.36	A lipoxygenase gene mediates systemic root growth inhibition in Arabidopsis heterogeneously exposed to excess zinc	Remans
12:40		End of Split session	
12:40		Lunch	
		Swap posters to posters for Poster Session 2	
14.00		Plenary Keynote (in Lecture Theatre 3)	
Split Session			
14:40		**Talking posters** **Chaired by Vetterlein and Dodd**	
14:45	TP01	Detecting change in root length density in response to nutrient patches using micro-CT	Flavel
14:55	TP02	Combining in vivo and in silico experiments to unravel root water uptake dynamics	Lobet
15:05	TP03	Root growth and water status as studied by 3D reconstruction of MRI images	van Dusschoten
15:15	TP04	Modelling the potential root water extraction ratio in soil: application to sugar cane on the Island of Réunion	Chopart
15:25	TP05	Measuring the impact of soil compaction on root system architecture	Tracy
16:00	TP06	Influence of forest management on beech (Fagus sylvatica L.) fine root growth	Kraigher
16:10	TP07	Dry root biomass of sugarcane grown under different lime rates in conventional and no-tillage systems	Bolonhezi
16:20	TP08	"RootLAB: A tree-ring based 3D root-development tool	Wagner
16:30	TP09	Soil and roots characteristic under short rotation plantations compared to different land management practices	Slazak
16:40	TP10	Increasing the root exploitation of soil by arable cropping systems	Thorup-Kristensen
16:50	TP11	High resolution X-Ray Computed Tomography (XCT) of soil and root structures	Keyes
17:00	TP12	Tri-trophic belowground symbiosis between a weevil, bacteria and a desert plant	Rachmilevitch
17:10		END	

Plenary Keynote

Wednesday, June 27, 2012
09:00 - 09:40
Lecture Theatre 3
Chair: K Brown, US
Co-chair: X Draye, Belgium

09:00

Root growth under water deficits: physiological complexity and coordination

Sharp, R.

Division of Plant Sciences, University of Missouri, 1-31 Agriculture Building, Columbia, 65211, United States

Root growth is critical for plant adaptation to drought. This presentation will focus on recent studies of the complexity and coordination of root growth regulation under water deficits, focusing on the role of apoplastic reactive oxygen species and modifications of cell wall extensibility.

PLK3

Function 2:
Root function and uptake

Wednesday, June 27, 2012
09:45 - 10:30
Lecture Theatre 3
Chair: K Brown, US
Co-chair: X Draye, Belgium

09:45

Genetically enhanced root suberin levels regulate shoot ion accumulation and confer improved drought tolerance

Franke, R.

Institute of Cellular and Molecular Botany, University of Bonn, Kirschallee 1, BONN, 53115, Germany

The characterization of additional mutants with enhanced suberin content in roots provided genetic evidence that suberin is involved in the control of water balance and ion uptake and translocation.

SKN2.1

10:15

Arabidopsis root nutrient acquisition responses to changing water and nitrate supply

Chapman, N.[1]; Miller, T.[2]; Lindsey, K.[3]; Whalley, R.[1]

[1]Rothamsted Research, West Common, Harpenden, AL5 2JQ, United Kingdom; [2]John Innes Centre, Norwich Research Park, Norwich, NR4 7UH, United Kingdom; [3]Durham University, South Road, Durham, DH1 3LE, United Kingdom

Studying Arabidopsis root nutrient acquisition under altered water and nitrate supply in a sand rhizotron system, Chapman et al. report root architecture and transporter responses to changing environmental conditions which indicate increased nutrient acquisition under plentiful supply.

SS2.11

10:30 Coffee

Function 2:
Root function and uptake

Wednesday, June 27, 2012
11:00 - 12:40
Lecture Theatre 3
Chair: K Brown, US
Co-chair: X Draye, Belgium

11:00

Modeling zinc uptake via ZIP transporters

Claus, J.; Chavarría-Krauser, A.

Interdisciplinary Center for Scientific Computing, University of Heidelberg, INF 368, Heidelberg, 69120, Germany

Zinc is transported into root cells by ZIP transporters. Their regulation is essential for zinc homeostasis, but the underlying mechanisms are largely unknown. Using a theoretical model and simulations we suggest putative models, analyze their features and identify the most likely mechanism.

SS2.12

11:20

Phosphate uptake by Brassica napus from nutrient solution is limited by diffusion and not by membrane transport

Santner, J.[1]; Smolders, E.[2]; Wenzel, W.W.[1]; Degryse, F.[3]

[1]Institute of Soil Science, University of Natural Resources and Life Sciences, Vienna, Konrad-Lorenz-Strasse 24, Tulln, 3430, Austria; [2]Laboratory for Soil and Water Management, Katholike Universiteit Leuven, Kasteelpark Arenberg 20, Heverlee, 3001, Belgium; [3]School of Food, Agriculture and Wine, University of Adelaide, PMB1, Glen Osmond, SA 5064, Australia

Uptake of phosphate by plant roots from nutrient solutions is commonly considered to be limited by the protein-mediated transport via the plasma membrane. Santner et al. demonstrate that at low P concentration diffusion towards the root surface is limiting P uptake, even in nutrient solutions.

SS2.13

11:40

Where do roots take up water? A technique to quantify local root water uptake

Zarebanadkouki, M.[1]; Kim, Y.[2]; Moradi, A.B.[3]; Carminati, A.[4]

[1]Soil Hydrology, George August University of Göttingen, Büsgenweg2, Göttingen, 37075, Germany; [2]Soil Physics, Helmholtz Center for Environmental Science- UFZ, Leipzig, Germany; [3]. University of California Davis, California, California, United States; [4]Soil Hydrology, George August University of Göttingen, Germany

We used a combination of neutron radiography and D_2O tracer to monitor and quantify flow of water into different parts of root system. The transport of D_2O into roots was described by a simple convection-diffusion model.

SS2.14

12:00

Auxin is involved in the responses of cluster root formation and citrate exudation to P limitation in white lupin

Shen, J.B.[1]; Tang, H.L.[1]; Cheng, L.Y.[1]; Li, X.Q.[1]; Vance, C.P.[2]; Zhang, F.S.[1]

[1]Department of Plant Nutrition, Key Laboratory of Plant-Soil Interactions, Ministry of Education, Chi, No.2 Yuanmingyuan Wesy Road, Beijing, 100193, China; [2]USDA-ARS, Plant Science Research, University of Minnesota, United States

Auxin stimulates not only cluster-root formation, but also citrate exudation, indicating a role in modifying root morphological and physiological plasticity. Auxin is involved in cluster-root development as well as citrate exudation induced by P deficiency in Lupinus albus.

SS2.15

12:20

Model-based analysis of resource capture by lettuce roots exposed to temporally or spatially dynamic stress

Kerbiriou, P.J.[1]; Lammerts van Bueren, E.T.[1]; Struik, P.C.[2]

[1]Laboratory of Plant Breeding, Wageningen UR, P.O Box 386, Wageningen, 6700 AJ, Netherlands; [2]Centre for Crop System Analysis, Wageningen UR, P.O Box 430, Wageningen, 6700 AK, Netherlands

Both cultivars reduced their root development in the top compartment and increased it in the lower compartment, leading to proportional nitrate capture performance similar to the control levels in the 20-30 cm. The final NUE for 'Matilda' was reduced by 7% while it was increased by 7% for 'Pronto'.

SS2.16

12:40 Lunch

Plenary Keynote

Wednesday, June 27, 2012
14:00 - 14:40
Lecture Theatre 3
Chair: A Price, UK
Co-chair: A Eshel, Israel

14:00

The roots of our soils

Hinsinger, P.[1]; Cloutier-Hurteau, B.[2]; Jourdan, C.[3]; Laclau, J.P.[3]

[1]UMR Eco&Sols, INRA, Placa Viala, Montpellier, 34060, France; [2]UMR Eco&Sols, INRA/CIRAD, Place Viala, Montpellier, 34060, France; [3]UMR Eco&Sols, CIRAD, Place Viala, Montpellier, 34060, France

Roots of higher plants play a key role in major ecosystem support services, such as soil formation, biogeochemical cycles and habitat provision for an extremely diverse biota. We provide an overview of how roots shape the rhizosphere and ultimately the bulk of the soil.

PLK4

Function 3: Evolution and function of root structures

Wednesday, June 27, 2012
14:45 - 15:30
Lecture Theatre 3
Chair: A Price, UK
Co-chair: A Eshel, Israel

14:45

Anatomical aspects of angiosperm root evolution

Seago, J.

Biological Sciences, SUNY, College at Oswego, NY 104 West, Oswego, 13126, United States

Microscopic examination of roots in Basal Angiosperms (ANAs and Magnoliids), Monocots, and Eudicots reveals trends in the anatomy of the vascular cylinder and cortex that supports recent molecular phylogenies of Angiosperms.

SKN3.1

15:15

Four Dimensional Phenotyping of Gravitropism in Rice Roots and Potential Impacts on Phosphate Acquisition

Zappala, S.[1]; Mooney, S.J.[1]; Pridmore, T.[2]; Bennett, M.J.[2]

[1]School of Biosciences, University of Nottingham, Sutton Bonington Campus, United Kingdom; [2]Centre for Plant Integrative Biology, University of Nottingham, United Kingdom

X-ray Micro Computed Tomography (Micro CT) provides non-destructive observation of rice root architecture development in soil. Zappala et al. explore the non-destructive aspect of Micro CT and its usefulness for capturing root gravitropism in relation to phosphorus uptake.

SS3.11

15:30 Coffee

Function 3: Evolution and function of root structures

Wednesday, June 27, 2012
16:00 - 17:20
Lecture Theatre 3
Chair: A Price, UK
Co-chair: A Eshel, Israel

16:00

Auxin dual action paradox and its possible role in root system shaping

Dubrovsky, J.[1]; Ivanchenko , M.G.[2]; Napsucialy-Mendivil, S.[1]; Duclercq, J.[3]; Shishkova, S.[1]; Friml, J.[3]; Murphy, A.S.[4]; Benková, E[3]

[1]Instituto de Biotecnología, Universidad Nacional Autónoma de México, Av. Universidad 2001, Col. Chamilpa, Cuernavaca, 62210, Mexico; [2]Department of Botany & Plant Pathology, Oregon State University, Corvallis, United States; [3]VIB Department of Plant Systems Biology, Gent University, Belgium; [4]Purdue University, West Lafayette, United States

Auxin is required for lateral root (LR) formation. Dubrovsky et al. found that in terms of its effect on LR initiation, auxin may act simultaneously as a promoter in one root portion and as an inhibitor in another one. Possible mechanisms of auxin dual action paradox are considered.

SS3.12

16:20

The cell wall: defense reactions to abiotic stress in the root apoplast/apoplasm

Lux, A.[1]; Martinka, M.[1]; Vaculik, M.[1]; White, P.J.[2]; Broadley, M.R.[3]

[1]Department of Plant Physiology, Faculty of Natural Sciences, Comenius University in Bratislava, Mlynska dolina B2, Bratislava, SK 84215, Slovak Republic; [2]The James Hutton Institute, Invergowrie, Dundee, DD2 5DA, United Kingdom; [3]Plant Science Division, University of Nottingham, Sutton Bonigton, Leicestershire, LE12 5RD, United Kingdom

Reactions in the apoplasm represent in many cases the key stage in defense of roots to toxic concentrations of ions, drought or wounding. Lux et al. describe specific cell wall modifications occurring after local treatment of roots, demonstrating sensitive and rapid defense of endangered root parts.

SS3.13

16:40

Differential protein expression among shoot-borne roots and their laterals

Zobel, R.

USDA-ARS, 1224 Airport Rd, Beaver, United States

In orchardgrass (Dactylis glomerata L.) electrophoretic protein gels, at least 10 differentially expressing protein bands can be found between shoot-borne roots and their component lateral roots. It is suggested that this supports the hypothesis that different root classes have different functions.

SS3.14

17:00

Root morphological and architectural characteristics of T. repens × T. uniflorum interspecific hybrids

Nichols, S.N.[1]; Hofmann, R.W.[2]; Williams, W.M.[3]; Crush, J.R.[1]

Biological Sciences, SUNY, College at Oswego, NY 104 West, Oswego, 13126, United States

[1]AgResearch, Private Bag 3123, Hamilton 3240, New Zealand; [2]Lincoln University, P.O. Box 84, Lincoln 7647, New Zealand; [3]AgResearch, Private Bag 11008, Palmerston North 4442, New Zealand

SS3.15

Interaction 2: Exudates

Wednesday, June 27, 2012
09:45 - 10:30
Lecture Theatre 4
Chair: P Hinsinger, France
Co-chair: G Neumann, Germany

09:45

Contrasting roles of cluster roots and carboxylate exudation in nutrient cycling in young and old ecosystems

Lambers, H.[1]; Bishop, J.G.[2]; Hopper, S.D.[3]; Laliberté, E.[1]; Zúñiga-Feest, A.[4]
[1]School of Plant Biology, The University of Western Australia, 35 Stirling Highway, Crawley (Perth), 6009, Australia; [2]School of Biological Sciences, Washington State University, Vancouver, 98686, United States; [3]Royal Botanic Gardens, Kew, Richmond, TW9 3AB, United Kingdom; [4]Laboratorio de Ecofisiología Vegetal, Ciencias Ambientales y Evolutivas, Universidad Austral de Chile, Casilla 567, Valdivia, Chile

Cluster roots and massive carboxylate exudation in young landscapes where P is strongly sorbed, combined with shedding leaves that are rich in P, likely allows ecosystem engineering . P-mobilisation ecosystem engineering provides phosphorus for neighbouring plants lacking specialised roots.

SKN2.2

10:15

Rhizosheath as a future breeding target for improved abiotic stress tolerance in cereals

George, T.[1]; Brown, L.K.[1]; Thomas, W.T.B.[2]; White, P.J.[1]
[1]Ecological Sciences, The James Hutton Institute, Invergowrie, Dundee, DD2 5DA, United Kingdom; [2]Cell and Molecular Sciences, The James Hutton Institute, Invergowrie, Dundee, DD2 5DA, United Kingdom

Barley produces rhizosheaths of variable mass which improve tolerance to abiotic stress. Rhizosheath mass is a novel functional trait that we have used to rapidly screen populations to understand the genetic and physiological controls of cereal tolerance to phosphorus and water deficit.

SS2.21

10:30 Coffee

Interaction 2: Exudates

Wednesday, June 27, 2012
11:00 - 12:40
Lecture Theatre 4
Chair: P Hinsinger, France
Co-chair: G Neumann, Germany

11:00

Aluminium tolerance of root hairs underlies genotypic differences in rhizosheath size of wheat grown on acid soil

James, R.A.; Ryan, P.R.; Delhaize, E.
CSIRO Plant Industry, Australia

Wheat germplasm varies in its ability to form rhizosheaths when grown on acid soil. Using defined germplasm derived from a series of backcrosses, Delhaize et al. show that differences in aluminium tolerance of root hairs underlies the differences in rhizosheath size.

SS2.22

11:20

Roots as source of fatty acids in soil traced in a triple 13CO_2 pulse labeling experiment

Wiesenberg, G.L.B.[1]; Kuzyakov, Y.[2]; Schwarzbauer, J.[3]; Schwark, L.[4]
[1]Department of Agroecosystem Research, University of Bayreuth, Universitaetsstrasse 30, Bayreuth, 95447, Germany; [2]University of Goettingen, Germany; [3]RWTH Aachen University, Germany; [4]University of Kiel, Germany

Fatty acids are quickly incorporated into the rhizosphere as root exudates and microorganisms derived compounds. At a large distance from living roots, dead roots lead to an enrichment of root derived fatty acids, which can be also an energy source for microorganisms in soil.

SS2.23

11:40

Detection of pH gradients in between acidifying and alkalizing roots with a novel camera/pH-sensor system

Schreiber, C.M.[1]; Betencourt, E.[1]; Blossfeld, S.[2]; Souche, G.[1]; Hinsinger, P.[1]
[1]INRA, UMR Eco&Sols, Place Viala, Montpellier, France; [2]Institute of Bio-and Geosciences (IBG2): Plant sciences, Research Centre Juelich GmbH, Wilhelm-Johnen-Str., Juelich, Germany

A novel pH camera system was used to assess the pH gradient between roots and root systems of Chickpea and Durum wheat. Alkalizing (Durum wheat) and acidifying (Chickpea) effects were monitored in high resolution.

SS2.24

12:00

Intercropping system output relies on rhizosphere modification differing in species and soil pH

Zhang, C.C.[1]; Liao, H.[2]; Li, L.[1]; Jiao, N.Y.[3]; Shen, J.B.[1]; Zhang, F.S.[1]
[1]Plant Nutrition, China Agricultural University, NO.2 Yuanmingyuan Xilu, Haidian District, Beijing, 100193, China; [2]Root Biology Center, South China Agricultural University, Guangzhou, 510642, China; [3]Agronomy, Henan University of Science & Technology, Luoyang, 471003, China

The activation of unavailable nutrient causes overyielding of intercropping system. Using series of field studies across acidic and calcareous soil, Zhang et al. shows that rhizosphere modification relies on soil pH and the facilitation to maize acquiring phosphorus varies with its neighbours.

SS2.25

12:20

Benzoxazinoids in root exudates of maize attract Pseudomonas putida to the rhizosphere

Neal, A.[1]; Ahmad, S.[2]; Gordon-Weeks, R.[2]; Ton, J.[3]
[1]Rothamsted Centre for Sustainable Soils and Grassland Systems, Rothamsted Research, West Common, Harpenden, AL5 2JQ, United Kingdom; [2]Biological Chemistry Department, Rothamsted Research, West Common, Harpenden, AL5 2JQ, United Kingdom; [3]Department of Animal and Plant Sciences, University of Sheffield, Western Bank, Sheffield, S10 2TN, United Kingdom

Benzoxazinoids act as important allelochemicals in cereals. Neal et al. demonstrate that the common rhizobacterium Pseudomonas putida is able to metabollise maize BXs and is therefore resistant to BX toxicity. Furthermore P. putida is attracted to the maize rhizosphere by BXs in root exudates.

SS2.26

12:40 Lunch

Interaction 3: Root-microbe interactions

Wednesday, June 27, 2012
14:45 - 15:30
Lecture Theatre 4
Chair: E Baggs, UK
Co-chair: M Wissuwa, Japan

14:45

Phosphate transporter genes in mycorrhizal Brachypodium distachyon

Grønlund, M.; Clausen, S.S.; Hammer, E.; Jakobsen, I.
Department of Chemical and Biochemical Engineering, Risø Campus, Technical University of Denmark, Frederiksborgvej 399, P.O. Box 49, Roskilde, 4000, Denmark

Growth depressions in mycorrhizal B. distachyon plants are potentially caused by down-regulation of phosphate transporter genes in the direct phosphate uptake pathway. Ongoing studies examine the interplay between the direct phosphate uptake and mycorrhizal uptake pathways.

SKN3.2

15:15

Influence of barley root exudates on community structure of ammonia oxidisers and nitrification rates in soil

Skiba, M.[1]; George, T.S.[1]; Baggs, E.M.[2]; Daniell, T.J.[1]
[1]The James Hutton Institute, Invergowrie, Dundee, DD2 5DA, United Kingdom; [2]University of Aberdeen, United Kingdom

Different barley lines have varying Biological Nitrification Inhibition (BNI) ability. Using T-RFLP, we demonstrated that community structure of ammonium oxidisers differs between rhizospheres of various barley lines and the microbial production of soil nitrate is reduced under high BNI.

SS3.21

15:30 Coffee

Interaction 3: Root-microbe interactions

Wednesday, June 27, 2012
16:00 - 17:20
Lecture Theatre 4
Chair: E Baggs, UK
Co-chair: M Wissuwa, Japan

16:00

Constraints on colonisation by arbuscular mycorrhizal fungi in pasture species in south-western Australia

Orchard, S.; Ryan, M.H.; Standish, R.J.; Nicol, D.
School of Plant Biology, University of Western Australia, 35 Stirling Highway, Crawley, 6009, Australia

Arbuscular mycorrhizal fungi (AMF) form associations with plant roots. Investigating AMF colonisation in pasture species, Orchard et al. found no link with soil properties, but under waterlogging, AMF may be limited by host plant adaptation. DNA analysis showed distinct changes in AMF community.

SS3.22

16:20

Role of auxin signaling in the interaction of Arabidopsis with the plant growth-promoting bacterium Azospirillum

Bossuyt, S.; Spaepen, S.; Vanderleyden, J.
Centre of Microbial and Plant Genetics, University of Leuven, Heverlee, Belgium

Azospirillum is a plant-associated auxin-producing bacterium that can exert beneficial effects on Arabidopsis. A transcriptome analysis on Azospirillum-treated Arabidopsis revealed extensive changes in gene expression of processes related to cell wall, defense and hormones.

SS3.23

16:40

Improving rice yield and quality through inoculation with mycorrhiza and plant growth promoting rhizo-bacteria in India

Srivastava, R.[1]; Berset, E.[2]; Mäder, P.[2]; Adholeya, A.[3]; Fried, P.M.[4]; Sharma, A.K.[1]
[1]Department of Biological Sciences, G.B. Pant University of Agriculture and Technology, India; [2]Soil Science Division, Research Institute of Organic Agriculture (FiBL), Switzerland; [3]Biotechnology and Bioresources Division, The Energy and Resources Institute (TERI), India; [4]Agroscope Reckenholz-Tänikon Research Station (ART), Switzerland

Microorganisms were integrated as bio-fertilizers in a wheat-rice trial in India. Four-year results show that rice grain yield was 30% higher, compared to control plots, after application of an inoculum containing mycorrhiza and rhizo-bacteria. Substantial increase of grain quality was achieved.

SS3.24

17:00

Nano LC-MS analysis on root secreting proteins

Shinano, T.[1]; Yoshimura, T.[2]; Komatsu, S.[3]; Tokutake, S.[2]; Kong, F.J.[3]; Watanabe, T.[2]; Osaki, M.[2]
[1]NARO, Hokkaido Agricultural Research Center, 1-Hitsujigaoka, Toyohira-ku, Sapporo, 0628555, Japan; [2]Graduate School of Agriculture, Hokkaido University, Japan; [3]NARO, Institute of Crop Science, Japan

Rice roots secrete a large variety of proteins to the rhizosphere even under aseptic conditions. From nano LC-MS/MS based proteome analysis we have found that about half of them belong to PR proteins, and some of them have not reported to be expressed in rice plant.

SS3.25

Environment 2: Hostile conditions

Wednesday, June 27, 2012
09:45 - 10:30
Lecture Theatre 2
Chair: A Lux, Slovakia
Co-chair: A Smucker, US

09:45

Lipoamide dehydrogenase is a primary target for arsenic toxicity in plants

Chen, W.[1]; Taylor, N.L.[2]; Chi, Y.[1]; Millar, A.H.[2]; Lambers, H.[1]; Finnegan, P.M.[1]
[1]School of Plant Biology, University of Western Australia, 35 Stirling Highway, Crawley, 6009, Australia; [2]Australian Research Council Centre of Excellence in Plant Energy Biology, University of Western Australia, 35 Stirling Highway, Crawley, 6009, Australia

Lipoamide dehydrogenase has a central role in primary carbon metabolism. Finnegan et al. show that mutation of a gene encoding mitochondrial lipoamide dehydrogenase caused roots of Arabidopsis to become overly sensitive to arsenic toxicity through enhanced disruption to oxidative metabolism.

SKN2.3

10:15

Root system distribution and root morphology of energy crop Erianthus

Shiotsu, F.[1]; Abe, J.[2]; Morita, S.[3]
[1]The college of agriculture, Ibaraki University, 3-21-1, Ami, 300-0393, Japan; [2]AE-Bio, Graduate School of Agricultural and Life Sciences, The University of Tokyo, 113-8657, Japan; [3]Institute for Sustainable Agro-ecosystem Services, The University of Tokyo, 1-1-1, Nishi-Tokyo, 188-0002, Japan

Erianthus spp. perform huge biomass in abandoned lands and high tolerance to environmental stresses. Shiotsu et al. examine root system distribution and root morphology of Erianthus spp. and find that they have deep root systems and possible relation to tolerance for environmental stresses.

SS2.31

10:30 Coffee

Environment 2: Hostile conditions

Wednesday, June 27, 2012
11:00 - 12:40
Lecture Theatre 2
Chair: A Lux, Slovakia
Co-chair: A Smucker, Slovakia

11:00

Testing the Ability of Bacteria to Colonize the Rhizosphere of Salix caprea Grown in Contaminated Soil

Fallmann, K.[1]; Kuffner, M.[2]; Puschenreiter, M.[1]; Sessitsch, A.[2]
[1]Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences, Konrad-Lorenz-Strasse 24, Tulln, 3430, Austria; [2]Bioresources Unit, AIT – Austrian Institute of Technology GmbH, Konrad-Lorenz-Strasse 24, Tulln, 3430, Austria

Bacteria do not necessarily survive when inoculated into the plant rhizosphere. Here, an approach for selecting suitable bacteria in a heavy metal-phytoextraction setup is tested and evaluated.

SS2.32

11:20

The adaptive responses of tall Fescue (Festuca arundinacea) growing in sand contaminated with naphthalene

Balasubramaniyam, A.[1]; Chapman, M.[1]; Rees, D.[2]; Harvey, P.J.[1]
[1]School of Science, University of Greenwich, University of Greenwich at Medway, Chatham Maritime, ME4 4TB, United Kingdom; [2]Natural Resources Institute, University of Greenwich, University of Greenwich at Medway, Chatham Maritime, ME4 4TB, United Kingdom

Tall fescue grown in naphthalene-treated sand exhibited changes to its root structure, root growth patterns and physiology. The treated plants showed resilience to drought and xenobiotic uptake.

SS2.33

11:40

Metal and water transport in plant roots: modelling and multiscale analysis

Ptashnyk, M.[1]; Chavarria Krauser, A.[2]
[1]Division of Mathematics, University of Dundee, Old Hawkhill, Dundee, DD1 4HN, United Kingdom; [2]BIOQUANT, University of Heidelberg, Im Neuenheimer Feld 267, Heidelberg, 69120, Germany

The transport of water and metal molecules is considered on the scale of a single plant root cell. We distinguish between apoplastic and symplastic pathways. Averaged model of transport processes defined on the scale of a whole root branch is derived using multiscale analysis.

SS2.34

12:00

Genetic programs involved in root meristem activity or exhaustion: Lessons from a Sonoran Desert Cactaceae

Shishkova, S.[1]; Matvienko, M.[2]; Kozik, A.[3]; Ugartechea-Chirino, Y.[4]; Lopez-Valle, M.[4]; Napsucialy-Mendivil, S.[4]; Dubrovsky, J.G.[4]
[1]Departamento de Biología Molecular de Plantas, Instituto de Biotecnología - Universidad Nacional Autónoma de México, Av. Universidad 2001 Col. Chamilpa, Cuernavaca, 62210, Mexico; [2]CLC bio, 10 Rogers St # 101, Cambridge, MA 02142, United States; [3]Genome Center, University of California, 451 Health Sciences Drive, Davis, CA 95616, United States; [4]Departamento de Biologia Molecular de Plantas, Instituto de Biotecnología - Universidad Nacional Autónoma de México, Av. Universidad 2001 Col. Chamilpa, Cuernavaca, 62210, Mexico

To study meristem maintenance, differential gene expression was analyzed using RNA-seq in a cactus species with determinate root growth. Shishkova et al. suggest that there are similarities and differences in regulation of root growth and meristem maintenance in Pachycereus and Arabidopsis.

SS2.35

12:20

A lipoxygenase gene mediates systemic root growth inhibition in Arabidopsis heterogeneously exposed to excess zinc

Remans, T.; Vangronsveld, J.; Cuypers, A.
Centre for Environmental Sciences, Hasselt University, Agoralaan Gebouw D, Diepenbeek, Belgium

The effect of Cd and Cu on root growth is local and plants maximize the colonization and avoidance responses. In contrast, the systemic effect of Zn causes a reduced capability of Arabidopsis to colonize non-contaminated zones; a lipoxygenase gene was found to mediate this systemic effect.

SS2.36

Talking Posters

Wednesday, June 27, 2012
14:45 - 15:35
Lecture Theatre 2
Chair: D Vetterlein, Germany
Co-chair: I Dodd, UK

14:45

Detecting change in root length density in response to nutrient patches using micro-CT

Flavel, R; Guppy, CN; Young, IM
University of New England, Agronomy and Soil Science, Armidale, 2351, Australia

Micro-CT techniques are able to spatially resolve and visualise root morphological changes in response to nutrient patches over small distances.

TP01

14:55

Combining in vivo and in silico experiments to unravel root water uptake dynamics

Lobet, G.[1]; Couvreur, V.[2]; Javaux, M.[2]; Draye, X.[1]
[1]Earth and Life Institute, Université catholique de Louvain, Croix du Sud, 2 - L7-05-11, Louvain-la-Neuve, 1348, Belgium; [2]Earth and Life Institute, Université catholique de Louvain, Croix du Sud, 2 - L7-05-02, Louvain-la-Neuve, 1348, Belgium

We combined experimental (light transmission imaging in 2D rhizotrons) and modeling (R-SWMS) approaches to unravel root water dynamics. With this approach, we showed that the soil water content variations observed experimentally can not be used as a proxy of local root water uptake.

TP02

15:05

Root growth and water status as studied by 3D reconstruction of MRI images

van Dusschoten, D.[1]; Schulz, H.[2]; Scharr, H.[3]; Postma, J.A.[3]
[1]IBG-2, Plant Sciences, Forschungszentrum Juelich, Forschungszentrum Juelich, Juelich, D-52425, Germany; [2]AIS, University of Bonn, Bonn, Germany; [3]IBG-2, Plant Sciences, Forschungszentrum Juelich, Juelich, Germany

We show MRI images of barley roots growing in soil. Novel software allows us to reconstruct the root architecture from these images for further analysis. Besides root architecture, we were able to observe the cortical senescence and the dynamics in root water status during a drying-wetting cycle.

TP03

15:15

Modelling the potential root water extraction ratio in soil: application to sugar cane on the Island of Réunion

Chopart, J.L.[1]; Le Mézo, L.[2]; Vauclin, M.[3]
[1]CIRAD, Station Roujol, Petit-Bourg, 97170, Guadeloupe; [2]CIRAD, Réunion; [3]CNRS, France

Using the PRER concept, defined as the ratio of the volume of soil available to roots for water uptake to the volume of soil assigned to those roots, Chopart et al. show the need to consider the spatial distribution of sugar cane root length densities and root distances in Réunion.

TP04

15:25

Measuring the impact of soil compaction on root system architecture

Tracy , S.R.; Black , C.R.; Roberts, J.A.; Mooney , S.J.
University of Nottingham, School of Biosciences, Sutton Bonington Campus, College Road, Loughborough, LE12 5RD, United Kingdom

Using X-ray μCT, Tracy et al. were able to visualise and quantify the response of root systems to soil compaction in undisturbed soil in 4-D. Many morphological root characteristics were adversely affected by soil compaction, resulting in a reduced volume of soil for exploration and resource uptake.

TP05

15:30 Coffee

Talking Posters

Wednesday, June 27, 2012
16:00 - 17:20
Lecture Theatre 2
(Talking Posters are on display all week in the Main Hall)
Chair: D Vetterlein, Germany
Co-chair: I Dodd, UK

16:00

Influence of forest management on beech (Fagus sylvatica L.) fine root growth

Železnik, P.; Bajc, M.; Kraigher, H.
Slovenian Forestry Institute, Veèna pot 2, Ljubljana, 1000, Slovenia

Beech fine root growth in a managed and a virgin forest stand was compared, using ingrowth soil cores and minirhizotrons. A significantly lower fine root production was observed in the managed forest than in the virgin forest stand. Fine roots growth has not stopped during winter months.

TP06

16:10

Dry root biomass of sugarcane grown under different lime rates in conventional and no-tillage systems

Bolonhezi, D.[1]; Cury, T.N.[2]; De Maria, I.C.[3]; Rossini, D.B.[4]; Marconato, M.B.[4]; Camilo, E.[4]
[1]APTA Centro Leste, APTA - Research Institute of São Paulo State, Avenida Bandeirantes, 2419, Ribeirão Preto, 1403-670, Brazil; [2]Centro de Solos e Recursos Agroambientais, APTA - Instituto Agronômico de Campinas, Avenida Barão de Itapura, 1428, Campinas, Graduate Student, Brazil; [3]Centro de Solos e Recursos Agroambientais, APTA - Instituto Agronômico de Campinas, Avenida Barão de Itapura, Campinas, Brazil; [4]UNESP, São Paulo State University, Jaboticabal, Undergraduate Student - Scholarship CNPQ, Brazil

After 12 years in no-till the yield of root biomass was 1.7 Mg/ha higher than conventional tillage during the dry season. Despite the advantages of liming, it was observed significant decreased of root biomass (in average 21.4%) in function of lime rates for both tillage systems.

TP07

16:20

RootLAB: A tree-ring based 3D root-development tool

Wagner, B.[1]; Santini, S.[2]; Ingensand, H.[3]; Gaertner, H.[4]

[1]Plant Ecology and Ecosystem Research, University of Goettingen, Untere Karspüle, Goettingen, 37073, Germany; [2]Department of Computer Science Distributed Systems, ETH Zurich, Universitätstrasse 6, Zurich, 8092, Switzerland; [3]Geodesy and Photogrammetry, ETH Zurich, Wolfgang-Pauli-Str. 15, Zurich, 8093, Switzerland; [4]Landscape dynamics, Swiss Federal Research Institut WSL, Zuercherstr 111, Birmensdorf, 8903, Switzerland

A 3D coarse-root development tool was developed, which calculates tree-ring profiles, annual growth layers and the annual volume increment. Interpolation accuracy was × 9% (mean absolute percentage error) for mean ring chronologies. Total volume computations deviated by × 7% from the reference model.

TP08

16:30

Soil and roots characteristic under short rotation plantations compared to different land management practices

Slazak, A.; Böhm, C.; Freese, D.

Chair of Soil Protection and Recultivation, Brandenburg University of Technology, Konrad Waschamm-Allee 6, Cottbus, Germany

Paper presents the research on carbon concentration in soil-root system of the short rotation coppice established on former arable soils compared to conventional agriculture management practices.

TP09

16:40

Increasing the root exploitation of soil by arable cropping systems

Thorup-Kristensen, K.[1]; Dresbøll, D.B.[1]; Kristensen, H.L.[2]

[1]Dept. of Agriculture and Ecology, University of Copenhagen, Højbakkegårds Allé 13, Tåstrup, 2630, Denmark; [2]Dept. Food Science, Aarhus University, Kirstinebjergvej 10, Årslev, 5792, Denmark

A main reason for nutrient losses from arable farming is the limited soil root exploitation compared to natural plant stands. Results showed that the root exploitation was almost doubled by adding cover crops, strongly improving ecosystem services delivered by the root systems.

TP10

16:50

High resolution X-Ray Computed Tomography (XCT) of soil and root structures

Keyes, S.; Grinev, D.V.; Boardman, R.P.; Mavrogordato, M.; Marchant, A.; Sinclair, I.; Roose, T.; Smyth, K.

University of Southampton, University Rd, Southampton, SO17 1BJ, United Kingdom

Interactions between root structures and soils govern many rhizosphere processes. XCT tools, including bench-top scanners, a bespoke high-energy system, and synchrotron light sources, are being used for multi-scale investigation of soil and root interactions at resolutions down to × 1μm.

TP11

17:00

Tri-trophic belowground symbiosis between a weevil, bacteria and a desert plant

Rachmilevitch, S.[1]; Shelef, O.[1]; Helman, Y.[2]; Behar, A.[2]; Friedman, L.[3]

[1]Blaustein Institutes for Desert Reseach, Ben Gurion University of the Negev, Blaustein Institutes for Desert Research, Midreshet Ben Guriom, 84990, Israel; [2]Hebrew University of Jerusalem, Israel; [3]Tel Aviv University, Israel

A unique tri-trophic symbiosis taking place belowground in mud huts built on roots of a desert plant was found. Roots contribute carbon, whereas the weevil contributes nitrogen to the roots. This reciprocal interaction is possible due to nitrogen fixing bacteria harboured within the weevil's gut.

TP12

Thursday 28 June

Lecture Theatre 3

Time	Ref	Talk/Event	Presenter
09:00	PLK5	Plenary Keynote Chaired by Lambers and Helmisaari	
		Speeding up the delivery of root system improvements to farmers to increase crop productivity	Watt
Split Session			
09:40		Function 4. Roots in the field Chaired by Lambers and Helmisaari	
09:45	SKN4.1	Genotypic X environment interactions for root depth of wheat	Acuna
10:15	SS4.11	Root distributions in biodiverse grasslands: spatial niche differentiation or competitive intransitivity?	Ravenek
10:30		tea/coffee (30 mins)	
11:00	SS4.12	Root connections between trees : Ecological implications	DesRochers
11:20	SS4.13	"The effect of inter- vs. intraspecific interactions on root growth dynamics of mature trees"	Paya
11:40	SS4.14	Fine root dynamics in a mixed temperate forest inferred from scanner image analysis	Dannoura
12:00	SS4.15	Quantitative analysis of root distribution in pea-oat intercropping by Fourier transform infrared (FTIR) spectroscopy	Meinen
12:20	SS4.16	Tradeoffs for lateral root branching density in maize	Postma
12:40		End of Split session	
12:40		Lunch	
13:45 14:00		Poster Session 2 & tea/coffee Lemnatech sponsors talk: Future developments for non-destructive 3D plant and root imaging	
15:00	PLK6	**Plenary Keynote** **Chaired by Stokes & Fusuo Zhang**	
		Morphology and anatomy of rice roots	Abe
Split Session			
15:40		**Environment 3. Roots and changing environments** **Chaired by Stokes & Fusuo Zhang**	
15:45	SKN5.1	A paradigm shift towards low-nitrifying production systems – Role of Biological Nitrification Inhibition (BNI)	Guntur
16:15	SS5.11	"Variation of rooting depth of trees, subshrubs, grasses and herbs under different site conditions"	Loiskandl
16:35	SS5.12	"Relationship between coarse root architecture and wind-firmness in sown and planted Pinus pinaster saplings"	Danjon
16:55	SS5.13	Root structure-function relationships : evidence of a "root economics spectrum"?	Roumet
17:15	SS5.14	Root attributes affecting water uptake of rice (Oryza sativa) under drought	Henry
17:35		End of session and instructions for conference dinner dep	
18:45		Leave for Conference Dinner - Fairmont Hotel, St. Andrews (please be aware of your bus pickup point)	
24:00		Return to Dundee	

Lecture Theatre 4

Time	Ref	Talk/Event	Presenter
Split Session			
09:40		Interactions 4. Water Chaired by Javaux and Wilkinson	
09:45	SKN4.2	Root water uptake and rhizosphere dynamics	Carminati
10:15	SS4.21	"Visualising the root-particle and soil-water interfaces using X-ray microtomography"	Schmidt
10:30		tea/coffee (30 mins)	
11:00	SS4.22	Is water availability more important for cluster root allocation than soil-P distribution?	Felderer
11:20	SS4.23	Horizontal root growth in Bassia indica: halotropism or nutrient tropism?	Shelef
11:40	SS4.24	Root distribution alters physiological responses to soil moisture heterogeneity	Dodd
12:00	SS4.25	Crop effects on the spatio-temporal distribution of oxygen and redox potential in the Rhizosphere	Uteau
12:20	SS4.26	Roots shaping ecosystem scale processes: how extreme rhizosphere oxygenation removes methane and nutrients from wetlands	Fritz
12:40		End of Split session	
Split Session			
15:40		Interactions 5. Root sensing of the environment Chaired by Hund and Whiite	
15:45	SKN5.2	Abiotic stress elicits stimulus-specific Ca^{2+} signaling throughout the root system	Gilroy
16:15	SS5.21	Arabidopsis root responses to patches with nutrients: a role for external and internal cues	Fritz
16:35	SS5.22	Variability among lateral roots. Auxin and sugars interact to relate early primordia dynamics with lateral root fate	Muller
16:55	SS5.23	Growth patterning of maize roots in the field	Li
17:15	SS5.24	Investigating root to root interactions in wheat and Arabidopsis	Swarbreck

Lecture Theatre 2

Time	Ref	Talk/Event	Presenter
09:40		**Talking posters** **Richardson and Alison Bennett, JHI**	
09:45	TP14	Adventitious root formation is suppressed by strigolactones in Arabidopsis and Pea	Rasmussen
09:55	TP15	Bacterial succession in the wheat rhizosphere under continuous cropping	Donn
10:05	TP16	How do strigolactones control nodulation on Medicago truncatula?	De Cuyper
10:15	TP17	C and N in above- and belowground litter in stands of different tree species in northern Finland	Helmisaari
10:30		tea/coffee (30 mins)	
11:00	TP18	Turnover rate of Norway spruce fine roots after long-term soil warming and nutrient manipulation	Leppälammi-Kujansuu
11:10	TP20	Rhizosphere bacterial populations are root class specific.	Zobel
11:20	TP21	Adjacent AM grasses enhance while ^{14}N-addition to receiver EM pines reduces ^{15}N movement between paired pine saplings	He
11:30	TP22	Root distribution, morphological changes and interspecific interactions in intercropping	Li
11:40	TP23	Association mapping of root hair traits in rice (Oryza sativa)	Brown
11:50	TP24	Root growth dynamics and root architecture in wild and cultivated Andean Chenopods facing soil water deficit	Alvarez Flores
12:00	TP25	Can root electrical capacitance be used to predict root mass in soil?	Dietrich
12:10	TP26	A general capacitance relationship for plant root length? – testing the Dalton Model	Ellis
12:20		End of Split Session	
12:30		Lunch	
15:00		Plenary Keynote in Lecture Theatre 3	
Split Session			
15:40		**Emerging methods** **Chaired by Watt and Dupuy**	
15:45	EM01	Dynamics of root responses to water heterogeneity in soil using neutron radiography	Dara
16:00	EM02	Utilizing CT technology to answer unsolved questions in root research	Bauerle
16:15	EM03	Timelapse scanning reveals spatial variation in tomato root elongation rates during partial waterlogging	Dresbøll
16:30	EM04	Characterization of root growth in biopores by using in situ endoscopy	Athmann
16:45	EM05	In-situ observation and quantification of root-growth by X-ray tomography – Implications on root water uptake	Koebernick
17:00	EM06	A field based phenotyping facility for cereal roots	Deery
17:15	EM07	Green fluorescent protein (GFP), a tool to study root interactions in mixed plant stands	Faget
17:35		End of session and instructions for conference dinner dep	

Plenary Keynote

Thursday, June 28, 2012
09:00 - 09:40
Lecture Theatre 3
Chair: H Lambers, Australia
Co-chair: H-S Helmisaari, Finland

09:00

Speeding up the delivery of root system improvements to farmers to increase crop productivity

Watt, M.
CSIRO Plant Industry, GPO Box 1600, Canberra, 2603, Australia

The challenge for researchers is to speed up use of existing root knowledge and technologies to deliver new varieties and practices to farmers faster. We integrate laboratory and field research to develop new wheats with roots for water conserving farming.

PLK5

Function 4: Roots in the field

Thursday, June 28, 2012
09:45 - 10:30
Lecture Theatre 3
Chair: H Lambers, Australia
Co-chair: H-S Helmisaari, Finland

09:45

Genotypic X environment interactions for root depth of wheat

Acuna, T.[1]; Wade, L.J.[2]
[1]Tasmanian Institute of Agriculture, University of Tasmania, PB54, Hobart, 7001, Australia; [2]EH Graham Centre for Agricultural Innovation, Charles Sturt University, Locked Bag 588, Wagga Wagga, 2678, Australia

For root depth, genotype accounted for only 12% of total variance compared with 40% for G × E interaction. Differences in root growth between environments were related to a differential capacity to respond in penetration to changes in soil hardness and/or soil water content.

SKN4.1

Function 4: Roots in the field

Thursday, June 28, 2012
09:45 - 10:30
Lecture Theatre 3
Chair: H Lambers, Australia
Co-chair: H-S Helmisaari, Finland

10:15

Root distributions in biodiverse grasslands: spatial niche differentiation or competitive intransitivity?

Ravenek, J.M. (Netherlands); Mommer, L. (Netherlands); van Ruijven, J. (Netherlands); Visser, E.J.W. (Netherlands); de Kroon, H. (Netherlands), 2678, Australia

We studied species-specific root placement and nutrient uptake in a pairwise competition experiment with eight grassland species and found some degree of competitive intransitivity, related to root traits and foraging capacity.

SKN4.11

10:30 Coffee

Function 4: Roots in the field

Thursday, June 28, 2012
11:00 - 12:40
Lecture Theatre 3
Chair: H Lambers, Australia
Co-chair: H-S Helmisaari, Finland

11:00

Root connections between trees : Ecological implications

DesRochers, A.
Applied Sciences, Université du Quebec en Abitibi-Temiscamingue, 341 Principale Nord, Amos, J9T2L8, Canada

Root connections and grafts between trees affect stand dynamics by allowing trees to directly interact with each other. Here we show how tree physiology may be affected by root connections.

SS4.12

11:20

The effect of inter- vs. intraspecific interactions on root growth dynamics of mature trees

Paya, A[1]; Grams, T.E.[2]; Bauerle, T.L.[3]
[1]Horticulture, Cornell University, 159 Plant Science Building, Ithaca, 14853, United States; [2]Ecophysiology of Plants, Technical University of Munich, Munich, Germany; [3]Horticulture, Cornell University, Ithaca, 14853, United States

Neighbor identity affects root growth and root interactions in a mature Norway spruce and European beech forest. Using minirhizotrons and ^{15}N enriched nitrate, Paya et al. describe the partitioning of species' root systems in mixture, as well as greater nitrate uptake efficiency in spruce trees.

SS4.13

11:40

Fine root dynamics in a mixed temperate forest inferred from scanner image analysis

Dannoura, M.[1]; Kominami, Y.[2]; Hattori, K.[1]
[1]Kyoto University, Kitashirakawa oiwake-cho, sakyo-ku, Kyoto, Japan; [2]Kansai Research Center, Forestry & Forest Products Research Institute, Japan

To better understand root activities, the elongation rate and respiration rate of Quercus serrata were monitored simultaneously by combined root scanner and automatic chamber. They do not only respond to environmental parameters but are also related to the phenological stage of the trees.

SS4.14

12:00

Quantitative analysis of root distribution in pea-oat intercropping by Fourier transform infrared (FTIR) spectroscopy

Meinen, C.; Rauber, R.
Georg-August-University Goettingen, Department of Crop Sciences, Von-Siebold-Str. 8, Goettingen, 37075, Germany

We used FTIR spectroscopy to calibrate a model based on samples with specified pea and oat root ratios. The cross validated model showed a low error of cross validation (RMSECV=3.6) and a high r^2 (98.5). This model was used to predict species composition in root samples of intercropped pea and oat.

SS4.15

12:20

Tradeoffs for lateral root branching density in maize

Postma, J.A.[1]; Dathe, A.[2]; Lynch, J.P.[3]
[1]IBG2, Forschungszentrum Juelich, Wilhelm-Johnen-Strasse, Juelich, 52425, Germany; [2]Crop systems & global change, USDA, BLDG 001 BARC-WEST, Beltsville, MD 20705, United States; [3]Horticulture, PennState, Tyson Building, University Park, PA 16802, United States

We simulated the nutrient acquisition of maize root architectures varying in lateral branching density (LRBD). The optimal LRBD is greater for phosphorus than for nitrate acquisition, which shows that plants face clear tradeoffs for LRBD when optimizing the acquisition of multiple soil resources.

SS4.16

12:40 Lunch followed by Poster Session 2

Lemnatech Sponsors Talk

Thursday, June 28, 2012
14:00
Lecture Theatre 3
14:00-14:20 Future developments for non-destructive 3D plant and root imaging
Dr J. Vandenhirtz

Plenary Keynote

Thursday, June 28, 2012
15:00 - 15:40
Lecture Theatre 3
Chair: A Stokes, France
Co-chair: F Zhang, China

15:00

Morphology and anatomy of rice roots

Abe, J.
AE-bio, Graduate School of Agricultural and Life Sciences, The University of Tokyo, Yayoi, Bunkyo-ku, 113-8657, Japan

I will view the key morphological traits of rice root system from perspectives of developmental morphology and rice cultivation, and introduce recent research topics relating to the anatomy of rice roots.

PLK6

Environment 3: Roots and changing environments

Thursday, June 28, 2012
15:45 - 17:35
Lecture Theatre 3
Chair: A Stokes, France
Co-chair: F Zhang, China

15:45

A paradigm shift towards low-nitrifying production systems – Role of Biological Nitrification Inhibition (BNI)

Guntur, S.; Ishikawa, T.; Nakahara, K.
JIRCAS (Japan International Research Center for Agricultural Sciences), Japan

Nitrification is the primary reason for nitrogen leakage and for the low-NUE of the production agriculture. Biological nitrification inhibition (BNI) is a plant function where nitrification inhibitors are released from roots to control nitrification. Current status of knowledge and the potential applications from this plant function to the production agriculture will be the focus during the presentation.

SKN5.1

16:15

Variation of rooting depth of trees, subshrubs, grasses and herbs under different site conditions

Sobotik, M.[1]; Schnepf, A.[2]; Himmelbauer, M.[2]; Loiskandl, W.[2]
[1]Pflanzensoziologisches Institut Klagenfurt, Kempfstr. 12,, KLAGENFURT, 9020, Austria; [2]Water, Atmosphere and Environment, University of Natural Resources and Life Sciences Vienna, Muthgasse 18, Vienna, 1190, Austria

Root systems of trees, subshrubs, grasses and herbs have been documented through hand drawing in series of root atlases. We analysed the drawings to identify the variations for different plant species and sites.

SS5.11

16:35

Relationship between coarse root architecture and wind-firmness in sown and planted Pinus pinaster saplings

Collin, A.[1]; Danquechin Dorval, A.[1]; Issenhuth, B.[2]; Meredieu, C.[3]; Danjon, F.[3]
[1]INRA, UMR1202 BIOGECO, F-33610 Cestas, France / Univ. Bordeaux, UMR1202 BIOGECO, F-33400 Talence, F, Cestas, 33610, France; [2]INRA, UE0570 Forêts Pierroton, F-33610 Cestas, France, Cestas, 33610, France; [3]INRA, UMR1202 BIOGECO, F-33610 Cestas, France / Univ. Bordeaux, UMR1202 BIOGECO, F-33400 Talence, F, 69, route d'Arcachon, Cestas, 33610, France

Architectural analysis of root system was performed in 10 paired toppled/undamaged Pinus pinaster saplings in a planted and a seeded plot 2 years after a storm. Variability of architecture is much higher in planted trees. Windthrow damage could not be attributed to a deficient root architecture.

SS5.12

16:55

Root structure-function relationships : evidence of a "root economics spectrum"?

Roumet, C.[1]; Picon-Cochard, C.[2]; Birouste, M.[1]; Ghestem, M.[3]; Stokes, A.[3]
[1]Centre d'Ecologie Fonctionnelle et Evolutive, UMR 5175, CNRS, 1919 Route de Mende, Montpellier, 34293, France; [2]Unité de recherche sur l'écosystème prairial, UR 874, INRA, 234 Avenue du Brézet, Clermont-Ferrand, 63100, France; [3]Botanique et bioinformatique de l'architecture des plantes, UMR T51, INRA, Boulevard de la lironde, Montpellier, 34398, France

Root structure-function relationships were examined on 75 species. We demonstrated the existence of a trade-off opposing species promoting root metabolism (high respiration rate and tissue quality) to species reducing resource loss (recalcitrant dense roots which decomposed slowly).

SS5.13

17:15

Root attributes affecting water uptake of rice (Oryza sativa) under drought

Henry, A.[1]; Cal, A.J.[1]; Batoto, T.C.[1]; Torres, R.O.[1]; Serraj, R.[2]

[1]International Rice Research Institute (IRRI), DAPO Box 7777, Metro Manila, Philippines; [2]ICARDA, Syria

Rice root structural and functional roles may differ in drought and flooded conditions. Here, the endodermis and schlerenchyma layers showed opposing responses to drought. Sap bleeding rates from the root system, root hydraulic conductance, and aquaporin expression were most affected by time of day.

SS5.14

Interaction 4: Water

Thursday, June 28, 2012
09:45 - 10:30
Lecture Theatre 4
Chair: M Javaux, Belgium
Co-chair: S Wilkinson, UK

09:45

Root water uptake and rhizosphere dynamics

Carminati, A.

Georg-August University Goettingen, Busgenweg 2, Goettingen, Germany

The rhizosphere is where plants and soil meet. What are its hydraulic properties and does it affect root water uptake? We introduce a model of root water uptake coupled with the dynamics of mucilage exuded by roots. The model describes the dynamic nature of the root-soil interactions.

SKN4.2

10:15

Visualising the root-particle and soil-water interfaces using X-ray microtomography

Schmidt, S[1]; Bengough, A G[2]; Gregory, P J[3]; Grinev, D[4]; Otten, W[1]

[1]SIMBIOS, University of Abertay Dundee, Bell Street, Dundee, DD1 1HG, United Kingdom; [2]The James Hutton Institute, Invergowrie, Dundee, DD2 5DA, United Kingdom; [3]East Malling Research, New Road, East Malling Kent, ME19 6BJ, United Kingdom; [4]Engineering and the Environment, University of Southampton, Highfield, Southampton, SO 17 1BJ, United Kingdom

Root-particle and root-solution contact will be visualised and quantified for maize and lupin roots in contrasting growth media of various aggregate/ particle size distribution and matric potentials using X-ray microtomography.

SS4.21

10:30 Coffee

Interaction 4: Water

Thursday, June 28, 2012
11:00 - 12:40
Lecture Theatre 4
Chair: M Javaux, Belgium
Co-chair: S Wilkinson, UK

11:00

Is water availability more important for cluster root allocation than soil-P distribution?

Felderer, B.[1]; Vontobel, P.[2]; Schulin, R.[1]
[1]Department of Environmental Sciences, ETHZ, Universitätstrasse 16, Zürich, 8092, Switzerland; [2]PSI, Villigen, Switzerland

We investigated the effect of heterogeneous water and P distribution on cluster root allocation of white lupin. In contrast to the lacking impact of localized P supply, locally increased available water capacity of soil had a negative effect on cluster root formation in the respective soil area.

SS4.22

11:20

Horizontal root growth in Bassia indica: halotropism or nutrient tropism?

Shelef, O.; Rewald, B.; Golan, A.; Shimon, R.
French Associates Institute for Agriculture & Biotechnology of Drylands, Ben-Gurion University of the Negev, the Jacob Blaustein Institutes for Desert Research, Midreshet Ben-Gurion, 84990, Israel

B. indica roots exhibit a unique growth of horizontal root towards salinity. Manipulating roots enhanced horizontal root development towards salinity. Sap flow measurements showed that redistribution of water is probable. Halo- and nutrient tropisms can explain the behavior of B. indica roots.

SS4.23

11:40

Root distribution alters physiological responses to soil moisture heterogeneity

Dodd, I.[1]; Puertolas, J.[1]; Martin-Vertedor, A.I.[2]
1Lancaster Environment Centre, Lancaster University, Bailrigg, Lancaster, United Kingdom; 2Comercio e Innovación de la Junta de Extremadura, Finca "La Orden" Autovía A-V, km 372 06187,, Guadajira (Badajoz), Spain

Altering the proportion of the root system exposed to soil drying (by different irrigation techniques or genetic variation) alters shoot physiology (e.g. leaf growth, stomatal closure) by modifying root-to-shoot signalling.

SS4.24

12:00

Crop effects on the spatio-temporal distribution of oxygen and redox potential in the Rhizosphere

Uteau, D.; Pagenkemper, S.K.; Peth, S.; Horn, R.
Institute of plant nutrition and soil science, Christian Albrechts Universität zu Kiel, Hermann-Rodewald-Str. 2, Kiel, 24118, Germany

Gas diffusivity measurements and X-ray tomography were linked to root induced pore architecture leading to an improved aeration in the subsoil. The authors were able to describe oxygen gradients in the soil and in the rhizosphere, determining the importance of distribution and morphology of pores.

SS4.25

12:20

Roots shaping ecosystem scale processes: how extreme rhizosphere oxygenation removes methane and nutrients from wetlands

Fritz, C.[1]; Smolders, A.[2]; Pancotto, V[3]; Visser, E.[1]
[1]Experimental Plant Ecology, Radboud University Nijmegen, Heyendaalseweg 135, Nijmegen, 6525 AJ, Netherlands; [2]Aquatic Ecology, Radboud University Nijmegen, Heyendaalseweg 135, Nijmegen, 6525 AJ, Netherlands; [3]CADIC-CONICET, B. Housay 200, Ushuaia, 9410, Argentina

Roots change soils by releasing oxygen and exudates into the rhizosphere.
Comparing root density with depth profiles of methane/nutrients, Fritz et al. show how a dense root biomass causes thorough soil oxidation in the upper 2 m, cutting-off methane emissions and nutrients in Patagonian wetlands.

SS4.26

12:40 Lunch

Interaction 5: Root sensing of the environment

Thursday, June 28, 2012
15:45 - 17:35
Lecture Theatre 4
Chair: A Hund, Switzerland
Co-chair: PJ White, UK

15:45

Abiotic stress elicits stimulus-specific Ca^{2+} signaling throughout the root system

Choi, W.G.; Toyota, M.; Gilroy, S.
Department of Botany, University of Wisconsin-Madison, Birge Hall, 430 Lincoln Drive, Madison, 53706, United States

We have characterized Ca^{2+} signals associated with exogenous stresses applied to the root system. A range of biotic and abiotic stimuli led to unique cell-type specific patterns of Ca^{2+} response that appear critical for eliciting a coordinated molecular response from the root.

SKN5.2

16:15

Arabidopsis root responses to patches with nutrients: a role for external and internal cues

Visser, E.J.W.; Fritz, C.
Experimental Plant Ecology, Radboud University Nijmegen, Heyendaalseweg 135, Nijmegen, Netherlands

Root proliferation of Arabidopsis plants is triggered by local nutrient concentrations in the soil, but modified by the internal nutrient concentration in the plant. Together, these two cues optimize ion uptake on soils with heterogeneous distribution of nutrients.

SS5.21

16:35

Variability among lateral roots. Auxin and sugars interact to relate early primordia dynamics with lateral root fate

Muller, B.; Bouteillé, M.
LEPSE, INRA, 2 place Viala, Montpellier, 34060, France

We show that a link exists between the variability of lateral root fate and the dynamics of primordia development under the control of C and auxin. These features offer the maximum plasticity for the root system to face a fluctuating and challenging environment at a minimum C cost.

SS5.22

16:55

Growth patterning of maize roots in the field

Li, C.J.[1]; Peng, Y.F.[2]; Niu, J.F.[2]; Yan, H.F.[2]; Ma, W.[2]; Liao, C.S.[2]; Yu, P.[2]; Zhang, Y.[2]; Ning, P.[2]; Li, X.X.[2]
[1]China Agricultural University, Yuanmingyuan West Road 2, Beijing, 100193, China; [2]Plant Nutrition, China Agricultural University, Yuanmingyuan West Road 2, Beijing, 100193, China

It is a challenge to study root growth in the field. By six consecutive year's field experiments, Li et al. showed that temporal and spatial distribution of maize roots in the soil during whole growth period was determined by shoot demand, N applied, and heterogeneous soil Nmin distribution.

SS5.23

17:15

Investigating root to root interactions in wheat and Arabidopsis

Swarbreck, S.M.[1]; Dark, A.M.[1]; Habib, N.[2]; Davies, J.M.[1]
1Department of Plant Sciences, University of Cambridge, Downing Street, Cambridge, CB2 3EA, United Kingdom; 2Department of Plant Sciences, Plant Sci University of Cambridge, Downing Street, Cambridge, CB2 3EA, United Kingdom

Interactions between plants can critically affect yield. Understanding the mechanism of root-root interactions may be key to developing crop genotypes for sustainable production. Wheat root system architecture analyses were conducted and showed specific patterns dependent on the neighbour's species.

SS5.24

Talking Posters

Thursday, June 28, 2012
09:45 - 10:25
Lecture Theatre 2
Chair: A Richardson, Australia
Co-chair: A Bennett, UK

09:45

Adventitious root formation is suppressed by strigolactones in Arabidopsis and Pea

Rasmussen, A.[1]; Beveridge, C.[2]; Geelen, D.[3]
[1]University of Gent, coupure links 653, Gent, 9000, Belgium; [2]The University of Queensland, Australia; [3]University of Gent, Belgium

Adventitious root formation is critical for clonal propagation of important plant species. Rasmussen et al. demonstrate that the plant hormone strigolactone suppresses adventitious root formation in Arabidopsis hypocotyls and in stem cuttings of garden pea using strigolactone mutants in both species.

TP14

09:55

Bacterial succession in the wheat rhizosphere under continuous cropping

Donn, S.; Richardson, A.E.; Perera, G.; Kirkegaard, J.A.; Watt, M.
CSIRO Plant Industry, PO Box 1600, Canberra, Australia

Bacterial community structure in the wheat rhizosphere is dependent on plant stage, vicinity to the root, soil type and to some extent wheat variety. Using a combination of culturing, DNA fingerprinting and sequencing we investigated how a rhizosphere community evolved in the field over two years.

TP15

10:05

How do strigolactones control nodulation on Medicago truncatula?

De Cuyper, C.; Endah, R.; Van Dingenen, J.; Goormachtig, S.
Department of Plant Systems Biology - VIB, Belgium

Strigolactones are a new class of plant hormones which are involved in many different processes of plant growth and development. We study the link between strigolactones and nodulation. Our preliminary results suggest an inhibitory role for strigolactones on nodulation.

TP16

10:15

C and N in above- and belowground litter in stands of different tree species in northern Finland

Helmisaari, H-S.[1]; Leppälammi-Kujansuu, J.[2]; Sah, S.[2]; Smolander, A.[3]
[1]Department of Forest Sciences, University of Helsinki, P.O.Box 27, Helsinki, 00014, Finland; [2]University of Helsinki, Finland; [3]Finnish Forest Research Institute, Finland

The above- and belowground litter production was determined in northern Finland. Helmisaari et al. found out that the annual fine root litter production and respective C and N inputs of birch were smaller but those of pine and spruce as large or larger than in leaf/needle litterfall.

TP17

10:30 Coffee

Talking Posters

Thursday, June 28, 2012

11:00 - 12:30

Lecture Theatre 2 (Talking Posters are on display all week in the Main Hall)

Chair: A Richardson, Australia

Co-chair: A Bennett, UK

11:00

Turnover rate of Norway spruce fine roots after long-term soil warming and nutrient manipulation

Leppälammi-Kujansuu, J.[1]; Salemaa, M.[2]; Berggren, D.K.[3]; Sah, S.[1]; Helmisaari, H-S.[1]
[1]Department of Forest Sciences, University of Helsinki, P.O. Box 27, Helsinki, 00014, Finland; [2]Finnish Forest Research Institute, P.O. Box 18, Vantaa, FI-01301, Finland; [3]Department of Soil and Environment, Swedish University of Agricultural Sciences, P.O. Box 7001, Uppsala, SE-75007, Sweden

Long-term soil warming and/or nutrient manipulation experiment in northern boreal forest showed the median fine root lifespan to be the lowest in a combined treatment compared to only warmed or only fertilized treatments: 48, 57 and 99 weeks, respectively.

TP18

11:10

Rhizosphere bacterial populations are root class specific.

Zobel, R.
USDA-ARS, 1224 Airport Rd, Beaver, United States

We conclude that bacterial populations in the rhizosphere are controlled by roots such that different root classes support different bacterial populations. We also conclude that this control can be genetically manipulated.

TP20

11:20

Adjacent AM grasses enhance while 14N-addition to receiver EM pines reduces 15N movement between paired pine saplings

He, X.[1]; Horwath, W.[2]; Bledsoe, C.[2]; Zasoski, R.[2]
[1]WA's Centre of Excellence for Ecohydrology, Edith Cowan University and University of Western Australia, 270 Joondalup Drive, Joondalup, 6027, Australia; [2]Department of Land, Air and Water Resources, University of California at Davis, United States

Mechanism of nutrient movement between mycorrhizal plants is less understood. By supplying 15N to donor or 14N to receiver EM pines in the presence/absence of an AM annual grass, we found that grasses appeared to facilitate, while 14N-addition to pine receivers to reduce, N movement between trees.

TP21

11:30

Root distribution, morphological changes and interspecific interactions in intercropping

Li, L.[1]; Li, Q.[2]; Wang, L.[2]; Liu, N.[1]; Li, M.[1]; Zhang, F.[1]
[1]College of Resources and Environmental Sciences, China Agricultural University, 2 Yuan Ming Yuan Xilu, Haidian District, Beijing, 100193, China; [2]China Agricultural University, Beijing, China

Interspecific interactions leads to root growth and morphological changes that derived from resource competition as well as root recognition via root exudates.

TP22

11:40

Association mapping of root hair traits in rice (Oryza sativa)

Vejchasarn, P.; Lynch, J.P.; Brown, K.M.
Horticulture, Penn State, 102 Tyson Building, University Park, 16802, United States

Root hairs are important for phosphorus acquisition and could be an important breeding target for rice cultivars destined for upland soils. We here describe association mapping of root hair length and density in rice.

TP23

11:50

Root growth dynamics and root architecture in wild and cultivated Andean Chenopods facing soil water deficit

Alvarez-Flores, R.1; Winkel, T.2; Joffre, R.1
1CNRS-CEFE, UMR 5175, 1919 route de Mende, Montpellier, 34293, France; 2IRD, CNRS-CEFE, 1919 route de Mende, Montpellier, 34293, France

In South America, wild and cultivated Chenopods are distributed from arid highlands to temperate littoral. In glasshouse experiments, Alvarez et al. demonstrate that cultivated Chenopods from drier habitats respond to soil water deficit by better soil colonization than other populations.

TP24

12:00

Can root electrical capacitance be used to predict root mass in soil?

Dietrich, R.C.[1]; Bengough, A.G.[1]; Jones, H.G.[2]; White, P.J.[1]
[1]The James Hutton Institute, United Kingdom; [2]University of Dundee at the James Hutton Institute, Dundee, DD2 5DA, United Kingdom

Root capacitance is considered a non-invasive method for estimating root mass in soil. Capacitance correlated well with root mass, increased with local soil water content, and was closely related to shoot dimensions. The technique must be re-evaluated in the context of our results.

TP25

12:10

A general capacitance relationship for plant root length? – testing the Dalton Model

Ellis, T.W.[1]; Murray, W.[2]; Paul, K.[3]
[1]Land and Water, CSIRO, 41 Boggo Road, Dutton Park, Brisbane, 4001, Australia; [2]Material Science and Engineering, CSIRO, Bradfield Rd, Lindfield, 2070, Australia; [3]Ecosystems Services, CSIRO, Bellenden Street, Crace, 2911, Australia

We hypothesised that root capacitance (C) was proportional to tissue density (ρ) and length (L^{β}; $0 < \beta < 1$). In isolation, data from beans and trees supported this hypothesis. More importantly, the two data sets formed a single, strong relationship.

TP26

12:30 Lunch

Emerging methods

Thursday, June 28, 2012
15:45 - 17:30
Lecture Theatre 2
Chair: M Watt, Australia
Co-chair: L Dupuy, UK

15:45

Dynamics of root responses to water heterogeneity in soil using neutron radiography

Dara, A.[1]; Moradi, A.B.[2]; Oswald, S.[3]; Carminati, A.[4]; Vontobel, P.[5]

[1]Institute of Earth and Environmental Science, University of Potsdam, Karl-Liebknecht-Str. 24-25, Potsdam-Golm, 14476, Germany; [2]Dept. of Land Air and Water Resources,, University of California, Davis, United States; [3] Institute of Earth and Environmental Science, University of Potsdam, Karl-Liebknecht-Str. 24-25, Potsdam, 14476, Germany; [4]Georg-August-University Goettingen, Goettingen, Germany; [5]Paul Scherrer Institut - PSI, Switzerland

Unequal water distribution and root growth pattern of Lupin plants in a hydraulic-partitioned soil were monitored by Neutron Radiography for two weeks. The results show an active reciprocal root response to water heterogeneity for maximum soil water utilization.

EM01

16:00

Utilizing CT technology to answer unsolved questions in root research

Bauerle, T.; Paya, A.

Horticulture, Cornell University, 134A Plant Science Bldg, Ithaca, 14853, United States

Our studies utilize recent CT scanning technologies to represent in situ, non-destructive comparison of a) root neighbor interactions between two tree seedlings and b) tree root growth over time on whole root systems of 10 maturing tree species.

EM02

16:15

Timelapse scanning reveals spatial variation in tomato root elongation rates during partial waterlogging

Dresbøll, D.B.[1]; Thorup-Kristensen, K.[1]; McKenzie, B.M.[2]; Dupuy, L.[2]; Bengough, A.G.[2]

[1]Department of Agriculture and Ecology, University of Copenhagen, Højbakkegård Allé 13, Taastrup, 2630, Denmark; [2]The James Hutton Institute, Invergowrie, Dundee, DD2 5DA, United Kingdom

Detailed information on root growth rates was obtained by consecutive scans of root chambers under semi-natural conditions. Root growth rates differed spatially after partial waterlogging. Roots within the waterlogged zone decreased growth while roots above increased growth probably to compensate.

EM03

16:30

Characterization of root growth in biopores by using in situ endoscopy

Athmann, M.; Kautz, T.; Köpke, U.

Institute of Organic Agriculture, University of Bonn, Katzenburgweg 3, Bonn, 53115, Germany

Root growth in biopores was observed using in situ endoscopy. This approach allowed detection of differences in root morphology and orientation between different plant species and to characterize pore wall properties. The current status and future perspectives of the method are discussed.

EM04

16:45

In-situ observation and quantification of root-growth by X-ray tomography – Implications on root water uptake

Koebernick, N.[1]; Weller, U.[1]; Vetterlein, D.[1]; Vogel, H-J.[1]; Jahn, R.[2]

[1]Soil Physics, Helmholtz Zentrum für Umweltforschung - UFZ, Theodor-Lieser-Straße 4, Halle (Saale), 06120, Germany; [2]Institut für Agrar- und Ernährungswissenschaften, Martin-Luther-Universität Halle-Wittenberg, Von-Seckendorff-Platz 3, Halle (Saale), 06120, Germany

Dynamic change of root system architecture (RSA) is a key for understanding water and nutrient acquisition by plants. Koebernick et al. show that X-ray tomography is a suitable tool for temporally resolved non-destructive and quantitative analysis of RSA.

EM05

17:00

A field based phenotyping facility for cereal roots

Deery, D.[1]; Wasson, A.P.[2]; Hunt, J.[2]; Cavanagh, C.[2]; Richard, R.[2]; Watt, M.[2]

[1]Plant Industry, High Resolution Plant Phenomics Centre, CSIRO, Black Mountain Laboratories, Black Mountain, 2601, Australia; [2]Plant Industry, CSIRO, Black Mountain Laboratories, Black Mountain, 2601, Australia

Describes the development of a field-based phenotyping facility to identify root system traits for improved crop performance in wheat.

EM06

17:15

Green fluorescent protein (GFP), a tool to study root interactions in mixed plant stands

Faget, M.[1]; Herrera, J.M.[2]; Liedgens, M.[2]; Frossard, E.[2]; Stamp, P.[3]

[1]Forschungszentrum Jülich, Forschungszentrum Jülich, 52425 Jülich., Jülich, Germany; [2]ETH Zurich, Eschikon 33, CH-8315, Lindau, Switzerland; [3]ETH Zurich, Universitätstr. 2, CH-8092, Zurich, Switzerland

Maize expressing fluorescent protein was cultivated with neighbor in living mulches. Minirhizotron system specially developed allows studying the relative distribution of roots for each plant type and their interaction with each other. Roots of maize did not preferentially grow to avoid interactions.

EM07

Friday 29 June

Lecture Theatre 3

Time	Ref	Talk/Event	Presenter
09:10	PLK7	**Plenary Keynote** **Chaired by Lynch and Thorup-Kristensen** **Roots for future sustainable production**	
		Fine roots and soil carbon in boreal forests	Helmisaari
09:50	PLK8	**Plenary Keynote** **Maximizing root/rhizosphere efficiency for improving crop productivity and nutrient use efficiency**	Zhang
10:30		tea/coffee (30 mins)	
11:00	PL2.1	Genetic and physiological factors controlling root growth under P deficiency in rice	Wissuwa
11:20	PL2.2	Plant-driven mitigation of nitrous oxide in the rhizosphere	Baggs
11:40	PL2.3	Progress on development of forage plant root systems for sustainable New Zealand pastures	Crush
12:00	PL2.4	Drought effect on teak tree (Tectona grandis) roots on carbon inputs and water uptake in a deep soil of northern Laos	Maeght
12:20	PLK9	Plenary Keynote Roots to the future and routes to sustainability	Gregory
13:00		Lunch	
		Remove all remaining posters	
14:00		Optional visits to James Hutton Institute, Invergowrie; The Old Course St. Andrews (Green keeper tour); or The University of Dundee Botanic Garden	

Lecture Theatre 4

Time	Ref	Talk/Event	Presenter

Lecture Theatre 2

Time	Ref	Talk/Event	Presenter

Plenary Keynote

Friday, June 29, 2012
09:10 - 10:30
Lecture Theatre 3
Chair: J Lynch, US
Co-chair: K Thorup-Kristensen, Denmark

09:10

Fine roots and soil carbon in boreal forests

Helmisaari, H.S.
Department of Forest Sciences, University of Helsinki, P.O. Box 27, Helsinki, 00014, Finland

The keynote presentation of H-S. Helmisaari will concentrate on the recent research results for understanding the role of roots in boreal forest soil C cycling, especially concentrating on C allocation and its controls.

PLK7

Plenary Keynote

09:50

Maximizing root/rhizosphere efficiency for improving crop productivity and nutrient use efficiency

Zhang, F.S.; Shen, J.B.; Yuan, L.X.; Mi, G.H.; Li, L.; Li, C.J.; Chen, X.P.; Chen, F.J.
Key Laboratory of Plant-Soil Interactions, China Agricultural University, No.2 Yuanmingyuan West Road, Beijing, 100193, China

How to achieve high nutrient-use efficiency and high crop productivity through maximizing root/rhizosphere efficiency has become a challenge in intensive agriculture. Rhizosphere management can be achieved by optimizing nutrient supply, modifying root traits and manipulating rhizosphere processes.

PLK8

10:30 Coffee

Roots for future sustainable production

Friday, June 29, 2012
11:00 - 13:00
Lecture Theatre 3
Chair: J Lynch, US
Co-chair: K Thorup-Kristensen, Denmark

11:00

Genetic and physiological factors controlling root growth under P deficiency in rice

Wissuwa, M.[1]; Gamuyao, R.[2]; Mori, A.[1]; Pariasca-Tanaka, J.[1]; Heuer, S.[2]
[1]JIRCAS, 1-1 Ohwashi, Tsukuba, Japan; [2]IRRI, Philippines

This paper reviews evidence from physiological, morphological and genetic studies as to which factors enable tolerant rice genotypes to maintain root growth and P uptake under P deficiency and identifies traits and loci to be used on breeding rice with improved tolerance to P deficiency.

PL2.1

11:20

Plant-driven mitigation of nitrous oxide in the rhizosphere

Baggs, E.M.; Morley, N.
University of Aberdeen, United Kingdom

Linking plant C flow to N_2O production and reduction in the rhizosphere.

PL2.2

11:40

Progress on development of forage plant root systems for sustainable New Zealand pastures

Crush, J.; Crush, J. R.; Ryan, D.; Nichols, S.N.
AgResearch, Private Bag 3123, Hamilton, 3240, New Zealand

Root phenotyping techniques have been developed and applied to ryegrass and white clover populations. Key aims are improved acquisition of nutrients and water. Breeding for improved root system function is achievable in ryegrass and white clover.

PL2.3

12:00

Drought effect on teak tree (Tectona grandis) roots on carbon inputs and water uptake in a deep soil of northern Laos

Maeght, J.L.[1]; Henry des Tureaux, T.[1]; Sengtaheuanghoung, O.[2]; Stokes , A.[3]; Ribolzi, O.[4]; Pierret, A.[1]

[1]UMR BIOEMCO, IRD, IRD-NAFRI BP 5992, Vientiane, Lao People's Democratic Republic; [2]NAFRI, Lao People's Democratic Republic; [3]INRA, France; [4]GET, IRD, IRD-NAFRI BP 5992, Vientiane, Lao People's Democratic Republic

Fine deep roots are organs of foremost functional importance and bring about evidence that teak tree extracts deep water during critically dry periods. The presence of measurable amounts of deep fine roots should be taken into account when quantifying long-term carbon storage.

PL2.4

Closing Plenary Keynote

12:20

Roots to the future and routes to sustainability

Gregory, P.

East Malling Research, New Road, East Malling, ME19 6BJ, United Kingdom

This presentation will highlight new areas of root science that offer ways of managing vegetation more effectively to deliver the many services that society demands. Interactions at the root/soil interface will be stressed.

PLK9

13:00 Close of spoken sessions followed by lunch and optional visits.

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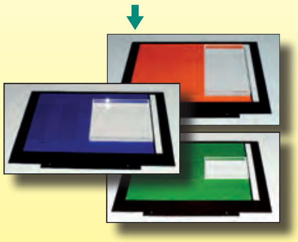
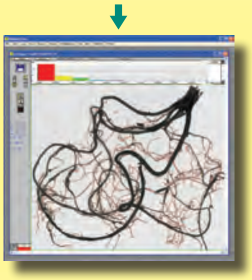


See analysis results summarized on screen automatically after scanning. Details are autosaved in data files.



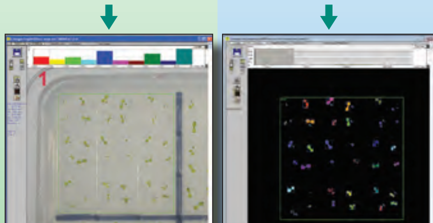
- √ Root morphology in function of root diameter and color: length, area, volume, and number of tips
- √ Total number of tips, forks and crossings
- √ Root overlap detection for accurate measurement

- √ Topology, link and architecture with fractals
- √ Developmental classification

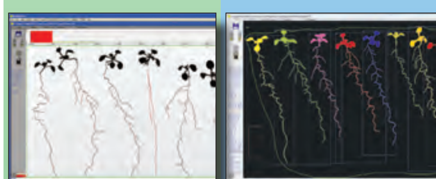
Arabidopsis

Unique system for automatic analysis of washed roots and seedlings in Petri dish

Analyse seedlings and leaves
globally (one analysis per image) or individually (multiple analyses per image)

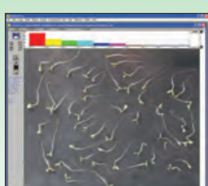


√ Leaf area of seedlings grown in Petri dish

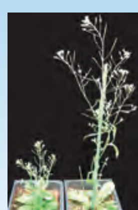


- √ Leaf area - leaf/hypocotyl distinction
- √ Root morphology
- √ Topology and developmental analysis

√ Leaf area, length and width of plants in soil



√ Germination Count



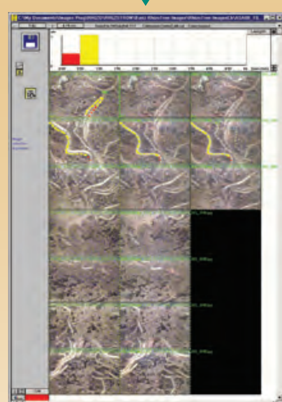
√ Plant height and width

Tron & Tron MF

Software for interactive analysis of images of roots in rhizotron and soil

Trace roots manually with a mouse or by touching the screen of all-in-one computers or tablet computers.

Monitor root growth by analysing Multiple Frames (images) of a root system taken at different times. Roots that overlap frames are saved as a single measurement data set for the group of images.



- √ Root morphology in function of root diameter and color: length, area, volume, and number of tips
- √ Topology and developmental analysis
- √ Data retrievable from file names using the ICAP naming scheme
- √ Previous analysis of a location can be retrieved to resume analysis of the same location at a later time simply by adding new or dead roots since the last analysis.

Poster Session 1

Tuesday, June 26, 2012
13:45-15:00
Room: 1.F.06

Identification of phosphorus-responsive miRNAs in soybean roots and leaves

Jinxiang, W.; Xu, F.; Kuang, J.; Liao, H.
Root Biology Center, South China Agricultural University, Wushan, Guangzhou, 510642, China

18 P-responsive miRNAs in soybean roots and 26 in soybean leaves were determined.

P001

Effect of simulated microgravity on the development of primary roots in wild-type Arabidopsis and Auxin mutants

Migliaccio, F.; Tassone, P.; Fortunati, A.
National Research Council of Italy, Via Salaria Km 29.300, Monterotondo (Rome), Italy

The presentation describes the effect of simulated microgravity on the root grow pattern in wild-type Arabidopsis and in two auxin and gravitropism mutants.

P002

Soil erodibility and root growth: greater susceptibility following germination

Dumlao, M.R.; Silk, W.K.
Land, Air, and Water Resources, University of California, Davis, One Shields Avenue, Davis, 95616, United States

The impact of root growth on soil erodibility was assessed using simulated rainfall experiments. Soil erosion was higher in planted compared to fallow soil, particularly during the first week of growth, which was correlated with greater destabilization of the soil surface during shoot emergence.

P003

Diurnal change of bleeding rate in saline-sodic soil rice of Northeast China

Liu, M.[1]; Morita, S.[2]; Abe, J.[2]; Liang, Z.W.[3]
1Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences, China, 3195 Weishan road,high-tech. district,Changchun,Jilin,China, ChangChun, China; 2Department of Agrobiology, Faculty of Agriculture, The University of Tokyo, Japan, Japan; 3Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences, China, China

Conclusions: Our results suggested that in terms of rice in saline-sodic soil of Northeast China, the best time for collecting root bleeding sap was at 5:00-6:00, and this result may lay the foundation for further research.

P004

Determination of root tissue density: method matters

Birouste, M; Zamora- Ledezma, E.; Bossard, C.; Roumet, C.
CNRS, Centre d'Ecologie Fonctionnelle et Evolutive (UMR 5175), 1919 route de Mende, Montpellier, 34293, France

Root tissue density is a key trait in root ecology. However comparison among studies is difficult due to the lack of a standard method. The comparison of three common methods showed that WinRHIZO underestimated root volume, while root dry matter concentration is a good proxy of root tissue density.

P005

Rooting density of three grass species and eight Lolium perenne varieties

Deru, J.[1]; Van Eekeren, N.[1]; Zanen, M.[1]; De Boer, H.[2]
[1]Louis Bolk Institute, Hoofdstraat 24, Driebergen, 3972 LA, Netherlands; [2]Wageningen UR Livestock Research, Postbus 65, Lelystad, 8200 AB, Netherlands

Root biomass and root length density differed significantly between grass species and varieties measured in field experiments. Festuca arundinacea had more roots in the deeper soil layers than Lolium perenne and Dactylis glomerata. Diploid varieties had a higher root mass than tetraploid varieties.

P006

Analyzing plant root distribution by computed tomography applications

Kriston, S.[1]; Benedek, S.[2]; Soki, P.[3]; Babcscan, N.[3]; Czinkota, I.[4]; Fenyvesi, L.[2]; Lehoczky, E.[5]
[1]Institute of Environmental Management, Department of Hydrogeology and Engineering Geology, University of Miskolc, Miskolc-Egyetemváros, 3515, Hungary; [2]Hungarian Institute of Agricultural Engineering, Tessedik S. u. 4., Gödöllö, 2100, Hungary; [3]Bay Zoltan Nonprofit Ltd, Hungary; [4]Institute of Environmental Science, Department of Soil Science and Agricultural Chemistry, Szent István University, Páter K. u. 1., Gödöllõ, 2103, Hungary; [5]Institute for Soil Science and Agricultural Chemistry, Centre for Agricultural Research, Hungarian Academy of Sciences, Hungary

Plant root distribution in soil was monitored by computed tomography measurements. Results indicate a good quality of 3D image and a good distribution of root axes and laterals for the observed plants.

P007

Root growth dynamics of three beech (Fagus sylvatica L.) provenances

Železnik, P.; Bajc, M.; Kraigher, H.
Slovenian Forestry Institute, Veèna pot 2, Ljubljana, 1000, Slovenia

Fine roots of three planted beech provenances and natural beech regeneration in ingrowth soil cores showed significant differences in necromass. Fine roots in minirhizotrons are still growing 5 years after the initiation of measurements.

P008

Comparison of lucerne root characteristics under irrigated and rain-fed conditions

Raza, A.[1]; Friedel, J.K.[2]; Moghaddam, A.[3]; Ardakani, M.[4]; Loiskandl, W.[5]; Himmelbauer, M.[5]; Bodner, G.[6]
[1]Nuclear Insitute of Agriculture, Tando Jam, Hyderabad, 70060, Pakistan; [2]Sustainable Agricultural Systems, University of Natural Resources and Life Sciences, A-1180, Vienna, Austria; [3]Seed and Plant Improvement Institute, Tehran, Iran, Islamic Republic of; [4]Division of Sustainable Agriculture, Agriculture Research Center, Islamic Azad University, Karaz, Iran, Islamic Republic of; [5]Institute of Hydraulics and Rural Water Management, BOKU, Vienna, Austria; [6]Institute of Agronomy and Plant Breeding, Department of Crop Sciences, BOKU, Vienna, Austria

This study compares the root biomass and root length density of three lucerne varieties under irrigated and rain-fed conditions in a two year field experiment. We found that varieties had usually higher biomass and root length density under rain-fed conditions than under irrigated conditions.

P009

Absorption of carbonate acid gas by Vetiveria plants and Pampas grass within the boundaries of international corridors

Gavardashvili, G.; Tevzadze , V.; Chakhaia, G.; Tsulikidze, L.
Water Management Institute, Georgian Technical University, 60, Ave. I. Chavchavadze, Tbilisi, 0162, Georgia, Republic of

Considering the principal geological, ameliorative, hydrological and climatic factors of the soil, the irrigation norms and the watering of Vetiver, the coefficient of evaporation and transpiration were determined, as well as dynamics of growth of the height and root system of Vetiver.

P010

Absorption of carbon dioxide by vetiveria plants with their root system within the boundary corridors

Gavardashvili, G.[1]; Tevzadze, V.[2]; Chakhaia, G.[3]; Tsulukidze, L.[3]

[1]Director, Water Management Institute of Georgian Technical University, Ave, 60 I. Chavchavadze, Tbilisi, 0162, Georgia, Republic of; [2]Department of Natural Disaster, Water Management Institute of Georgian Technical University, Ave, 60 I. Chavchavadze, Tbilisi, 0162, Georgia, Republic of; [3]Department of Environmental Protection and Engineering Ecology, Water Management Institute of Georgian Technical University, Ave, 60 I. Chavchavadze, Tbilisi, 0162, Georgia, Republic of

Using the theory of reliability the soil antierosional effect of the so-called biological wall formed of Vetiver has been determined, taking into consideration the principal parameters of the maximum intensity of rainfall, the washout rate of the soil particles and other parameters.

P011

Effects of soil strength on plant architecture

Lloyd, D.P.A.; Coelho Filho, M.A.; Webster, C.P.; Colebrook, E.H.; Phillips, A.L.; Hedden, P.; Whalley, W.R.

Rothamsted Research, Rothamsted Research, Harpenden, AL5 2JQ, United Kingdom

The architecture of a plant can be influenced by a variety of environmental factors. Utilising sand-columns in a controlled environment, Lloyd et al. demonstrate that soil strength influences the number of tillers and leaf elongation in wheat (Triticum aestivum L.).

P012

The coefficient of soil-root friction during soil penetration by roots of Pisum sativum

McKenzie, B.M.[1]; Mullins, C.E.[2]; Tisdall, J.M.[3]; Bengough, A.G.[4]

[1]The James Hutton Institute, Invergowrie, Dundee, DD2 5DA, United Kingdom; [2]Private, United Kingdom; [3]La Trobe University, Australia; [4]The James Hutton Institute, United Kingdom

We have quantified the two separate components needed for roots to penetrate soil i.e. the cavity expansion and the soil-root friction.

P013

Sweet sorghum root and canopy responses to water deficit occurring at different growth stages

Zegada-Lizarazu, W.[1]; Alessandro, Z.[1]; Lorenzo, N.[2]; Andrea, M.[1]

[1]Department of Agroenvironmental Science and Technology, University of Bologna, 44, Viale G. Fanin, Bologna, 40127, Bologna, 40127, Italy; [2]University of Bologna, Italy

Regardless of the duration (20/40 days) or the growth stage (early/late) sweet sorghum has the capacity to recover its physiological activities after the plant is rewatered.

P014

Influence of soil depth and mycorrhizal infection on rhizosphere extension

Hafner, S.[1]; Wiesenberg, G.L.B.[2]; Kuzyakov, Y.[1]

[1]Department of Soil Science of Temperate Ecosystems, Georg-August-University of Göttingen, Büsgenweg 2, Göttingen, 37077, Germany; [2]Department of Agroecosystem Research, University of Bayreuth, Bayreuth, 95440, Germany

Rhizosphere extension was higher in subsoil than in topsoil treatment excluding mycorrhizal influence. Mycorrhizal hyphae had no influence on rhizosphere extension in subsoil, whereas hyphal transport of C increased the spatial influence of roots in the topsoil treatment.

P015

Roots to Variety: ML365, A deep root introgressed finger millet variety for drought and food security in India

Hittalmani, S.; Rao, A.M.; Selvi, G.A.

Genetics and Plant Breeding, University of Agricultural Sciences, College of Agriculture, GKVK, Bangalore, 560065, India

Deep-rooted fingermillet introgressed lines developed and evaluated for grain yield under moisture stress indicated ML365 genotype with 135 cm root depth, 6 tons grain yield with 45 days stress. This is success story of role of roots for food security crop.

P016

Linkages between plant functional composition, root traits and soil N cycling in Mediterranean grasslands

Zamora-Ledezma, E.; Fromin, N.; Blanchard, A.; Roumet, C.
Département d'Ecologie Fonctionnelle, CNRS, Centre d'Ecologie Fonctionnelle et Evolutive (UMR 5175), 1919 Route de Mende, cedex 5, Montpellier, 34293, France

Root traits can be modified by environmental conditions and plant diversity. In return they could alter soil processes. Zamora-Ledezma et al. analyzed above and belowground diversity and processes and found that root functional traits responses are related to the acquisition–conservation trade-off.

P017

Modelling of rhizospheric pH based on plant mineral nutrition

Custos, J.M.[1]; Moyne, C.[2]; Blossfeld, S.[3]; Sterckeman, T.[1]
[1]ENSAIA, INPL-INRA, 2, avenue de la Foret de Haye - BP 172, Vandoeuvre-les-Nancy cedex, 54505, France; [2]ENSEM, Nancy Université, CNRS, 2, avenue de la Foret de Haye - BP 160, Vandoeuvre-les-Nancy cedex, 54504, France; [3]Forschungszentrum Juelich, IBG-2, Plant Sciences, Juelich, 52425, Germany

The nutrients concentrations in soil solution were driven by desorption from solid phase and their transport towards the root by diffusion and convection. When more anions entered the root than cations an equivalent charge flux (HCO^{3-} and OH^{-}) left the root and consecutively the soil was alkalinized.

P018

Root architecture of Atlas pistachio in relation with its underlying soil properties in arid area (Algeria)

Limane, A.; Smail-Saadoun, N.
Biologie Animale et végétale, Mouloud Mammeri University, 15000, Hasnaoua, Tizi-Ouzou., Tizi-Ouzou, Algeria

In arid areas, the root system of the Atlas pistachio evolves according to the physicochemical characteristics of the underlying soil.Young pistachio installs quickly a shallow root network. With age, it prospects deep "reservoir-levels" by issuing many tap roots that also allow it a best anchorage.

P019

Local landraces of rice from Sri Lanka: variation in alleles and traits related to drought resistance

Munasinghe, M.; Price, A.H.
Department of Plant and Soil Science, University of Aberdeen, Cruickshank Building, St. Machar Drive, Aberdeen, AB24 3UU, United Kingdom

Three genotypes (Podi wee, Sinnavellai and Niyan wee) were revealed as the most deep-rooting drought-resistant landraces using three root screening methods: herbicide screening, hydroponics and rhizotrons. The herbicide scores significantly co-correlated with the drought scores in IRRI database.

P020

A conceptual model of root hair ideotypes for future agricultural environments

Brown, L.; George, T.S.
Ecological Sciences, The James Hutton Institute, Invergowrie, Dundee, DD2 5DA, United Kingdom

We present a conceptual model that has been developed to enhance understanding of interactions between the production of root hairs by plants and phosphorus acquisition. Furthermore potential root hair ideotypes are identified which represent breeding targets for future agricultural environments.

P021

Identity and diversity effects on fine root biomass and morphology of temperate deciduous tree species

Kubisch, P.; Jacob, A.; Hertel, D.; Leuschner, C.
Albrecht von Haller Institute for Plant Sciences, Plant Ecology, University of Goettingen, Untere Karspuele 2, Goettingen, 37073, Germany

Biodiversity often is suggested to be the key for productivity in plant communities. In our studied mature deciduous broad-leaved tree species there were no biodiversity effects on fine root biomass, so we conclude that species identity plays the major role in soil occupation by fine roots.

P022

Initial root development of Jatropha curcas L. seedlings under three different substrates

Valdes-Rodriguez, O.A.[1]; Sanchez, O.[1]; Angeles, P.[2]; Caplan, J.S.[3]; Danjon, F.[4]
[1]Centro de Investigaciones Tropicales, Priv de Araucadias sn, Xalapa, 91000, Mexico; [2]Inecol, Xalapa, Mexico; [3]Rutgers University, United States; [4]INRA, Pierroton, France

Jatropha curcas seedlings developed better in loam soils compared to clay and sandy soils. Scanning electron microscope images and WinRHIZO analysis showed higher root development in loam soils.

P023

Relations between root survivorship and root diameter, soil depth and birth season in a perennial alpine meadow

Cui, X[1]; Wu, Y.[2]
[1]College of Life Science, Graduate University of the Chinese Academy of Sciences, Yuquanlu A19, Beijing, China; [2]Department of Environmental Engineering, Ningbo University, China

Root life span was positively correlated with root diameter. An increase of diameter of 0.1 mm decreased mortality risk by 17.5 %. Roots in surface 10 cm soil layer had significantly shorter longevity. Of all the factors examined, root birth season had the strongest effects on root life span.

P024

Root development and soil fertility in the root zone of rice under flooded and aerobic conditions in Northeast Thailand

Seto, R.[1]; Moritsuka, N.[1]; Toriumi, A.[1]; Homma, K.[1]; Inamura, T.[1]; Yamagishi, J.[2]; Jongdee, B.[3]
[1]Graduate School of Agriculture Kyoto University, Japan; [2]Graduate School of Agricultural and Life Science, The University of Tokyo, Japan; [3]Ubon Rachathani Rice Research Center, Thailand

A core sampler allowing soil sampling with the distance from a hill was applied to aerobic and flooded paddy fields in Northeast Thailand. Soil analyses suggested that root growth was limited by phosphorus and that its availability was increased by an increase of pH around a hill.

P025

Modeling tree rooting depth and distribution from incomplete profile root biomass data

Starr, M.[1]; Helmisaari, H-S.[1]; Merilä, P.[2]
[1]Department of Forest Sciences, P.O. Box 27, Helsinki, FI-00014 University of Helsinki, Finland; [2]Finnish Forest Research Institute, P.O Box 413, University of Oulu, 90014, Finland

Non-linear functions were fitted to fine-root biomass data for Scots pine and Norway spruce stands in Finland. The aims were to test for differences in function parameters between the two species and whether they could be used to define depth for use in calculating soil water storage capacity.

P026

Response of rhizosphere characteristics of two different P-efficiency wheat genotypes to the various P sources

Zhang, S.[1]; Zhan, X.[2]
[1]Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences, 12 ZhongGuanCun NanDaJie, Beijing, China; [2]Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences, China

The mechanism of the P-efficient wheat genotypes to adapt to P deficiency would also depend on the phosphorus sources with a sparing solubility in the substrate, especially inorganic or organic forms, in addition to available levels.

P027

Root exudates of wheat cultivars change the soil microbial community and humic acid structure

Polonskaya, D.[1]; Polonskiy, V.[2]
[1]Krasnoyarsk State Agrarian University, Mira str., 90, Krasnoyarsk, 660049, Russian Federation; [2]Krasnoyarsk State Agrarian University, Russian Federation

It was shown that the root exudates change the direction of microbiological processes of conversion of nutrients and humus in soil. In consideration with influence of root exudates of plants, preference must be given to cultivars, which give big crop yields and excludes the utilization of nitrogen.

P028

Root growth of watermelon grown in different methods of tillage

Branco, R.B.F.[1]; Nowaki, R.H.D.[2]; Salles, F.A.[1]; Bolonhezi, D.[1]; Suguino, E.[1]; Suguino, E.[1]
[1]Horticultural, Agência Paulista de Tecnologia dos Agronegócios (APTA), Av. Bandeirantes, 2419, Ribeirão Preto, 14030-670, Brazil; [2]Universidade de Marília - UNIMAR, Av. Rua Hygino Muzy Filho, Marília, 17525-902, Brazil

Root growth is important characteristic to evaluate plant performance in field. Using images from root scanner we verified that watermelon had a great root growth in no-tillage after lupine and in a minimum tillage in both, oat and lupine cover crops, compared with conventional tillage.

P029

Plant Defense Alteration against Insect Pest through Activation of Plant-Root Secondary Metabolism under Gravisensing

Marabi, R.S.[1]; Satpute, G.K.[2]; Singh, Y.[3]; Mishra, S.[4]
[1]Entomology, Jawaharlal Nehru Agricultural University, College of Agriculture, Tikamgarh, 472 001, India; [2]Plant Breeding & Genetics, Jawaharlal Nehru Agricultural University, College of Agriculture, Tikamgarh, 472 001, India; [3]Plant Biotechnology, Jawaharlal Nehru Agricultural University, College of Agriculture, Tikamgarh, 472 001, India; [4]Plant Breeding & Genetics, Jawaharlal Nehru Agricultural University, College of Agriculture, Jabalpur, 482 004, India

TCH-4 gene encodes a xyloglucan endotransglycosylase (XET) that ensures cell wall reinforcement. A recombinant brassinosteroid protein acts as a XET. Cytochrome P450 is a gravity-regulated gene responsible for secondary metabolites elaboration and involved in brassinosteroid biosynthesis.

P030

The differential effect of nutrient deficiencies on the root morphology of Arabidopsis thaliana

Gruber, B.D.; Giehl, R.F.H.; von Wirén, N.
Molecular Plant Nutrition, Leibniz Institute of Plant Genetics and Crop Plant Research (IPK), Corrensstrasse 3, Stadt Seeland, OT Gatersleben, 06466, Germany

Nutrient deficiencies influence root morphology in ways that are specific for some nutrients. However, for other nutrients roots respond similarly to a number of deficiencies. This comprehensive study details the response of Arabidopsis to the deficiency of more than 10 different nutrients.

P031

The Arabidopsis NRT1.1 gene acts as a NO_3^- sensor and governs root colonization via local modification of auxin fluxes

Bouguyon, E.; Perrine-Walker, F.; Krouk, G.; Mounier, E.; Pervent, M.; Gojon, A.; Nacry, P.
INRA, B&PMP, IBIP, 2 place viala, Montpellier, 34060, France

The Arabidopsis NRT1.1 gene enables the plant to detect local NO_3^- concentration and modulates RSA. It stimulates root proliferation in high NO_3^- patches by regulating the expression of the MADS box TF, ANR1 and represses root growth under NO_3^- depletion by preventing auxin accumulation in primordia

P032

Root structural responses to cadmium and copper pollution

Tarshis, L.G.[1]; Budkevich, T.A.ß
[1]Ecology Department, Pedagogical University of Ekaterinburg, Belorechenskay street, number 9/4, 27, Ekaterinburg, 620102, Russia; [2]V.F. Kuprevich Institute of Experimental Botany of National Academy of Sciences of Belarus, Academicheskaya, 27, Minsk, 220072, Belarus

Roots can be used for indication of pollution soil by heavy metals. In conditions of pollution in roots radial symmetry and differentiation of elements secondary phloem and xylem is broken.

P033

Metabolite profiling of Komatusna (Brassica rapa L.) field-grown under different soil organic amendment and fertilisers

Okazaki, K.[1]; Shinano, T.[1]; Oka, N.[1]; Takebe, M.[2]
[1]Agro-environmental Research Divison, NARO Agricultural Research Center, Toyohira-ku, 1 Hitsujigaoka, Sapporo, 062-8555, Japan; [2]Soil Science and Plant Nutrition Division, NARO Agricultural Research Center, Tsukuba, 305-8666, Japan

Metabolite profiling was carried out using GC/MS in Brassica rapa L. The three most significant factors were N absorption, manure amendments and slow release N. Current findings will serve to direct further studies on the relationship between plant and soil environments.

P034

Cadmium stress and rootstock influence on antioxidant responses in tomato grafted plants

Azevedo, R.A.; Gratão, P.L.
University of São Paulo, Departamento de Genética, ESALQ, Av. Padua Dias 11, Piracicaba, 13418-900, Brazil

Uniform tomato plants were grafted with distinct combinations among rootstocks and scions with combination of Cd concentrations. The results revealed that the responses obtained were much more dependent upon Cd presence in the rootstock than scions exposed to Cd.

P035

Maize nodal root growth response to water deficits: Characterization in a divided-chamber model system

Riggs, K.J.; Sharp, R.E.
Division of Plant Sciences, University of Missouri, Columbia, 1-31 Agriculture Building, Columbia, 65211, United States

A divided-chamber system was developed to characterize the nodal root growth response to water deficits in maize. The system models the field situation, in which upper soil layers dry, to enable studies of nodal root growth regulation under a range of steady-state and reproducible conditions.

P036

Root Structure and Development in Rootless Maize Mutant lrt1

Husáková, E.; Soukup, A.
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Detailed anatomical analysis of the root system of lrt1 (lateral rootless1) maize mutant under different conditions of cultivation is presented.

P037

Fine root morphology of four tree species at two different managed agroforestry sites

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Fine root morphology influences nutrient and water uptake. This study shows that the fine root parameters (root length density, specific root length, branching) and intensity of space occupation differs between four tree species as well as between the two management systems.

P038

Extended exposure to NaCl stress influences growth, root parameters and ion content in faba bean seedling

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Effect of extended exposure to 0.1%NaCl increment every week could stimulate growth of faba bean seedling, especially in roots development, but higher salt concentration inhibited their growth. K^+/Na^+ ratio in shoot increased with the extended treatment, but did not affect in root.

P039

Effects of silicon on root growth and root exudates of rice under cadmium and zinc stress

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Si plays an important role in enhancing heavy metal tolerance of plants. Our studies demonstrate that Si-alleviated Cd or Zn toxicity in rice is associated with an increase in phenols concentrations of root exudates and maintaining integrity of cell structure of root.

P040

Effect of nitrogen fertilizer form on root system structure in regrowth of first-year alfalfa

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Superior recovery in root length during regrowth stage of alfalfa plants fertilized with ammonium-N compared to plants fertilized with nitrate-N was found. This was associated with changes in fractal dimension and lacunarity of root system structure.

P041

Pedogenic carbonate formation is enhanced by rhizosphere activity

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Pedogenic carbonates as important carbon pool of arid regions, are suggested to form during millennia. 14C labeling experiments showed that carbonate recrystallization occurs much faster in rhizosphere, indicating the role of plants for acceleration of PC formation and carbon sequestration in soil.

P042

Time-lag in root-shoot growth of ash seedlings after the two disturbances during growing period

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Root-shoot growth of regenerated ash seedlings was monitored after canopy-gap formation at July and Sept. in three successive years. July gap-formation accelerated root growth without fine roots in first year but autumn one did not. The pattern of root-shoot was characterized by ring porous wood.

P043

Root-shoot growth of ash seedling after the disturbances during growing period

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Root-shoot development of regenerated ash seedlings was monitored with the top canopy opening in early summer and autumn during three successive growing seasons. Early summer opening accelerated intensive root development in first year but autumn one did not.

P044

Ecosfix – Ecosystem services provided by root systems

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We will investigate the supporting and regulating services that plant root systems can provide in different ecosystems and in particular, focus on the functional importance of deep roots with regard to shallow roots and their role, function and form at an ecosystem level.

P045

Root Discrimination Of Crop And Weed Species By Fourier Transform Infrared (FTIR) Spectroscopy

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We used FTIR-ATR spectroscopy to discriminate roots of crop and weed species. Spectral pattern of roots differed depending on species. Cluster analyses of root spectra revealed a successful discrimination of even closely related species.

P047

Application of a DNA-based method to measure the root growth of perennial grasses in an acid soil

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Measuring root growth in the field is difficult due to the spatial heterogeneity of roots and the potential loss of roots during sampling. This paper demonstrates the application of a DNA-based method to investigate the root growth of perennial pasture grasses varying in acid-soil resistance.

P048

Root biomechanics depend on root type and on soil abiotic stresses

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Abiotic stress influenced maximum root length. Root type influenced greatly the relationship between root diameter and root tensile modulus and strength. Separation of different root types improves our ability to model root tensile strength and stiffness.

P049

Genes involved in carbon partitioning in maize and their effects on roots

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The data suggest either that Sut1 may not play a role in sink strength or that its role is redundant with other proteins. The effects of tdy1 mutation on root growth are presented suggesting a direct effect on root growth and that tdy1 may play a role in determining sink strength in roots.

P050

Root characteristics of lucerne under rain-fed conditions

Raza, A.[1]; Friedel, J.K.[2]; Moghaddam, A.[3]; Ardakani, M.R.[4]; Loiskandlityty , W.[5]; Himmelbauer, H.[6]; Bodner, G.[7]
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This study compares root biomass and root characteristics of six lucerne varieties under rain-fed conditions in a field experiment in Eastern Austria. We identified two varieties Ordobad and NS-banat as a suitable choice for rain-fed organic farming conditions on account of their high root yields.

P051

Influences of root circling on the growth of Ligustrum obtusifolium and Quercus myrsinifolia seedlings

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The root circling noticeably restrained the top and root growth of tree seedlings raised in containers. This was concluded to result in less formation of active fine roots in the seedlings. The root egress ability and biodegradability of containers might improve the growth after transplanting.

P052

Effects of sand dune encroachment on the growth of two salix species in inner Mongolia, China

Teraminami, T.[1]; Nakashima, A.[2]; Ominami, M.[2]; Yamamoto, M.[3]; Gou Shen, Z.[4]; Yoshikawa, K.[1]
[1]Graduate School of Environmental Science, Okayama University, 1-1-1 Tsushimanaka, Kita-ku, Okayama-shi, 700-0811, Japan; [2]Graduate School of Systems Engineering, Wakayama University, 640-8444, Japan; [3]Wakayama Pref., Japan; [4]Inner Mongolia Agricultural University, China

S. psammophila grows adventitious roots from the part of the main shoot that has been engulfed by sand, and the biomass of the aboveground part increases with the increase in the number and biomass of adventitious roots from the engulfed main shoot.

P053

The Dynamics of Paddy Rice Roots in Organic Farming

Tajima, R.; Kamo, K.; Tsushima, K.; Mashiko, A.; Ito, T.; Saito, M
Field Science Center, Tohoku University, Yomogida, Naruko-onsen, Ohsaki, 989-6711, Japan

Root dynamics of rice in organic farming is important but unclear. With ingrowth core method, Production and mortality of roots were estimated. The production and mortality of roots were high in organic farming. The production of roots was accelerated by PolySilicate-Iron sludge.

P054

Mapping tree root distribution for improved belowground analysis in an agroforestry site using ground penetrating radar

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Ground penetrating radar is being used to determine distribution of tree roots in an agroforestry site in southern Ontario, Canada. Tree root systems will be assessed using root distribution data and tree root carbon content analysis.

P055

Field measurement of root growth of winter wheat and fodder radish before winter using different methods

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Root development before winter in catch crops and cash crops are essential in relation to nitrogen uptake and thus controlling the nitrogen leaching problem. We investigated different methods to assess root density and depth in the field for winter wheat and a fodder radish catch crop.

P056

Angle of root crossed scanning line is important for root detection with ground penetrating radar

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To detect the root underground using nondestructive ground-penetrating radar, the effect of angle and diameter were tested. The relationship between diameter/angle and strength of reflected wave were shown as a sine curve formula.

P057

Root growth dynamic in relation to aerial growth and phenology in sweet cherry trees on a semi-dwarfing rootstock II

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Information about root growth patterns is important for optimization of nutrient management. Using rhizotrons installed in a high density orchard at central Chile, common features were found in root growth patterns across three seasons, reflecting a primary dependency on photosynthate availability.

P058

Variation of seedling root traits in wild barley (Hordeum vulgare L. ssp. spontaneum) germplasm

Yun, S.J.[1]; Tyagi, K.[1]; Lee, H.J.[2]; Steffenson, B.J.[3]; Lee, K.J.[4]
[1]Department of Crop Science, Chonbuk National University, Jeonju, 561-756, Korea, Republic of; [2]Chonbuk National University, Jeonju, 561-756, Korea, Republic of; [3]Department of Plant Pathology, University of Minnesota, St. Paul, United States; [4]Division of Biotechnology, Chonbuk National University, Korea, Republic of

Several WBDC accessions from Jordan and Syria exhibited several favorable root traits like highest RL, SRL, and few SRN and may be useful in breeding for drought conditions. Accessions WBDC266, WBDC302, WBDC286 and WBDC241 had the longest RL, highest RW, SDRW and SRL, respectively.

P059

Roots of legumes on soils with different texture in organic farming

Chmelikova, L.[1]; Schmid, H.[1]; Hejcman, M.[2]; Hülsbergen, K.H.[1]
[1]Chair of Organic Agriculture and Agronomy, Technische Universität München, Alte Akademie 12, Freising, 85354, Germany; [2]Department of Ecology, Czech University of Life Sciences, Kamycka 1176, Prague, 16521, Czech Republic

The study aimed to clarify the influence of soil texture on roots and nodules of M. sativa and T. pratense in field experiment of organic farming. The soil texture had no effects on the nodules, but it is still not clear if it influenced the root traits variability.

P060

Root distribution and interactions in jujube tree/wheat agroforestry system

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In a field study of 2 or 4 or jujube tree were intercropped with wheat, we found that both root length densities of jujube tree and wheat were changed compared to corresponding sole cropping, which can partly explain the observed interspecific interactions above-ground.

P062

iRH: a comprehensive root hair information database

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Department of Genetics, University of Silesia, Jagiellonska 28, Katowice, 40-032, Poland

To date, more than 100 genes involved in root hair development have been identified and functionally characterized in plants. Kwasniewski et al. present an unique, comprehensive database, iRH, that integrates a large volume of data related to root hair genomics.

P067

Decreasing Cytosolic Triosephosphate Isomerase Expression Alters Carbon Metabolism in Transgenic Potato Roots

Dorion, S.[1]; Clendenning, A[1]; Jeukens, J.[1]; Salas, J.J.[2]; Parveen, N.[1]; Haner, A.A.[3]; Law, R.D.[3]; Martínez Force, E.[2]; Rivoal, J.[1]
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Triosephosphate isomerase is involved in plastidial and cytosolic glycolysis. Dorion et al. used a genetic approach to evaluate the function of the cytosolic isoform in transgenic roots. They show that a large decrease of this enzyme leads to alterations in carbon fluxes and metabolic pools.

P068

Key root traits and useful genes on rainfed lowland rice breeding for water stress avoidance

Inukai, Y.[1]; Kitomi, Y.[1]; Inahashi, H.[1]; Nakata-kano, M.[2]; Niones, J.[1]; Suralta, R.[3]; Yamauchi, A.[1]
[1]Graduate School of Bioagricultural Sciences, Nagoya University, Japan; [2]ICCAE, Nagoya University, Japan; [3]Philippine Rice Research Institute, Philippines

In order to avoid water stress under rainfed lowland conditions, we found that maintaining and increasing the total root length are very important. We are now trying to understand genetic mechanisms regulating root development to improve root system architecture for rice breeding.

P069

Enhancing resource Uptake from Roots under stress in cereal crops: the EURoot Project

Guiderdoni, E.[1]; Courtois, B.[1]; Visser, E.[2]; Wilkinson, S.[3]; Faget, M.[4]; Dupuy, L.[5]; Price, A.[6]; Hund, A.[7]; Russell, J.[5]; Salvi, S.[8]; Szarejko, I.[9]; San Segundo, B.[10]; Chaumont, F.[11]; Hinsinger, P.[12]; Muller, B.[12]; Nacry, P.[12]; Hochholdinger, F.[13]; Pridmore, T.[14]; Paolini, M.[15]; Camp, K.H.[16]; Krause, C.[17]; Doussan, C.[18]; Pagès, L.[18]; Wissuwa, M.[19]; Langridge, P.[20]; Lynch, J.[21]
[1]Centre de coopération internationale en recherche agronomique pour le développement, Montpellier, France; [2]Radboud Universiteit Nijmegen, Nijmegen, Netherlands; [3]University of Lancaster, Lancaster, United Kingdom; [4]Forschungszentrum Jülich, Jülich, Germany; [5]James Hutton Institute, Dundee, United Kingdom; [6]University of Aberdeen, Aberdeen, United Kingdom; [7]Eidgenössische Technische Hochschule Zürich, Zürich, Switzerland; [8]Università di Bologna, Bologna, Italy; [9]Uniwersytet Śląski w Katowicach, Katowice, Poland; [10]Centre de Recerca en Agrigenòmica, Barcelona, Spain; [11]Université Catholique de Louvain, Louvain la Neuve, Belgium; [12]Institut national de la recherche agronomique, Montpellier, France; [13]Rheinische Friedrich-Wilhelms-Universität Bonn, Bonn, Germany; [14]University of Nottingham, Nottingham, United Kingdom; [15]Società Produttori Sementi, Bologna, Italy; [16]PreSens, Regensburg, Germany; [17]Delley Samen und Pflanzen AG, Delley, Switzerland; [18]Institut national de la recherche agronomique, Avignon, France; [19]Japanese International Research Centre for Agricultural Sciences, Tsukuba, Japan; [20]Australian Centre for Plant Functional Genomics, Adelaide, Australia; [21]Pennsylvania State University, University Park, United States

We describe the structure of a new EU FP7 funded consortium EURoot integrating physiology, genetics and soil and microbial sciences aiming at providing models, markers, signatures and tools for breeding cereal crops with an higher capacity to capture soil resources through their root system.

P070

Modulating root system architecture in crops

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Modulating RSA is expected to benefit plant growth and yield under standard agronomic and stressful environments. The screening capabilities for assessing RSA and transgene testing strategies to improve root architecture and function is outlined in the poster.

P072

Differences in modern North European winter wheat cultivars in deep root growth

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Deep rooting is an important factor reducing nitrate leaching potential. Measurements of root penetration rate in transparent soil columns was used as a fast screening method to find significant cultivar differences in modern winter wheat cultivars.

P073

Functional analysis of PvSPX1 regulating bean roots in response to phosphate starvation

Liao, H.; Yao , Z.; Liang , C.; Tian, J.
Root Biology Center, South China Agricultural University, Wushan, Guangzhou, 510642, China

PvSPX1 played a vital role for bean roots responding to P deficiency through modifying root growth and up-regulating expression levels of downstream genes.

P074

Root specific expression of OsNAC10 improves drought tolerance and grain yield in rice

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School of Biotechnology and Environmental Engineering, Myongji University, Nam-Dong, Chuin-Gu, Yongin, 449-728, South Korea

Drought stress is one of the major constraints to crop production. This study shows that OsNAC10 is involved in drought resistance mechanisms of rice and controlling of root radial growth can be one of the potential tools for improving drought resistance and grain yield in rice.

P075

Comparison of root systems of durum wheat of different origin and genetic resources

Bodner, G.; Nakhforoosh, A.; Schuhwerk, D.; Kaul, H.-P.; Grausgruber, H.
Department of Crop Science, University of Natural Resources and Life Sciences, Gregor Mendel Straße 33, Vienna, Austria

Diversity of root traits is of potential use in breeding for efficient water uptake. Although genetic resources show most diverse root morphologies, also within modern durum germplasm high diversity exists. Capacitance measurement can be used as a pre-screening tool for root system diversity.

P076

Varying substrate compaction in split-root rhizotron systems affects barley root growth and shoot performance

Pfeifer, J.[1]; Nagel, K. A.[1]; Faget, M.[1]; Blossfeld, S.[1]; Walter, A.[2]
[1]Plant Sciences (IBG-2), Forschungszentrum Jülich GmbH, Wilhelm-Johnen-Straße, Jülich, Germany; [2]Institute of Agricultural Sciences, ETH Zürich, Universitätsstrasse 2, Zürich, Switzerland

The impact of heterogeneous soil compaction on root system architecture and root growth dynamics is scarcely investigated. We analyzed effects of substrate compaction on barley root and shoot growth by an automatic rhizotron screening device facilitating such studies for research and phenotyping.

P077

Identification of loci/genes regulating root morphology of wheat

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We constructed a pair of NILs with significant differences in root morphology for qTaLRO-B1, a major QTL for maximum root length and primary root length. Further proteomic study on the pair of NILs showed that TaTRIP1 was involved in regulating root morphology of wheat by BR signaling pathway.

P078

A new high-throughput technique to screen root depth in different rice varieties associated with mapping (qtl)

Alshugeairy, Z.; Standing, D.; Price, A.
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P079

Genetic diversity of Oxalate oxidase activity in water-stressed roots of maize

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The relationship of oxalate oxidase activity (produces hydrogen peroxide) to root elongation under water stress was evaluated among diverse maize lines. Temperate lines generally showed increased activity in the apical elongation zone, whereas subtropical lines exhibited diverse patterns of activity.

P080

Poster Session 1

Tuesday, June 26, 2012
13:45-15:00
1.F.01

Characterization and transcriptional expression of the β-expansin gene family in soybean

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Expansin proteins play various biological roles during plant growth and development. Real-time PCR results demonstrate that nine soybean â-expansin genes act as different roles in organ development and in adaptation to abiotic stresses. Some GmEXPBs involve in soybean symbiosis with rhizobia or AM fungi.

P084

Mapping and functional analysis of REDUCED ROOT LENGTH2 gene, RRL2, in rice

Shelley, I.J.[1]; Ozaki, H.[1]; Kitano, H.[2]; Inukai, Y.[1]
[1]Graduate School of Bioagricultural Sciences, Nagoya University, Japan; [2]Biotecnology and Bioscience Center, Nagoya University, Japan

We screened a rice recessive mutant, rrl2, characterized by a reduced root length and employed a map-based cloning approach to isolate the causative gene, RRL2. We succeeded in finding the candidate gene on the chromosome 1 around 95 cM and now trying to understand the function of it.

P085

Roots for low nutrient availability – genotypic variation in spring wheat (Triticum spp. L.)

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Genotypic variation was found in root density and distribution in the top soil volume between twelve spring wheat cultivars. First order lateral roots differed significantly in time of initiation, site of appearance and density, where particular genotypes presented early and intensive abundance.

P086

Soybean stem-termination isolines differ in rooting characteristics

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Soybean isolines with distinct shoot architecture may also differ in root characteristics. Seasonal soil moisture depletion pattern and end-of-season root sampling indicate these lines possess divergent root characteristics.

P087

Detection of chromosome fragments associated with growth angle of seminal roots in wheat (Triticum aestivum L.)

Mori, M.; Abe, F.; Haque, M.E.; Kawaguchi, K.; Oyanagi, A.
NARO Institute of Crop Science, 2-1-18 Kannondai, Tsukuba, 305-8518, Japan

The growth angle of seminal roots is one of the important traits in wheat. There were clear differences in the growth angle of seminal roots between CS and CS ditelosomic 6AS and 6BS lines. These lines showed significantly larger value of root angle from the horizontal than those of CS.

P088

TTL genes in lateral root growth and development

Ales, S.[1]; Sefrnova , Y.[1]; Delgado, A.H.[1]; Cvrckova, F.[1]; Fischer, L.[1]; Vielle Calzada , J.P.[2]; Dubrovsky, J.G.[3]
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Novel regulatory elements from the family of Tetratricopeptide-repeat Thioredoxin-like proteins were identified to take part in lateral root development. Their expression pattern and mutant phenotype were recorded and bioinformatics analysis of phylogeny and distribution of genes was tested.

P089

Most important genetic position controlling potato root mass is located at Chromosome 5

Iwama, K.[1]; Iwasa, T.[1]; Anithakumari, A.[2]; Yoshikawa, A.[1]; Kuwahara, K.[1]; Miura, S.[1]; Linden, C.G.[2]; Visser, R.G.F.[2]
[1]Research Faculty of Agriculture, Hokkaido University, N9W9 Kitaku, Sapporo, 060-8589, Japan; [2]Wageningen University and Research Centre, Wageningen, Netherlands

QTLs with high LOD scores (about 20) for root length and dry weight were detected at one distinct region of Chromosome 5 in CxE diploid potato population grown in pots for two years. About two thirds of genotypic variation in both root traits related to plant maturity measured in the field.

P090

Future developments for non-destructive 3D plant and root imaging

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The goal of this joint study is to explore whether Nuclear Magnetic Resonance Imaging (NMRI) or (Sub) Terahertz Imaging (THz) might be used for obtaining non-invasive and valuable information about plant roots in soil or substrate.

P091

Phenotyping of root system size in field by its electrical capacitance and relevant genes

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Evaluation of root system size by its electrical capacitance gives relative values comparable for the same species, substrate and time. Responsible genes were mapped associated with agronomic traits. Selection for greater capacitance in alfalfa and clover was effective.

P092

Phenotyping root architectural traits of a tropical japonica rice panel in view of association mapping

Audebert, A.[1]; Roques, S[1]; Dardou, A.[1]; Rouan, L.[1]; Gozé, E.[2]; Frouin, J.[1]; Ahmadi, N.[1]; Ghneim, T.[3]; Courtois, B.[1]
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Audebert et al. phenotyped an association panel of 200 tropical japonica rice lines in a semi-hydroponic system composed of Plexiglas plates filled with glass beads. Varieties from Brazil, Indonesia and Taiwan showed the deepest roots. No link was noticed between root depth and cone angle.

P093

New pathways regulating Medicago truncatula root architecture

Laffont, C.[1]; Plet, J.[2]; Cosson, V.[2]; Ratet, P.[2]; Frugier, F.[2]
1CNRS, bat 23 avenue de la terrasse, Gif/Yvette, France; 2CNRS, France

Legume root system consists in lateral roots and symbiotic nitrogen fixing nodules. Laffont et al. identified mutants affected in these lateral organogenesis processes, either by targeting the cytokinin signalling pathway or by characterizing "compact root architecture" mutants.

P094

The root architecture of Brachypodium distachyon and its application to wheat genetic improvement

Chochois, V.[1]; Vogel, J.[2]; Wilson, I.[1]; Helliwell, C.[1]; Bragg, J.[2]; Watt, M.[1]
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Brachypodium distachyon is a temperate grass phylogenetically close to wheat and their root development is very similar. We are using it as a model to speed up the identification of genes affecting wheat root vigour and architecture, thanks to its small size and to the numerous tools available.

P095

Mapping QTLs for root system architecture of maize under field conditions

Chen, F.J.[1]; Cai, H.G[1]; Mi, G.H.[1]; Zhang, F.S.[1]; Maurer, H.P.[2]; Liu, W.X.[2]; Reif, J.C.[2]; Yuan, L.X.[1]
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The development of root system architecture (RSA) is central for maize productivity. Using advanced-backcross QTL analysis, Yuan et al. revealed the establishment of roots at early stage associated with grain yield formation, and identified several QTLs clusters for RSA under field conditions.

P096

Potato roots; phenotyping under glass and in the field. Root relationships with yield predict the effect of drought

Wishart, J.[1]; George, T.S.[2]; Brown, L.K.[2]; Ramsay, G.[3]; White, P.J.[2]; Gregory, P.J.[4]
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Variation in rooting characteristics of potato genotypes was identified after two weeks growth under glass and many were highly correlated with the same measures from the field. Final yield was positively associated with rooting characteristics which also gave an advantage when droughted.

P097

Arabidopsis homolog of Trithorax1 is required for cell patterning and morphogenesis in Arabidopsis root development

Dubrovsky , J.[1]; Napsucialy-Mendivil, S.[1]; Alvarez-Venegas, R.[2]; Shishkova, S.[1]
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Root system is a result of new apical meristem formation. Using a loss-of-function mutant in Arabidopsis homolog of Trithorax1 (ATX1) Dubrovsky et al. demonstrate that ATX1 gene is required for cell patterning and morphogenesis both in primary and lateral root development in Arabidopsis thaliana.

P098

New approach to phenotype root system architecture of maize

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Institute of Agricultural Sciences, ETH Zurich, Universitaetstrasse 2, Zurich, 8092, Switzerland

An improved system was developed to measure root system architecture of maize to facilitate targeted selection or the mapping of quantitative trait loci. It allows a more detailed analysis of growth and branching density of lateral roots, the growth of individual axile roots and their orientation.

P099

Characterization of auxin-related genes in barley involved in root development

Orman, B.[1]; Bennett, M.[2]; Waugh, R.[3]; Draye, X.[1]
[1]Crop physiology and Plant breeding, Earth and Life Institute, Agronomy, Universite catholique de Louvain, Croix du Sud 2, L7.05.11, Louvain-la-Neuve, 1348, Belgium; [2]Plant Sciences Division, School of Biosciences, University of Nottingham, Sutton Bonington Campus, Loughborough, LE12 5RD, United Kingdom; [3]Department of Genetics, The James Hutton Institute, Invergowrie, Dundee, DD2 5DA, United Kingdom

Auxin influx carriers in Arabidopsis mediate the formation of local auxin gradients which are crucial for many aspects of root development. How these regulatory processes translate in crops remains widely unexplored. Two carriers have been identified in barley and their possible role is discussed.

P100

A positive feedback loop between light and strigolactones in tomato roots

Kapulnik, Y.[1]; Cohen, M.[1]; Mayzlish-Gati, E.[1]; Wininger, S.[1]; Steinberger, Y.[2]; Ben Dor, B.[1]; Koltai, H.[1]
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Strigolactones (SLs) are a new group of plant hormones. Using physiological, biochemical and genomic approaches, Cohen et al., demonstrated that SLs and light perception are associated via a positive feedback loop in the plant; this may explain their similar effect on plant development.

P101

Identification of QTL for root architectural traits under low and optimal phosphorus availability in Brassica napus

Shi, L.[1]; Shi, T.X.[1]; Hammond, J.P.2; Ding, G.D.[1]; Long, Y.1; Meng, J. L.1; Xu, F. S.[1]
[1]National Key Lab of Crop Genetic Improvement, Huazhong Agricultural University, No. 1 Shizishan Street, Hongshan District, Wuhan, 430070, China; [2]Division of Plant and Crop Science, University of Nottingham, Sutton Bonington Campus, Loughborough, LE12 5RD, United Kingdom

Root architecture traits play an important role in the plant adaptions to the low phosphorus availability in soil. Shi et al. results demonstrate that about 30% QTL detected for root traits of Brassica napus with agar culture were co-located with QTL for seed yield and seed yield components at LP.

P102

Genetic and molecular characterization of TaSTOP1 for Al toxicity in bread wheat (Triticum aestivum L.)

Garcia-Oliveira, A.L.[1]; Benito, C.J.[2]; Prieto, P.[3]; Menezes, R.[4]; Rodrigues-Pousada, C.[4]; Guedes-Pinto, H.[1]; Martins-Lopes, P[1]
[1]Centro de Genomica e Biotecnologia, Portugal; [2]Universidade Complutence de Madrid, Spain; [3]Instituto de Agricultura Sostenible /CSIC, Spain; [4]Instituto de Tecnologia Quimica e Biologica, Portugal

Here, we identified a novel gene, TaSTOP1 having transcription factor activity and localized on chromosomes 3A, 3B and 3D in bread wheat. Transcript expression study suggests the role of TaSTOP1 under Al tolerance at post-transcriptional level in wheat.

P103

Root response to drought stress in Arabidopsis thaliana

El Soda, M.; Koornneef, M.; Aarts, M.G.M.
Plant Genetics, Wageningen UR, P.O. Box 309, Wageningen, 6700 AH, Netherlands

We identified major qtls controlling root response to drought stress. These qtls will be further confirmed using HIFs.

P104

Diversity in leaf and root morphological characteristics of trembling Aspen (Populus tremula)

Hajek, P.; Hertel, D.; Leuschner, C.
Albrecht-von-Haller Institute for Plant Sciences, Department of Ecology and Ecosystem Research, University of Goettingen, Untere Karspuele 2, 37073 Goettingen, Germany

Intra- and interspecific variation of leaf and root morphological characteristics among eight aspen demes point to genetically driven adaption strategies with no significant effect of deme on the interrelations of above- and belowground traits.

P105

Spring wheat genotype selection based on root hair and rhizosphere traits

Wang, Y.; Magid, J.; Jensen, L.S.; Thorup-Kristensen, K.
Department of Agriculture and Ecology, Faculty of Life Sciences, University of Copenhagen, Thorvaldsensvej 40, Frederiksberg C, DK-1871, Denmark

The variations in root and root hair traits among wheat cultivars under conditions of low nutrient availability are investigated to identify superior cultivars and critical root traits for higher nutrient use efficiency, which may be grown in organic production or used in breeding for new cultivars.

P106

Which processes drive fine root elongation in a natural forest ecosystem?

Stokes, A.[1]; Mao, Z.[1]; Bonis, M.L.[1]; Rey, H.[2]; Saint-Andre, L.[3]; Stokes, A.[1]; Jourdan, C.[4]
[1]INRA, AMAP, PS2 TA/A51, 2, Bld de la Lironde, Montpellier cedex 5, 34398, France; [2]CIRAD, AMAP, PS2 TA/A51, 2, Bld de la Lironde, Montpellier cedex 5, 34398, France; [3]INRA, UR BEF – Biogéochimie des Ecosystèmes Forestiers, Champenoux, 54280, France; [4]CIRAD, UMR Eco&Sols – Ecologie Fonctionnelle & Biogéochimie des Sols & Agroécosystèmes, 34060, France

Fine root growth in subalpine forest ecosystems is governed by soil temperature. Root growth can occur as long as soil temperatures are >0°C, even when monthly mean air temperatures are sub-zero.

P109

Root phytotoxicity by pre-emergence herbicides in high erucic Brassica seedlings

Zanetti, F.[1]; Vamerali , T.[2]; Mosca, G.[1]; Rampin, E.[3]
[1]DAFNAE, University of Padova, Agripolis, viale dell'Università 16, Legnaro, 35020, Italy; [2]Dept. of Environmental Sciences, University of Parma, Viale G.P. Usberti 11/A, Parma, 43100, Italy; [3]DAFNAE, University of Padova, Agripolis, Viale dell'Università 16, Legnaro, 35020, Italy

The extension of pre-emergence herbicides, used for B. napus, to minor high-erucic species should carefully consider root phytotoxicity at early stages, that may compromise establishment. The overcoming of phytotoxicity was more rapid in field than in greenhouse due to faster herbicide degradation.

P110

Miraculous plant derived smoke induce early and vigorous rooting in Ipomoea aquatica compared to IBA, IAA and GA

Rehman, S.; Nawaz, G.; Nisar, N.; Umbreen, N.; Ahmad, A.; Nigar, K.; Jamil, M.; Jamil, M.
Plant Sciences, KUST, Kohat University of Science and Technology (KUST), Kohat, 26000, Pakistan

These results showed that plant derived smoke solution induced early and vigorous rooting in Ipomoea aquatic, therefore, it could be used for quicker and healthier rooting, which could subsequently result in a healthy plant. Moreover, it is easy and economical to produce plant smoke which is environmental friendly, could be used as bio-enhance and bio-fertilizer.

P111

Use of GFP to determine the influence of competition on root dynamics

Rewald, B.[1]; Rachmilevitch, S.[2]; Ephrath, J.E.[2]
[1]French Associates Institute for Agriculture and Biotechnology of Drylands, Ben-Gurion University of the Negev, Campus Sede Boqer, Midreshet Ben Gurion, Israel; [2]French Associates Institute for Agriculture and Biotechnology of Drylands, Ben-Gurion University of the Negev, Israel

GFP expressing and non-GFP plants can be easily distinguished by the strong, green fluorescence of transgenic roots as compared with minor autofluorescence. The stable expression of GFP in crop plants allows for advanced studies on spatial and temporal rooting pattern in plant mixtures.

P113

Quantitative relationship between microbial respiration and resource quality of dead fine root in a broad-leaved forest

Kawamura, A.; Makita, N.; Osawa, A.
Kyoto University, Graduate School of Agriculture, Kyoto University, Kyoto, Japan

Microbial decomposition respiration of tree fine root was determined by resource quality beyond the two diameter classes and species. The quantitative relationship between microbial respiration and resource quality of dead fine root enables us to explain mechanisms in the fine root decomposition.

P114

Decomposition of fine-root and aboveground litters – quantification of soil microbial activity parameters

Liiva, H.; Orupõld, K.; Purgas, M.; Püttsepp, Ü.
Estonian University of Life Sciences, Kreutzwaldi 5, Tartu, Estonia

Decomposition of roots and aboveground litter in forest soils can be inhibited by environmental stress. Liiva et al. demonstrated in a microcosm experiment with decomposing fine-root and aboveground litters that microbial respiration but not the soil enzymatic activities, were inhibited by the presence of Cu and Cd.

P115

Breeding plants with deep roots for carbon, water and nutrient sequestration: what may be achievable?

Kell, D.
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An extra 1m depth of roots deployed over existing croplands and grasslands (ca 2300 Mha each) can have a very substantial impact in mitigating CO_2 increases (see also http://dbkgroup.org/carbonsequestration/rootsystem.html); we need to breed plants that can produce them.

P116

Fine root carbon age variation in boreal conifer forests determined by radiocarbon method

Sah, S.P.[1]; Bryant, C.[2]; Leppälammi-Kujansuu, J.[1]; Lõhmus, K.[3]; Ostonen, I.[3]; Helmisaari, H.S.[1]
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On the contrary to our expectation, we observed that up to 2-years old live larger fine roots of ingrowth cores of one of our sites showed similar C ages (7-12 years) as in the soil core fine roots and this can only be explained by the fact that new live roots grew from old carbon reserves.

P117

Below-ground parts of understorey vegetation in the carbon cycling of boreal coniferous forests

Salemaa, M.[1]; Helmisaari, H-S.[2]; Hilli, S.[3]
[1]Vantaa Unit, Finnish Forest Research Institute, P.O. Box 18, Vantaa, FI-01301, Finland; [2]Faculty of Agriculture and Forestry, University of Helsinki, P.O. Box 27, FI-00014 University of Helsinki, Finland; [3]Rovaniemi Unit, Finnish Forest Research Institute, P.O. Box 16, Rovaniemi, FI-96301, Finland

The living roots and rhizomes may have a significant effect to the change of C pool in the organic layer of boreal forests.

P118

Contribution of Mycorrhizal Hyphae to Carbon Fluxes in Temperate Forests

Andreasson, F.[1]; Dannoura, M.[1]; Kominami, Y.[2]; Hirano, Y.[3]; Makita, N.[4]; Ataka, M.[4]
[1]Laboratory of Forest Utilization, Graduate School of Agriculture, Kyoto University, Kitashirakawa Oiwake-too, Sakyo-ku, Kyoto, 606-8502, Japan; [2]Forestry and Forest Products Research Institute, Japan; [3]School of Bioagricultural Science, Nagoya University, Japan; [4]Laboratory of Forest Hydrology, Graduate School of Agriculture, Kyoto University, Japan

External mycorrhizal hyphae contribute to the complex carbon flux from temperate forest soils. Activity of mycorrhizal hyphae shows seasonal variations.

P119

Use of X-ray computed tomography to assess root decomposition in situ

Haling, R.; Tighe, M.; Flavel, R.; Young, I.
School of Environmental and Rural Science, University of New England, Armidale, 2351, Australia

Understanding the dynamics of root turnover and decomposition is crucial for quantifying the contribution of roots to soil carbon and nutrient cycling. This paper investigates the potential to use X-ray computed tomography to study root turnover and decomposition directly in soil.

P120

Assessment of the ability of barley for phytoremediation of soils contaminated with Zn, Cd or Cr

Gonzalez, A.; Chumillas, V.; Lobo, M.C.
Agroenvironmental Research, IMIDRA, Finca, Alcalá de Henares, 28800, Spain

The tolerance of barley plants exposed to increasing concentrations of Zn,Cd and Cr have been evaluated. The results showed significant tolerance to zinc and cadmium, but toxic effects were observed when plants were treated with Cr..The highest percentage of metal was found in the roots in all cases.

P122

Use of plants with allelopathy potential as a bio-barrier against bio-intrusion on covers with capillary barrier effects

Bussière, B.[1]; Bergeron, Y.[1]; Tremblay, F.[1]; Thiffault, N.[2]; Joanisse, G.[3]; Smirnova, E.[4]
[1]UQAT (Université du Québec en Abitibi-Témiscamingue), Canada; [2]MRNF (Ministère des Ressources naturelles et de la Faune du Québec), Canada; [3]CERFO (Centre d'enseignement et de recherche en foresterie de Sainte-Foy), Canada; [4]UQAT, 445, boul. de l'Université, Rouyn-Noranda, J9X 5E4, Canada

Bluejoint reedgrass is the most promising bio-barrier species for the CCBE (cover with capillary barrier effects) compared to sheep laurel and Labrador tea. Mainly trough root system development bluejoint reedgrass has rapid and strong inhibitory effects on undesirable trees. Favourable planting substrate will amplify bio-barrier species efficiency on the CCBE.

P123

Plants adapted to the arctic tundra conditions: structural features of roots

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Root structure features of all the studied of the flowering herbaceous perennial plants and small shrubs show how the angiosperm plants are adapting to the harsh tundra conditions in a vast variety of ways.

P126

The guttation rate as a criterion of physiological status of plants

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It was shown that the root activity which was measured using value of GR of seedlings is the parameter of physiological status of plants and can be used for nondestructive evaluation of cultivars for resistance to different stress-factors and monitoring of environment quality.

P127

Fine-root patterns along a drought gradient in Spruce forests (Picea crassifolia) of the Qilian Mountains

Wagner, B.[1]; Dulamsuren, C.[2]; Liang, E.[3]; Leuschner, C.[2]; Hauck, M.[2]
[1]Plant Ecology and Ecosystem Research, University of Goettingen, Untere Karspüle 2, Goettingen, 37073; [2]Plant Ecology and Ecosystem Research, University of Goettingen, Untere Karspüle 2, Goettingen, 37073, Germany; [3]Institute of Tibetan Plateau Research, Chinese Academy of Sciences, P.O.Box 2871, Beijing, 100085, China

First observations show differences in the ratio between biomass and necromass along the elevation gradient, but need to be further quantified.

P128

Comparison of Brassica napus and Alyssum serpyllifolium regarding platinum group element-uptake, determined by ICP-OES

Herincs, E.[1]; Limbeck, A.[2]; Puschenreiter, M.[1]; Wenzel, W.W.1
[1]Department of Forest and Soil Sciences, Institute of Soil Science, University of Natural Resources and Life Sciences, Konrad Lorenz Straße 24, 3430 Tulln an der Donau, Austria; [2]Institute of Chemical Technologies and Analytics, Division of Instrumental Analytical Chemistry, Vienna University of Technology, Getreidemarkt 9, 1060 Vienna, Austria

Within our studies the variable uptake of platinum group elements (PGEs) in both Brassica napus and Alyssum serpyllifolium, cultivated in nutrient solution at two pH levels and various PGE concentrations, was investigated using inductively coupled plasma optical emission spectrometry (ICP-OES).

P129

Interaction of the trace elements with the iron mineral in the presence of organic acids produced by plant roots

Perelomov, L.V.[1]; Violante, A.[2]
[1]Tula State University, Lenin Avenue, 92, Tula, 300600, Russia; [2]University of Naples, Italy

The sorption of Cu and Pb added alone or in mixture in the absence or presence of low molecular mass aliphatic acids (LMMAAs) produced by plant roots (oxalic, citric or glutamic) onto a goethite at different pH values was studied.

P130

Silicon and cadmium interaction in two Brassica species

Zelko, I.; Kollárová, K.; Vatehová, Z.; Kuèerová, K.; Kákoniová, D.; Lišková, D.
Department of Glycobiotechnology, Institute of Chemistry, Slovak Academy of Sciences, Dúbravská cesta 9, Bratislava, 84538, Slovakia

Comparing the effect of silicon and cadmium on two Brassica species, Zelko et al. demonstrated positive effect of Si on growth and Cd translocation from root to shoot in Cd treated plants. Based on further results B. napus seems to be more suitable for Cd phytoextraction than B. juncea.

P131

Root responses after severe metal contamination: learning for phytoremediation purposes

Bandiera, M.[1]; Lucchini, P.[1]; Mosca, G.[1]; Vamerali, T.[2]
[1]Department of Agronomy, Food, Natural resources, Animals and Environment, University of Padova, Viale dell'Università 16, Legnaro - Padova, 35020, Italy; [2]Department of Environmental Sciences, University of Parma, Viale G.P. Usberti 11/A, Parma, 43100, Italy

The root system of plant species is more sensitive to soil metal pollution than shoots, and this may reduce the phytoremediation efficiency. Standardised root growth (contaminated/control) may be a suitable index of species selection for phytoremediation purposes.

P132

Poster Session 2

Thursday, June 28, 2012
13:45-15:00hrs
1.F.06

Maintaining nodal root development under stress – a key tolerance mechanism

Wissuwa, M.[1]; Impa, S.[2]; Beebout, S.[2]; Gregorio, G.[2]; Rose, M.T.[3]; Rose, TJ[4]; Pariasca-Tanaka, J.[1]
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Zinc deficiency reduces nodal root development in rice with tolerant varieties maintaining higher relative root number. We present evidence that the ability to maintain nodal root development is a key tolerance mechanism common to tolerant varieties and discuss putative genes controlling this trait.

P201

Visualizing belowground competition amongst genotypes of Oryza sativa using Positron Emission Tomography

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Non-destructive imaging involving Positron Emission Tomography uses radioactive ^{11}C, administered as $^{11}CO_2$ to leaves, to image the dynamic flow of ^{11}C-photosynthate to roots and provide quantitative measurement of root allocation and transport speed for phenotype screening of complex root systems.

P203

The widespread research on ephemeral root modules in fine root of perennial plant

Liu, B.; Lei, J.Q; Zeng, F.J.
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By exploring the pattern of variation of the lifespan characteristics of roots in arbors, shrubs, finally confirm the universal presence of ephemeral roots in perennials, and lay a theoretical foundation for the delineation of the paradigms of root classification.

P204

Hydraulic redistribution via adventitious roots of Juniperus sabina L., an evergreen shrub growing in semi-arid region

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[1]Okayama University, Post Graduate School of Environmental Science, Tsushima Naka 1-1-1, Okayama, 700-8530, Japan; [2]Okayama University, Post Graduate School of Environmental Science, Japan; 3Mie University, Japan

Juniperus sabina grows in semi-arid region by spreading decumbent stems with adventitious roots. Dye-solution-feeding experiment and sap-flow velocity measurement were conducted to determine the role of adventitious roots. Results suggested the presence of hydraulic redistribution.

P205

New clues from proton flux of root border cells exposed to aluminum and cadmium toxicity under low pH

Yu, M.; Li, X.; Wang , H.; Xiao, H.; Feng, Y.; Liu, J.; He, L.
Department of Horticulture, Foshan university, 18 Jiangwanyilu, Foshan, Guangdong, China, Foshan, 528000, China

Using Non-invasive Micro-test Technology, Yu et al. reported that Al toxicity promoted H^+ efflux from root border cells while Cd toxicity promoted H^+ influx. H^+ influx in the tip and tail of root border cells while H^+ efflux in the body suggested the polar growth of root border cells.

P206

How the hydraulic parametrisation of roots affects overall plant-soil interactions

Bechmann, M.[1]; Schneider, C.L.[2]; Hildebrandt, A.[3]
[1]Friedrich-Schiller-University Jena, Hans Knöll Str 10, Jena, 07745, Germany; [2]Helmholtz Centre for Environmental Research (UFZ), Germany; [3]Friedrich-Schiller-University Jena, Germany

Root water uptake profiles (RWUP) are governed by root properties as well as by overall root system's topology. Root length density profiles (RLDP) are unsuitable predictors for RWUP at small scales. Plant individuals that are very similar in terms of RLDP may show significantly different RWUP.

P207

The effect of contrasting fertilisation regimes on root gene expression and associated rhizosphere community composition

Tétard-Jones, C.[1]; Edwards, M.[2]; Gatehouse, A.M.R.[2]; Handley, J.A.[1]; Leifert, C.[1]; Cooper, J.[1]
[1]Agriculture, Food and Rural Development, Newcastle University, United Kingdom; [2]School of Biology, Newcastle University, United Kingdom

P208

Cluster-root formation and carboxylate release vary among Lupinus species under different phosphorus supply

Wang, X.; Pearse, S.J.; Lambers, H.
School of Plant Biology, 35 Stirling Highway, Perth, 6009, Australia

Investment of resources in cluster roots was regulated by P supply, irrespective of plant growth rate, suggesting a complex relationship.

P209

Interaction of root architectural and anatomical phenes in maize

Nord, E.A.; York, L.M.; Postma, J.A.; Lynch, J.P.
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The optimal number of crown roots in maize differed between nitrogen and phosphorus stressed plants. The extent to which cortical aerenchyma increased root length and biomass depended on crown root number. Nord et al. demonstrate interaction between these root phenes.

P210

The physiological utility of root cortical aerenchyma for efficient nitrogen acquisition in maize (Zea mays)

Saengwilai, P.[1]; Brown, K.M.[2]; Lynch, J.P.[2]
[1]Intercollege Program in Plant Biology, Pennsylvania State University, University Park, 16802, United States; [2]Horticulture, Pennsylvania State University, University Park, 16802, United States

Root cortical aerenchyma improves plant growth under nitrogen stress by decreasing root metabolic costs, enhancing soil exploration in the deep soil profile, thus allowing the plants to acquire nitrogen at greater depths.

P211

Apoplastic barriers in outer cortex of lateral roots

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Lateral roots mediate major communication with rhizosphere. The differentiation of their internal structure (including exodermis) in response to environmental conditions resemble main root axis, but is less pronounced. The state of differentiation correlates with functional properties of root.

P212

The effects of trinexapac-ethyl on cytosolic free Ca^{2+} in winter wheat root meristem

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The Institute of Plant Physiology and Genetics of the National Academy of Sciences of Ukraine, 31/17 Vasylkivska Str., Kyiv-22, UA, Kyiv, 03022, Ukraine

Cytosolic free Ca^{2+} were collected in vacuoles under trinexapac-ethyl (TE) influence. Using fluorescense dye Fluo-3 AM, we demonstrate that 10^{-6} M TE induced $[Ca^{2+}]_{cyt}$ decrease by 52%, compared to the control variant. Observed changes may be related to a GA metabolism modification.

P213

Hydraulic lift maintains shallow root conductivity during drought

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[1]Centre d'Ecologie Fonctionnelle et Evolutive, 1919, Route de Mende Cefex 5, Montpellier, 34293, France; [2]Utah State University, United States

Water redistributed to roots maintains maximum root conductivities after a significant drought period, likely by modifying xylem development, either through growth of xylem vessels or more vessels/area. This may have implications for root and plant water transport.

P214

The relationship between root cell wall properties and salt tolerance of soybean

AN, P.[1]; Inoue, T.[1]; Zheng, M.Q.[1]; Eneji, A.E.[2]; Inanaga, S.[3]
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Higher levels of pectin and uronic acid in root cell wall resulted to higher cation exchange capacity (CEC). The higher CEC may lower the pH of the apoplast and thus activate the transport processes in the membrane, which may overall enhance plant growth under saline conditions.

P216

Contribution of Cd-EDTA complexes to cadmium root uptake: a modelling and experimental approach

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Cd uptake by maize in the presence of EDTA was measured and simulated in hydroponics and in soil. Addition of EDTA dramatically decreased Cd root uptake, as complex dissociation at the rhizoplan could not compensate the Cd^{2+} chelation. Cd-EDTA complexes were absorbed according to a linear kinetics.

P218

Metabolite profiling of shoot extracts, root extracts, and root exudates of rice plant under phosphorus deficiency

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[1]Yamagata University, Wakabamachi, 1-23, Tsuruoka, 9978555, Japan; [2]Yamagata University, Japan; [3]National Agricultural Research Center for Hokkaido Region, Japan; [4]RIKEN Plant Science Center, Japan

Metabolite profiling of shoot extracts, root extracts, and root exudates of rice plant with capillary electrophoresis/time-of-flight mass spectrometry (CE-TOF MS) clarified active release of many metabolites in response to phosphorus deficiency.

P219

Lignification process during xylogenesis of Populus trichocarpa roots

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The daily development of tracheary elements in first order roots of P. trichocarpa was monitored to uncover all stages of early vessel formation. Throughout each root stage the expressions of CLS and CAD genes, which can be treated as markers of xylogenesis, were studied.

P220

Relationship between root and shoot morphological traits of seedlings in four strains of Erianthus arundinaceus

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Erianthus arundinaceus is expected as a new biomass plant, which develops very deep root system. The morphological study on the seedlings of this species indicated close relationship between the shoot and root traits. E. arundinaceus strains with thick stem performed high bleeding rate.

P221

Sucrose: a signal for formation and function of cluster roots in white lupin?

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[1]Institute of Crop Science (340h), University of Hohenheim, Germany; [2]Department of Plant Nutrition, China Agricultural University, China

Sucrose was investigated as signal in inducing cluster roots formation by artificial culture. Using sterile culture, Wang et al. demonstrates sucrose can induce cluster roots formation even under P-sufficient condition but which are not functional in organic acid exudation and PEPC activity.

P222

Root-shoot allometry of tropical forest trees determined in large-scale aeroponics

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Allometric relationships of fast- and slow-growing tropical forest trees were determined. Ceiba pentandra and Khaya anthotheca trees were grown in a large aeroponic facility that allowed access to whole root-systems. The results will contribute to the analysis of carbon balance in tropical forests.

P223

Root hydraulic conductivity and vessel structure modification with increasing soil depth of two oak species

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The vessels diameter, lumen area increased and the vessel roundness, specific number of vessels decreased from upper soil layer to 50 cm soil depth. We hypothesise that vessel structure changes on our plots are driven by freeze events in upper soil layer.

P224

Characterisation of fine root functional traits under improved pastures, native pastures and woodlands on an Alfisol

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Fine root mass density, specific fine root length and specific fine root surface area were highest under improved pastures and lowest under woodlands. Root traits suggested dominance of annual species, associated with site disturbance (Roumet et al., 2006), under improved pastures.

P225

Non-continuous root diameter distributions in perennial ryegrass (Lolium perenne L.)

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Perennial ryegrass root systems are best characterized as a summation of a series of normal distributions. The resulting dataset would consist of a series of records each containing 4 values: 1) frequency, 2) mean diameter 3) average height, and 4) average standard deviation.

P226

The role of nutrient foraging in understory shrub invasions of northeastern North America

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Nutrient foraging may contribute to the invasive success of understory shrubs by providing advantages in exploration and acquisition of nutrients. Through studies of root proliferation and 3D architecture, we investigated the foraging capabilities of shrubs in northeastern North America.

P227

The impact of soil condition and rootstocks on morphological and anatomical root traits in avocado.

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The research comprised quantitative and qualitative analyses of a mature plant root system in the field through determining the number, length and dry matter of the particular components of the root system and some traits of the anatomical structure of the different root types found.

P228

Phenological and physiological plasticity of Citrus root orders under excess salinity

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[1]French Associates Institute for Agriculture and Biotechnology of Drylands, Ben-Gurion University of the Negev, Campus Sede Boqer, Midreshet Ben Gurion, Israel; [2]French Associates Institute for Agriculture and Biotechnology of Drylands, Ben-Gurion University of the Negev, Israel

Phenotypic root traits known to influence uptake processes are modified root order-specific under salinity. The importance of root orders for water uptake changed under salinity from root tips towards higher root orders.

P229

Analyzing root structure and function of sugar beet and barley non-invasively with MRI and PET

Metzner, R.; van Dusschoten, D.; Bühler, J.; Jahnke, S.
IBG-2 Plant Sciences, Forschungzentrum Jülich, Forschungszentrum Jülich GmbH, Jülich, 52425, Germany

Development of root structure and function in soil are studied in barley and sugar beet with Magnetic Resonance Imaging and Positron Emission Tomography. Images allowed for extracting development of root geometry, spatial distribution, internal structure and carbon allocation.

P230

Modelling root water uptake based on matric flux potential and root resistance

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Root water uptake distribution over depth has been estimated from soil water matric flux potential and root density. A root resistance term was introduced in a root water extraction model, making model performance to increase, especially when contrasting conditions were present at different depths.

P232

Phosphorus uptake of different wheat genotypes intercropped with fababean in an acidic soil

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The research was to select optimal wheat genotypes to maximize phosphorus (P) uptake facilitation in intercropping with fababean through analysing the effects of root length and Olsen P test on P uptake of intercropped wheat.

P234

Root OA, water extraction, and G×E for root depth in rice under rainfed lowland conditions

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This paper examines rice root osmotic adjustment, root traits and water extraction, G×E for root depth, and consequences for adaptation. Root OA was lower in CT9993 than IR62266. DHL differed in water extraction. G×E was complex, so different root traits are needed for different environments.

P235

An approach for the improvement of root aerenchyma formation in wheat by genetic transformation

Kawaguchi, K.[1]; Abe, F.[1]; Haque, Md. E.[1]; Mori, M.[1]; Oyanagi, A.1; Omori, F.[2]; Mano, Y[2]; Abiko, T.[3]; Obara, M.[3]; Yamauchi, T.[3]; Takahashi, H.[4]; Nakazono, M.[4]
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We are now trying to improve root characters of wheat by means of genetic transformation. There is an advantage of transgenic approach to investigate the complex characters, waterlogging tolerance in wheat.

P238

The Effects of Anthropogenic Nitrogen Deposition on the Ecological Functionality of Ectomycorrhizal Fungi

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P244

Underground hyphal network in agricultural soils is important for growth and nutrient uptake by plants

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Using the rotating tube method, Zhang et al., was able to demonstrate that underground hyphal network is critical for seedling growth and nutrient uptake in agricultural soils.

P245

Characterization of a Cytosolic Peroxiredoxin Induced by Meloidogyne hapla Infection in Tomato Roots

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Peroxiredoxins are ubiquitous thiol-dependent peroxidases. Maheux et al. cloned and characterized a cytosolic peroxiredoxin. They show this enzyme detoxifies hydrogen peroxide in vitro and is up-regulated by nematode infection in tomato roots.

P246

Rhizobacteria can control Criconemoides xenoplax

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[1]Phytossanity, Universidade Federal de Pelotas, DFs/FAEM - Universidade Federal de Pelotas, Pelotas, 96010-970, Brazil; [2]Embrapa CPACT, Pelotas, Brazil

Search for bacteria to control C. xenoplax was carried out by in vivo. Most bacteria reduced the reproduction factor. They resulted in 50 to 75% of reduction. Surprisingly the best treatments were isolated from onion seed (DFs306), from Tagetis sp. rhizosphere (DFs1341) and from buck soil (DFs886).

P247

Rice/nematode interactions using association mapping

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Institute of Biological and Environmental Sciences, University of Aberdeen, Aberdeen, United Kingdom

The studies revealed a significant variation in the distribution of the alleles within five rice subpopulations and also revealed a significant variation between cultivars for number of nematode galls formed upon infection.

P248

Gas Exchange and Stomatal Response of Root Parasitic Weed Striga hermonthica and Sorghum under Water Stress

Inoue, T.[1]; Yamauchi, Y.[2]; Eltyeb, A.A.[3]; Samejima, H.[2]; Babiker, A.G.T.[3]; Sugimoto, Y.[2]

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Root parasitic weed S. hermonthica maintained higher transpiration rate and greater stomatal aperture on both surfaces of the leaf than its sorghum host under soil water stress, which may result in maintaining water and solute transfer from the host to the parasite.

P249

Rhizosphere effects on soil microbial activity

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Microbial activity in the rhizosphere is profiled using the MicroResp™ and we show that the method is capable of identifying cultivar differences in rhizosphere respiration and differences between rhizosphere and bulk soil.

P250

Interaction between AM fungus and PSB from competition to facilitation on plant P uptake

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We used different inorganic P content soil to find that AM fungus and PSB had facilitation effect on plant P uptake only when the soil P was proper. In a P limited soil, PSB could compete P with AM fungus.

P251

The role of reactive oxygen species during Gluconacetobacter diazotrophicus–rice interaction

Alqueres, S.[1]; Rothballer, M.[1]; Menezes, C.[2]; Martins, O.B.[3]; Baldani, J.I.[2]; Schmid, M.[1]; Hartmann, A.[1]

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Alqueres et al. shows that ROS are produced at early stages of rice infection by endophytic bacteria - a typical response against avirulent pathogens, and that the ability of the bacteria to cope with this challenge is essential for the establishment of a successful interaction.

P253

Variation of phosphorus (P) efficiencies and mycorrhizal dependence of maize cultivars bred in different years

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Mycorrhizal dependencies were found to be generally lower in landraces than those of single cross hybrids but higher in low P efficiency cultivars than those of high P efficiency cultivars.

P254

Characterization of plant growth promoting Rhizobacteria associated with wheat from saline soil

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The inoculation with the PGPR isolate HM1, Pseudomonas fluorescens and B. polymyxa significantly alleviated the deleterious effects of salinity stress and leaf rust disease on wheat cultivar Giza-139.

P255

The effect of strain and concentration of Azotobacter on growth index of root in durum wheat cultivars

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Information obtained from this study show that the roots of durum wheat Respond differently to different levels of concentration and type of strains of Azotobacter. The optimum levels for the inoculum to roots due to the cultivars of strains of bacteria are determined.

P256

Metal accumulation and root distributions of Silene vulgaris (Moench) Garcke growth in artificially polluted soils

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An experiment was conducted in two soils to understand root distribution and metal accumulations of Silene vulgaris. Most of the metal that was taken up was accumulated in roots, followed by rhizomes, and strongly affected by metal and soil characteristics.

P258

Bioavailability of zinc and phosphorus in calcareous soils: Influence of citrate exudation

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Cluster root formation and citrate exudation is not a multiple stress response of white lupin at low zinc and phosphorus bioavailability in calcareous soils. However, exuded citrate triggered by low phosphorus supply can, dependent on the type of soil, mobilize Zn from a calcareous soil.

P259

Photosynthesis effect on nitrous oxide fluxes from the soil-rhizosphere continuum of beech and ash

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Plants influence greenhouse gas fluxes from soils by changing conditions in the soil. Biogeochemicals influence microbial production and consumption from GHG gases in soils. We tested if ash and beech differ in their influence and the response of photosynthesis activity on rhizosphere net GHG fluxes.

P260

Rhizospheric phosphatase activity of grassland poaceae grown under contrasting water and phosphorus supply

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Functional trait measurements on grass roots allowed us to identify species displaying capture or conservation strategies for resource acquisition. With contrasting P and water availability these species display significantly different root phosphatase activity.

P261

Root morphology plasticity determines crop fitness in competition for phosphorus between species in intercropping system

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Root architecture is important in phosphorus acquisition by plants. Using two greenhouse studies, Zhang et al. demonstrate that the difference in root morphology plasticity determine crop fitness in competition for phosphorus between species in intercropping system.

P262

Effects of long-term tillage and mineral P fertilization on AMF development and community structure

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Tillage and P fertilization stimulated AMF sporulation, reduced AMF hyphal growth and species richness, and caused a shift in AMF community structure, and these agricultural practices induced changes in AMF that could be partly explained by their effects on soil properties.

P263

pH modulation in successful infection of host by mycorrhizal and pathogenic fungi

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Institute of Dendrology, Polish Academy of Sciences, ul. Parkowa 5, Kornik, 62-035, Poland

Pathogen caused pH acidification in symplast and apoplast of P. sylvestris cell and accumulation of H_2O_2 and O_2^-. Mycorhizal fungus, however, evoke symplast alkalization and weaker apoplast alkalization and increase in H_2O_2 production at later stage of incubation.

P265

Fungal mechanisms in phosphate solubilization

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Phosphorus (P) is an essential nutrient for plant development; deficiencies in soil P limit agricultural crop yields worldwide. This research examines fungal mechanisms of phosphate solubilization from sparingly-soluble P sources and shows that soil fungi may be beneficial to plant acquisition of P.

P266

Biodiversity of ectomycorrhiza types with different nitrogen load on three larch species grown under two phosphorus levels

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We evaluated the biodiversity of ectomycorrhiza infected with three Larix species, including newly developed hybrid, grown in immature volcanic ash with different levels of fertilization. Ectomycorrhiza diversity was significantly different among the three species, and affected by fertilization.

P267

Quantification of fungal hyphae in soil - a new method

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Fungi are the main degraders of organic matter. To quantify hyphae in soil, Børja et al. used nylon nets vertically inserted into the soil to immobilize the hyphae and developed a system for automatic image analysis and determination of the hyphal mat area.

P268

Chlorophyll fluorescence to evaluate the effect of the combination PGPR and Rhizobium in bean plants

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The chlorophyll fluorescence was used to identify growth promotion by PGPR used alone or with irhizobia. The performance index, identified behavior for the double treatments in relationship to Semia4077. The best treatments increased the maximum quantum yield of electron transport.

P269

Community structures in Rhizospheres of Arabidopsis thaliana

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Composition of bacterial and fungal community is highly diverse. With the help of different accession lines of Arabidopsis thaliana we try to identify microbial community structures by using multi-tag targeted high throughput pyrosequencing.

P270

Mycorrhizal diversity and fine root growth of beech seedling growing under different temperature conditions

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Results of root growth, analyzed using Rootfly, confirmed the influence of soil temperature on growth and development of plant roots. Phylogenetic analysis of Scleroderma sp. did not provide species identification due to a possible miss-identification of GenBank data sources.

P271

Post-fire Restoration of Soil Hydrology and Wildland Vegetation using Surfactant Seed Coating Technology

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A novel surfactant seed coating technology (SSC) was developed that increases, percolation and water retention in water repellent soils. For two bunchgrass species used in post-wildfire restoration, mean survival was increased from 0.75% (untreated) to 37% for SSC. This technology is a promising strategy for post-fire restoration success.

P272

Variation in dry matter production and root branching ability under drought stress condition

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Cypress, Tainung67, LTH and N22 had better shallow root branching ability then Nipponbare and FR13 A under mild drought stress conditions in a shallow soil layer. The branching ability should have been expressed by maintenance of each nodal root elongation, promoting lateral root development.

P273

Can a root pressure probe measure the hydraulic resistance of root, soil, and their interface?

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How to measure the hydraulic resistance of roots, soil, and their interface? Combining a root pressure probe and neutron radiography, Kim et al. measured the hydraulic resistance of the whole system and tried to quantify the contribution of each components.

P274

Ecosystem services provided by plant root carbon combined with soil drying and wetting

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Plant root exudates strengthen and preserve soil aggregates and increase soil C sequestration while reducing respiration during multiple drying and wetting cycles. Increased dissolved organic carbon alters the abundance of unique microbial ribotypes within internal regions of aggregates.

P275

Field evaluation of the plasticity in root system development under various intensities of drought stress in rice

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Among OryzaSNP pane, greater plasticity in root system development was shown in Cypress, Tainung67, LTH and N22, which was triggered particularly under mild drought stress and expressed in lateral roots. Such plasticity was found to largely determine the dry matter production.

P276

Modeling of root water uptake responses in relation to soil water content

Huber, K.[1]; Vanderborght, J.[1]; Javaux, M.[1]; Schroeder, N.[2]; Vereecken, H.[1]
[1]Agrosphere Institute, Forschungszentrum Julich, Germany; [2]Julich Supercomputing Centre, Forschungszentrum Julich, Germany

Two different responses of root water uptake towards soil water content status are being explored using a 3D model that concurrently simulates water flow in soil and root system.

P277

Water and phosphorus stress: contrasting effects on root functional traits and between grass functional groups

Fort , F.; Jouany, C.; Cruz, P.
INRA, BP 52627, Castanet-Tolosan, 31326, France

Root resources acquisition strategies are defined with functional traits. However traits respond differently to water and phosphorus stress and the magnitude of the response depends on the plant's functional group. Grass species develop different root strategies to cope with P and water stress.

P278

Root system characterization in sweet sorghum and maize using two different methodologies

Zegada-Lizarazu, W.[1]; Alessandro, Z.[2]; Andrea, M.[2]
[1]Department of Agroenvironmental Science and Technology, University of Bologna, 44, Viale G. Fanin, Bologna, 40127, Bologna, 40127, Italy; [2]Department of Agroenvironmental Science and Technology, University of Bologna, Italy

A fast and relatively easy method to estimate root biomass and function from pictures taken in rhizotrons was developed for two main cereals. Significant and positive correlations were found.

P279

A novel image analysis toolbox enabling quantitative analysis of root system architecture

Lobet, G.[1]; Pagès, L.[2]; Draye, X.[1]
[1]Earth and Life Institute, Université Catholique de Louvain, Croix du Sud, 2 - L7-05-11, Louvain-la-Neuve, 1348, Belgium; [2]Plantes et Systèmes de Culture Horticoles, INRA Avignon, France

We present here a novel, semi-automated image analysis software to streamline the quantitative analysis of root growth and architecture of complex root systems. The software combines a vectorial representation of root objects with a powerful tracing algorithm.

P280

Imaging and characterization of crop root systems using electrical impedance tomography: A feasibility study

Weigand, M.[1]; Pfeifer, J.[2]; Nagel, K.A.[2]; Zimmermann, E.[3]; Walter, A.[4]; Kemna, A.[1]

[1]Applied Geophysics, University of Bonn, Nussallee 8, Bonn, 53115, Germany; [2]Plant Sciences (IBG-2), Forschungszentrum Jülich, Jülich, 52428, Germany; [3]Central Institute for Electronics (ZEL), Forschungszentrum Jülich, Jülich, 52428, Germany; [4]Institute of Agricultural Sciences, ETH Zürich, Zürich, 8092, Switzerland

Weigand et al. present a feasibility study on using electrical impedance tomography as a non-destructive tool for characterizing root growth and function in rhizotrons. They find that root systems can be spatially delineated and that electrical polarization depends on root mass and activity.

P281

Nitric oxide promotes plant lateral root formation: a hypothetic mechanism

Wu, C.[1]; Liu, L.[2]

[1]College of Horticulture & Gardenology, Yangtze University, 88 Jingmi Rd, Jingzhou, 434025, China; [2]Yangtze University, China

P282

Poster Session 2

Thursday, June 28, 2012
13:45-15:00hrs
1.F.01

Radial force development during root growth measured by photoelasticity

Kolb, E.[1]; Hartmann, C.[2]; Genet, P.[3]
[1]PMMH ESPCI – CNRS UMR 7636, 10 rue Vauquelin, Paris, 75231 Paris Cedex 5, France; [2]IRD - UMR 211 'BIOEMCO', 46 rue d'Ulm, Paris, 75230 Paris cedex 05, France; [3]UPMC Paris 6 – CNRS UMR 7618, 46 rue d'Ulm, Paris, 75230 Paris cedex 05, France

Root growth inside a pore of size comparable to radicle's diameter was observed by time-lapse imaging and radial forces measured by photoelasticimetry. The constriction did not reduce roots' axial growth while radial forces were still increasing with time with no force levelling even after 5 days.

P285

Root Anchorage: predicting and measuring soil-root interaction during uprooting

Duckett, N.
Civil/Geotechnical Engineering, University of Dundee, Nethergate, Dundee, DD1 4HN, United Kingdom

A novel calculation model, which combines numerical modelling and foundation design techniques with laboratory testing and PIV analysis, is proposed for quantifying and predicting the response of a root system to uprooting, the simplest form of root anchorage failure.

P286

Root-length densities of spring wheat (Triticum aestivum L.) and mallow (Malva sylvestris L.) in subsoil biopores

Perkons, U.; Kautz, T.; Köpke, U.
Institute of Organic Agriculture, University of Bonn, Katzenburgweg 3, 53115 Bonn, Germany

In the subsoil tap roots of mallow showed a higher percentage of root growth in biopores than fibrous wheat roots. It is therefore concluded that the relevance of biopores in the subsoil for facilitating root growth might depend on the specific characteristics of the root system.

P287

Root development in relation with soil strength and macroporosity; study case of a cultivated sandy soil.

Hartmann, C.[1]; Lecoq, L.E.[2]; Maeght, J.L.[2]; Pierret, A.[2]; Sipaseuth, N.[3]; Sengtaheuanghoung, O.[3]; Noble, A.D.[4]; Jaillard, B.[5]
[1]IRD (Institut de Recherche pour le Dévelopement), 32 rue Varagnat, Bondy, 93143, France; [2]IRD, Lao People's Democratic Republic; [3]NAFRI, Lao People's Democratic Republic; [4]IWMI, Lao People's Democratic Republic; [5]INRA, France

Root system extension depends on soil strength and porosity. Relative importance of these two factors was studied experimentally. Increased root development was indeed obtained by hardpan softening but fragmentation was more efficient. Both treatments also affected carbon allocation to root system.

P288

CT-assisted analysis of biopores and their influence on root growth (and root dynamics)

Blaser, S.[1]; Koebernick, N.[1]; Weller, U.[1]; Vetterlein, D.[1]; Vogel, H.J.[1]; Jahn, R.[2]
[1]Soil Physics, Helmholtz Zentrum für Umweltforschung - UFZ, Theodor-Lieser-Straße 4, Halle (Saale), 06120, Germany; [2]Institut für Agrar- und Ernährungswissenschaften, Martin-Luther-Universität Halle-Wittenberg, Von-Seckendorff-Platz 3, Halle (Saale), 06120, Germany

Biopores (BPs) are large continuous pores, developed and maintained mainly by roots or earthworms. X-ray tomography enables non-destructive imaging and analyzing of BPs. First results show that roots respond to the presence of BP and show preferential growth and fast elongation within these pores.

P289

Maize growth and development as affected by tillage systems under Mediterranean conditions

Ozpinar, S.[1]; Ozpinar, A.[2]
[1]Farm Machinery, Çanakkale Onsekiz Mart University, College of Agriculture, Çanakkale, 1720, Turkey; [2]Plant Protection, Çanakkale Onsekiz Mart University, College of Agriculture, Çanakkale, 1720, Turkey

Rototiller significantly improved crop growth after for maize. Much of root dry matter in all tillage is determined at topsoil followed by 10 to 20 cm and 20 to 30 cm. The lowest root was found for plough at the 20 to 30 cm depth. Tillage had no significant effect on biomass and crop growth rate, except the initial growing stage.

P290

Root architecture of two sorghum varieties differ than drought stress tolerance

Sine, B.[1]; Muller, B.[2]
[1]Centre d'Etude Régional pour l'Amélioration de l'Adaptation à la Sécheresse (CERAAS), Thiès Escale, Thiès, 3320, Senegal; [2]CIRAD, Avenue Agropolis, Montpellier, 34398, Senegal

Adventitious roots number, adventitious roots ranks number, and root length density could constitute for sorghum pertinent and easily accessible drought stress tolerance criterions.

P293

Effects of soil frost on fine root growth and longevity

Repo, T.[1]; Heinonen, J.[1]; Lavigné, A.[2]; Roitto, M.[1]; Koljonen, E.[1]; Sutinen, S.[1]; Finér, L.[1]
[1]Finnish Forest Research Institute, Yliopistokatu 6, Joensuu, 80101, Finland; [2]AgroParisTech/INRA, UMR 518 AgroParisTech/INRA MIA, Paris, France

Short root growth and longevity of Norway spruce was studied in a 50-years old stand with different soil frost treatments. Root growth was impaired by delayed soil thawing but seemed to recover after the treatments. Median root longevity ranged from 301 to 333 days depending on the treatment.

P294

Root recovery in two blackcurrant cultivars after a period of drying out

Čerekovič, N.[1]; Koefoed Petersen, K.[1]; Lakkenborg Kristensen, H.[1]; Brennan, R.[2]
[1]Department of Food Science, Aarhus University, Faculty of Science and Technology, Kirstinebjergvej 10, Aarslev, DK-5792, Denmark; [2]Cell and Molecular Sciences, The James Hutton Institute, Invergowrie Dundee, DD2 5DA, United Kingdom

Climate changes may become a limiting factor in blackcurrant production due to periods of drought stress during flowering.Two blackcurrant cultivars were found to differ in root recovery and growth of aerial parts after twelve days with no irrigation by Čerekovič et al..

P295

Drought Impact on Root Growth and Tracheid Structure in Norway Spruce (Picea abies (L.) Karst.)

Eldhuset, T.D.[1]; Børja, I.[1]; Gebauer, R.[2]; Krokene, P.[1]; Nagy, N.E.[1]; Volarik, D.[2]
[1]Norwegian Forest and Landscape Institute, P.O. Box 115, Ås, NO-1431, Norway; [2]Institute of Forest Botany, Dendrology and Geobiocenology, Mendel University in Brno, Zemedelska 3, Brno, CZ-61300, Czech Republic

Climate change is expected to increase drought-related stress and mortality in forest trees. Eldhuset et al. demonstrate that in Norway spruce fine roots, development of ellipsoid tracheids, increased rooting depth and changed morphology are mechanisms to adapt to drought treatment.

P296

Impact of winter and spring flooding on the silver and pubescent birch seedlings

Wang, A.F.[1]; Roitto, M.[1]; Lehto, T.[2]; Repo, T.[1]
[1]Finnish Forest Research Institute, Joensuu Unit, Finland, Metla, PO Box 68, FI-80101, Joensuu, Finland; [2]School of Forest Sciences, University of Eastern Finland, PO Box 111, Joensuu, FI-80101, Finland

With global climate change, winter and spring flooding increased in Northern Europe. Spring flood in growth chamber experiment had clear effects on the growth of leaves and roots in birch seedlings. Silver and pubescent birch had different respond to winter and spring flooding.

P298

Short-Term effects of a hypoxic hydroponic solution on gas exchange and root respiration of two Prunus rootstocks

Toro , G.[1]; Salazar, C.[1]; Pino, M.T.[2]; Pinto, M.[3]
1CEAF, Chile; 2INIA, Chile; 3CEAF, Av. Salamaca s/n, Rancagua, Chile

Hypoxia stress decreases the root respiration, that has a very dramatic effect on photosynthetically parameters, but tolerance rootstock maintains the root respiration for more time.

P299

Future lies beneath: Introgression of rice root QTLs, water use efficiency, grain yield for durable drought tolerance

Haradari, C.[1]; Hittalmani, S.[2]
[1]Genetics and Plant Breeding, UAS, GKVK, BANGALORE-65, Dept of GPB, UAS, GKVK, Bangalore, 560065, India; [2]Genetics and Plant Breeding, University of Agricultural Sciences, College of Agriculture, GKVK, Bangalore, 560065, India

QTLs conferring root traits, water use efficiency and grain yield were introgressed using SSR markers and evaluated under moisture stress conditions to derive durable drought tolerant genotypes in rice. QTLs on chromosome 1 and 7 (1+7) performed superior than 3 and 4 QTL combinations.

P300

Root responses of seven perennial forage species under severe soil drought

Zwicke, M.[1]; Bertrand, A.[2]; Prud'homme, M.P.[2]; Volaire, F.[3]; Picon-Cochard, C.[4]
[1]INRA-UREP, 234 avenue du Brezet, Clermont Ferrand, 63000, France; [2]UMR INRA-UCBN 950 EVA, France; [3]UMR CEFE-CNRS-INRA-SupAgro, France; 4INRA-UREP, France

Drought resistance and survival were studied for seven forage species which exhibited contrasted roots systems with contrasted survival rate. Relationships between survival, SWC, root depth and distribution will be presented to characterise plant survival strategies.

P302

Effects of nitrogen deposition combined with phosphorus deficiency on fine-root growth of three larch species

Mao, Q.Z.[1]; Watanabe, M.[2]; Wang, X.N.[1]; Koyama, A.[3]; Kita, K.[4]; Koike, T.[2]
[1]Graduate School of Agriculture, Hokkaido University, Japan; [2]Research Faculty of Agriculture, Hokkaido University, Japan; [3]Natural Resource Ecology Laboratory, Colorado State University, United States; [4] Hokkaido Forestry Research Institute, Japan

We investigated increased nitrogen deposition on the development of larches grown in soils derived from volcanic ash with phosphorus deficiency. New in-growth core methods were applied to monitor the root development. Nitrogen decreased root vertical elongations and influenced fine root dynamics.

P303

Characterization, suitability evaluation and management of ultisols for root crop production in southern Nigeria

Aruleba, J.; Ajayi, A.S.
Crop, Soil & Environmental Sciences, Ekiti State University, Iworoko Road, Ado Ekiti, +234, Nigeria

A detailed soil survey of about 100ha of Ultisols in derived Savanna region of South Western Nigeria was carried out. The soils were found to be marginaly suitable for the crops (yam, sweet potato, cassava, cocoyam etc.) that are commonly grown in the area.

P304

Responses of Scots pine roots to wintertime flooding

Roitto, M.[1]; Wang, A.W.[1]; Sutinen, S.[1]; Lehto, T.[2]; Repo, T.[1]
[1]Finnish Forest Research Institute METLA, P.O. BOX 68, Joensuu, FI-80101, Finland; [2]School of Forest Sciences, University of Eastern Finland, P.O Box 111, Joensuu, FI-80101, Finland

Fooding in winter did not adversely affect fine root biomass of Scots pine in the following growing season.

P306

Changes in root system of 4 potato genotypes among 4 years and 2 soil water conditions

Deguchi, T.[1]; Wangchuk, P.[2]; Itoh, E.[3]; Naya, T.[3]; Furukawa, K.[3]; Matsumoto, M.[3]; Kobayashi, T.[3]; Iwama, K.[3]
[1]Research Faculty of Agriculture, Hokkaido University, Hokkaido University, N9W9 Kitaku, Sapporo, 0608589, Japan; [2]Renewable Natural Resources Research and Development Centre, Wengkhar, Mongar, Bhutan; [3]Hokkaido University, Japan

Effects of climate and soil water conditions on potato root system were analyzed using data of root system for 4 years under irrigated and droughted fields. Drought, heat stress and delay of planting strongly affected root system, but effects of GxE interaction was not significant or small.

P307

Root growth and respiration of a perennial grassland subjected to future climate change and extreme event

Picon-Cochard, C.[1]; Augusti, A.[2]; Bahn, M.[3]; Roy, J.[4]
[1]INRA, 234 avenue du Brézet, Clermont-Ferrand, 63100, France; [2]CNR, Porano, Italy; [3]University of Innsbruck, Innsbruck, Austria; 4Ecotron, CNRS, Montferrier-sur-Lez, France

The aim of this work was to test the hypothesis that elevated CO_2, combined with air warming, may alleviate the negative effect of a severe soil drought. Our results show that elevated CO_2 promoted new root growth under severe soil drought, response that is essential for plant recovery.

P308

ROOTOPOWER: Empowering root-targeted strategies to minimize abiotic stress impacts on horticultural crops

Pérez-Alfocea, Francisco[1]; Asins, M.J.[2]; Thompson, A.J.[3]; Declerck, S[4]; Rubion, F[1]; Topcu, S[5]; Ghanem, M.E.[1]; Dodd, I[6]
[1]Consejo Superior de Investigaciones Científicas, Murcia, Spain; [2]Instituto Valenciano de Investigaciones Agrarias, Valencia, Spain; [3]Cranfield University, United Kingdom; [4]Université catholique de Louvain, Louvain-le-Neuve, Belgium; [5]Cukurova University, Adana, Turkey; [6]Lancaster Environment Centre, Lancaster University, Lancaster, United Kingdom

Using recombinant inbred lines (from wild tomato relatives) and/or transgenics as rootstocks can increase crop yields (especially under abiotic stresses such as salinity and drying soil) by altering chemical root-to-shoot chemical signalling

P310

Reducing Nitrogen Leaching While Maintaining Quality Turfgrass

McMillan, M.[1]; Guertal , E.[2]; Cisar, J.[3]
[1]Aquatrols Corporation of America, Paulsboro, NJ, United States; [2]Auburn University, Auburn, United States; [3]University of Florida, Fort Lauderdale, United States

Soil surfactants are used to alleviate soil water repellency. Research in 2009 and 2010 demonstrated the use of an APG-E surfactant reduced nitrate leaching while maintaining or improving turfgrass quality. These results suggest the addition of an APG-E surfactant may have the added benefit of enhancing nitrogen efficiency.

P311

Nutrient seed priming improves seedling growth and increases grain yield of maize exposed to low root-zone temperatures

Neumann, G.[1]; Imran, M.[1]; Asim, M.[2]
[1]Institute of Crop Science (340i), University of Hohenheim, Fruhwirthstr. 20, Stuttgart, 70593, Germany; [2]Institute of Crop Science (340i), University of Hohenheim, Fruwirthstr. 20, Stuttgart, 70593, Germany

Seed priming with micronutrients (Fe, Zn+Mn) stimulated growth, micronutrient status and root development of maize seedlings at low root-zone temperature in hydroponics and in soil culture in rhizoboxes. Positive effects persisted under field conditions, resulting in yield increase of 10-15 %.

P312

Responses of Indigenous Sorghum [Sorghum bicolor L. (Moench)] Landraces to Progressive Pre-flowering Drought Stress

G.Egziabher, Y.; Fetene, M.
Plant Biology and Biodiversity Management Programme Unit, Addis Ababa University, aau.edu.et, Addis Ababa, 1048, Ethiopia

The stay green property has attracted scholars in drought stress tolerance studies but the contribution of root length density and architecture for plants adapted to grow yield using only residual moisture have been ignored.

P313

Is sorgoleone release linked to BNI function in sorghum?

Tesfamariam, T.[1]; Yoshinaga, H.[1]; Santosh, D.[2]; Hash, C.T.[2]; Subbarao, G.V.[1]

[1]Crop, Livestock & Environment, JIRCAS, 1-1 Ohwashi, Tsukuba, 305-8686, Japan; [2]Millet Breeding, ICRISAT, Patancheru, India

Sorghum genotypes showed distinct differences for sorgoleone release and BNI activity from roots. Purified sorgoleone showed strong BNI function. Genetic exploitation for sorgoleone release could be a powerful strategy to control nitrification in sorghum production systems.

P314

Wheat root ideotypes for improved resource use efficiency in reduced input agriculture

Karley, A.J.; Valentine, T.A.; Squire, G.R.; Binnie, K.; Skiba, A.K.; Doherty, S.B.

Ecological Sciences, James Hutton Institute, Invergowrie, Dundee, DD2 5DA, United Kingdom

The New Wheat Root Ideotype project aims to identify root traits as selection criteria for reduced input cropping. Ex situ characterisation of 100 wheat genotypes indicated significant genetic variation in root size and root-depth distribution that will be examined for responses to reduced inputs.

P315

Limitations of no-tillage winter wheat production with long-term glyphosate use in South-West Germany

Afzal, A.; Müller, D.; Jocher, F.; Tesfamariam, T.; Bott, S.; Römheld, V.; Neumann, G.

Institute of Crop Science (340h), University of Hohenheim, Suttgart, 70593, Germany

Delayed degradation of herbicide residues in LT no-tillage soils contributes to re-growth problems in winter wheat.

P316

Exploiting natural variation of the root architecture response to nitrate supply in Arabidopsis

De Pessemier, J.[1]; Vercautern, A.[1]; Chardon, F[1]; Vuylsteke, N.[1;] Verbruggen, N.[1].845; Hermans, C[1]

[1]Lab Plant Physiology and Molecular Genetics, Université Libre de Bruxelles, Brussels, Belgium;

P317

Root enhancement for crop improvement in barley (Hordeum vulgare L.)

Gnad, H.[1]; Ramireddy, E.[2]; Weyen, J.[3]; Schmülling, T.[2]

[1]Saaten-Union Biotec GmbH, Am Schwabeplan 6, Stadt Seeland OT Gatersleben, D-06466, Germany; [2]Institute of Biology/ Applied Genetics, Dahlem Centre of Plant Sciences (DCPS), Albrecht-Thaer-Weg 6, Berlin, D-14195, Germany; [3]Saaten-Union Biotec GmbH, Hovedisser Str. 92, Leopoldshoehe, D-33818, Germany

Cytokinins regulate cell division and are negative regulators of root growth and lateral root formation. To investigate the impact of CYTOKININ OXIDASE/ DEHYDROGENASE1 (CKX1) or CKX2 in barley, four root-specific promoters were tested. Transformation efficiencies and first results will be presented.

P318

Will improved root foraging in fertiliser bands improve crop P use efficiency?

Humphries, C.J.[1]; Simpson, R.J.[2]; Stefanski, A.[2]; Culvenor, R.A.[2]; Richardson, A.E.[2]; Nicolas, M.E.[1]

[1]Food and Land Research, The University of Melbourne, Parkville, 3052, Australia; [2]CSIRO Sustainable Agriculture Flagship / CSIRO Plant Industry, GPO Box 1600, Canberra, 2601, Australia

Root growth by wheat in fertiliser bands was manipulated to assess whether increased root foraging will lead to improved uptake of fertiliser P from soil where crop P-balance efficiency is typically only 50%. It is concluded that root length growth in fertiliser bands did not limit P uptake.

P319

Interactive effects of elevated atmospheric CO_2 and waterlogging on vegetative growth of soybean (Glycine max)

Shimono, H.[1]; Konno, T.[2]; Hidemitsu, S.[3]; Sameshima, R.[4]

[1]Fac. Agric., Iwate Univ., 3-18-8, Ueda, Morioka, 020-8550, Japan; [2]Iwate Univ., Japan; 3NIAES, Japan; 4NARCT, Japan

A hypothesis that elevated CO_2 could alleviate the damage caused by waterlogging, was tested using vegetative growth of soybean in 10 experiments conducted at two locations in three years. The results rejected our hypothesis.

P320

Practical experience with instrumental measurements of root systems in large trees and forest stands

Cermák, J.; Nadezhdina, N.; Simon, J.
Mendel Univ. Brno, Czech Republic

P321

Screening and evaluation of contrasting rice varieties for growth and phosphorus acquisition in phosphorus-limiting soil

Al-Ogaidi, F.; Standing, D.; Price, A.H.
University of Aberdeen, Cruickshank Building, Aberdeen, AB24 3UU, United Kingdom

Using subsoil/sand mix plus nutrient solution with or without Phosphorus revealed that genotypes interact differently with treatments. Cultivars used were assessed for root traits in rhizotrons. Comparisons do not suggest that root architecture traits strongly affect plant growth in this experiment.

P322

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Key to presentation codes

Presentation code	Day	Room	Description
PLK	Tuesday, Wednesday, Thursday, Friday	Lecture Theatre 3	PLenary Keynote lectures
PL1	Tuesday	Lecture Theatre 3	PLenary session 1 lectures
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SKN1 & SS1	Tuesday afternoon	Lecture Theatres 3, 4, 2	Split Session 1 KeyNote & Split Session 1
SKN2 & SS2	Wednesday morning	Lecture Theatre 3,4 & 2	Split Session 2 KeyNote & Split Session 2
SKN4 & SS4	Wednesday afternoon	Lecture Theatre 3,4 & 2	Split Session 3 KeyNote & Split Session 3
SKN4 & SS4	Thursday morning	Lecture Theatre 3,4 & 2	Split Session 4 KeyNote & Split Session 4
SKN5 & SS5	Thursday afternoon	Lecture Theatre 3,4 & 2	Split Session 5 KeyNote & Split Session 5
EM	Thursday afternoon	Lecture Theatre 2	Emerging Methods
TP01-26	Wednesday afternoon & Thursday	Lecture Theatre 2	"Talking Posters" short spoken presentations
TP01-26	Tuesday-Friday	1.F06	"Talking Posters" on display
P001-P083	Tuesday afternoon	1.F06	Poster session 1
P084-P132	Tuesday afternoon	1.F01	Poster session 1
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P285-P323	Thursday afternoon	1.F01	Poster session 2

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