

Scotland's Rural College

Multi-criteria assessment of integrating legumes into cropping systems across Europe

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Print publication: 03/09/2021

Document Version

Publisher's PDF, also known as Version of record

[Link to publication](#)

Citation for published version (APA):

Notz, I., Alves, S., Haase, T., Hargreaves, PR., Hennessy, M., Iantcheva, A., Recknagel, J., Rittler, L., Schuler, J., Topp, CFE., Vasiljevic, M., Wolf, F., & Reckling, M. (2021). *Multi-criteria assessment of integrating legumes into cropping systems across Europe*. Paper presented at Legume Science and Practice 2.

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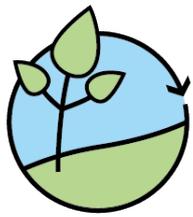
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ASSOCIATION OF APPLIED BIOLOGISTS

President: Professor Christine Foyer



Legumes
Translated

aab

ASSOCIATION OF APPLIED BIOLOGISTS
Cropping and the Environment Group

eso

ÉCOLE SUPÉRIEURE
D'AGRICULTURES
Angers Loire

Legume Science and Practice 2

A three day virtual conference

on 1st-3rd September 2021



FINAL PROGRAMME

Association of Applied Biologists, Warwick Enterprise Park, Wellesbourne, Warwick CV35 9EF, UK
Registered Charity No. 275655; <http://www.aab.org.uk>
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Legume Science and Practice 2

1st-3rd September 2021

(9 BASIS Points have been awarded as follows: 3CP, 3E and 3PN)

Legumes have the potential to play a substantial role in sustainable agriculture, as a resource for pollinators and birds, in intercropping regimes, providing break crops in rotations, enhancing soil nitrogen levels, accessing soil phosphorous and promoting soil biodiversity. The overall GHG emissions associated with legume foods are low whilst products are highly nutritious and many raw legumes products can be readily stored for long periods without spoilage. As such their role in sustainable food production and security is growing.

This is the second Legumes conference organised by the AAB ‘**Cropping And The Environment (CATE)**’ specialist group. We have brought together delegates from a broad spectrum of disciplines to explore the role of legumes in sustainable agriculture, with an emphasis on ecosystem service. This is an extremely international event and we are delighted to host an entire day of talks on ‘Legumes in Africa’.

Excitingly, a special issue of ‘*Annals of Applied Biology*’ will be associated with this event. Offers of review, research or opinion papers are encouraged for publication in the January 2022 edition of *Annals*. This issue will be free-to-access so will maximise the visibility of your research. This edition will be guest-edited by experts, such as Kairsty Topp (SRUC, Edinburgh, UK), Christine Watson (SRUC, Aberdeen, UK) and Joëlle Fustec (USC LEVA, ESA, INRAE, France). Submissions are required by mid-September 2021 (Please highlight your submissions as ‘Legumes 2 Conference Paper’) <https://mc.manuscriptcentral.com/aab>

Meeting Virtual Access

The zoom ink for the entire meeting is shown below. Each session will be chaired by a member of the organising committee or an invited guest. If you have any questions please use **Chat box**. The session chair will select questions to ask the speakers. Please use the personal chat option to communicate with other meeting delegates. We are hosting 30minute open discussion sessions at the end of Day 1 and Day 2. These will take place in a different Zoom meeting so please join that link if you would like to discuss anything with poster presenters or other delegates.

Main Meeting Zoom link:

<https://us02web.zoom.us/j/83861300556?pwd=Wk9uSnMrbGxL0DR2LzQ1Y3FVVL1M3Zz09>

Parallel Session 4B Zoom link:

<https://us02web.zoom.us/j/86050919007?pwd=ZU5hSzdUc1FLK0ZBVC9WdGRwVEFSQT09>

Day 1 Discussion Session (17:00 BST)

<https://us02web.zoom.us/j/86050919007?pwd=ZU5hSzdUc1FLK0ZBVC9WdGRwVEFSQT09>

Day 2 Discussion Session (15:30 BST)

<https://us02web.zoom.us/j/85642431158?pwd=ejRLVktEaktKUHU5RGRwWTd3b0hCQT09>

WEDNESDAY 1st SEPTEMBER 2021

All times in BST (CET -1^{hr})

09:50 **WELCOME and INTRODUCTION**

JOËLLE FUSTEC (Ecole Supérieure d'Agricultures, Angers, France)

Session 1: Legume market in Europe and knowledge transfer

CHAIR: JOËLLE FUSTEC (Ecole Supérieure d'Agricultures, Angers, France)

10:00 **Terrena case study: Knowledge transfer for increasing legume surface in Western France**

BERTRAND PINEL (Terrena, France)

10:25 **Markets and price indicators of peas and faba beans in the EU: Results from the H2020 LegValue Project**

BRUNO KEZEYA & **MARCUS MERGENTHALER** (Fachhochschule Südwestfalen, Soest, Germany)

10:40 **Scenarios for legume protein in European agricultural systems**

IOANNA MOURATIADOU (ISARA, Lyon, France; Leibniz Centre for Agricultural Landscape Research (ZALF), Müncheberg, Germany), HERMINE MITTER (University of Natural Resources and Life Sciences (BOKU), Vienna, Austria), EVGENIA VINOGRADOVA (Humboldt University of Berlin, Germany), SONOKO BELLINGRATH-KIMURA (Leibniz Centre for Agricultural Landscape Research (ZALF), Müncheberg, Germany; Humboldt University of Berlin, Germany; Leibniz Centre for Agricultural Landscape Research, Müncheberg, Germany), MARTIN SCHÖNHART (University of Natural Resources and Life Sciences (BOKU), Vienna, Austria), NYNKE SCHULP (Vrije Universiteit Amsterdam, Netherlands), MARK STODDARD (University of Helsinki, Finland), CHRISTINE WATSON (Scotland's Rural College (SRUC), Aberdeen, UK), & **MORITZ RECKLING** (Leibniz Centre for Agricultural Landscape Research (ZALF), Müncheberg, Germany)

Assessing the contribution of legume inclusion in crop rotations to soil health and ecosystem services: A case study

10:55 **Legumes Translated: compiling knowledge for developing legume-supported value chains**

DONAL MURPHY-BOKERN (Kroge-Ehrendorf, Lohne, Germany), **JENS DAUBER** (Johann Heinrich von Thünen Institute, Braunschweig, Germany), **LEOPOLD RITTLER**, **MATTHIAS KRÖN** (Donau Soja, Vienna, Austria), **JOHANNES SCHULER**, **HELGA WILLER** (Research Institute of Organic Agriculture (FiBL), Frick, Switzerland) & **CHRISTINE WATSON** (Scotland's Rural College (SRUC), Aberdeen, UK)



11:20 **Multi-criteria assessment of integrating legumes into cropping systems across Europe**

INKA NOTZ (Leibniz Centre for Agricultural Landscape Research (ZALF), Germany), **SHEILA ALVES** (Teagasc, Ireland), **THORSTEN HAASE** (Landesbetrieb Landwirtschaft Hessen (LLH), Germany), **PAUL HARGREAVES** (Scotland's Rural College (SRUC), UK), **MICHAEL HENNESSY** (Teagasc, Ireland), **ANELIA IANTCHEVA** (AgroBioInstitute, Bulgaria), **JÜRGEN RECKNAGEL** (Agricultural Technology Centre Augustenberg (LTZ), Germany), **LEOPOLD RITTLER** (Donau Soja, Austria), **JOHANNES SCHULER** (Leibniz Centre for Agricultural Landscape Research (ZALF), Germany), **KAIRSTY TOPP** (Scotland's Rural College (SRUC), UK), **MARJANA VASILJEVIĆ** (Institute of Field and Vegetable Crops, Serbia), **FRITZ WOLF** (Landwirtschaftlicher Beratungsdienst Schwäbisch Hall e.V., Germany) & **MORITZ RECKLING** (Leibniz Centre for Agricultural Landscape Research (ZALF), Germany)

11:35 COMFORT BREAK

Session 2: Soils, N₂ fixation

CHAIR: DONAL MURPHY-BOKERN (Kroge-Ehrendorf, Lohne, Germany)

11:45 **For an integrated strategy in ecophysiology of symbiotic nitrogen fixation and the agronomic engineering of legume ecosystemic services**

JEAN-JACQUES DREVON, J ABADIE, L AMENC, D BLAVET (INRAE Ecologie Fonctionnell & Biogéochimie des Sols & Agroécosystèmes, Montpellier, France), O DOMMERGUE (Laboratoire des Symbioses Tropicales et Méditerranéennes, Campus International de Baillarguet, Montpellier France)

12:10 **Increasing soybean productivity by inoculation with locally isolated *Bradyrhizobium* strains under cool growing conditions in Germany**

RICHARD ANSONG OMARI (Leibniz Centre for Agricultural Landscape Research (ZALF), Germany; Humboldt-University of Berlin, Germany), MORITZ RECKLING, MOSAB HALWANI (Leibniz Centre for Agricultural Landscape Research (ZALF), Germany) & SONOKO D BELLINGRATH-KIMURA (Leibniz Centre for Agricultural Landscape Research and Humboldt-University of Berlin, Germany)

12:25 **Comparing interactive effects of microbial symbionts and nutrients on biological nitrogen fixation, nutrition and yield of mung bean (*Vigna radiata*)**

ELAINE GOUGH, J P THOMPSON, R S ZWART & K J OWEN (University of Southern Queensland, Australia)

12:40 **Modelling the key role of microorganisms in C and N cycles of a cereal-legume agrosystem**

WAHID SLIMANI (High National School of Agronomy, Algiers, Algeria), DIDIER BLAVET (French National Research Institute for Sustainable Development, (IRD) Montpellier, France), HATEM IBRAHIM (University El Manar Tunis, Tunisia), GHILÈS KACI (High National School of Agronomy, Algiers, Algeria), KAREL VAN DEN MEERSCHÉ, CÉLINE BLITZ-FRAYRET (CIRAD Montpellier, France), ABDESSATAR HATIRA (University El Manar Tunis, Tunisia), FREDERIC GÉRARD, JEAN-JACQUES DREVON (French National Research Institute for Agriculture, Food and Environment (INRAE) Montpellier, France) & MARC PANSU (French National Research Institute for Sustainable Development (IRD), France)

12:55 **Symbiotic performance of indigenous soybean nodulating bradyrhizobia in European cropping systems**

MOSAB HALWANI (Leibniz Centre for Agricultural Landscape Research (ZALF), Germany; Humboldt-University of Berlin, Germany), MORITZ RECKLING (Leibniz Centre for Agricultural Landscape Research (ZALF), Germany; Swedish University of Agricultural Sciences, Uppsala, Sweden), DILFUZA EGAMBERDIEVA (Leibniz Centre for Agricultural Landscape Research (ZALF), Germany; National University of Uzbekistan, Tashkent, Uzbekistan), RICHARD ANSONG OMARI, SONOKO D BELLINGRATH-KIMURA (Leibniz Centre for Agricultural Landscape Research (ZALF), Germany; Humboldt-University of Berlin, Germany), JOHAN BACHINGER (Leibniz Centre for Agricultural Landscape Research (ZALF), Germany) & RALF BLOCH (Eberswalde University for Sustainable Development, Eberswalde, Germany)

13:10 **Recorded short talks to introduce Poster Presentations**

1. **Germination requirements to grow minor pulses in North Europe climates**
SOUKEYE GADIAGA (UniLaSalle, Mont-Saint-Aignan, France) & **ALICIA AYERDI GOTOR** (UniLaSalle, Beauvais, France)



2. **Strategies to enhance pollination in the field bean, *Vicia faba***
JAKE MOSCROP (University of Cambridge, UK), JANE THOMAS, TOM WOOD (NIAB, Cambridge, UK) & BEVERLEY GLOVER (University of Cambridge, UK)
3. **Growing field beans in ireland: A survey to assess variability in growth and development**
MUIREANN COAKLEY, PAUL PANNETIER, KEVIN MURPHY, BRENDAN REID, DERMOT FORRISTAL & **SHEILA ALVES** (Teagasc, Carlow, Ireland)



4. **Rye-vetch mixtures – their potential as multifunctional crops**
CHRISTINE WATSON, JOHN BADDELEY (SRUC, Aberdeen, UK), CAIRISTIONA TOPP (SRUC, Edinburgh, UK) & **ROBIN WALKER** (SRUC, Aberdeen, UK)
5. **Wild pollinators of lupin and faba bean in The Netherlands, and their importance for yield potential**
WILLEMIJN CUIJPERS (Louis Bolk Institute, The Netherlands), EDUARD PETER DE BOER (Bureau FaunaX, The Netherlands), JEROEN BREIDENBACH (Van Hall Larenstein University of Applied Sciences, The Netherlands), JEROEN SCHEPER (Alterra, Centre for Ecosystem Studies, Wageningen University and Research Centre, The Netherlands), MENNO REEMER (European Invertebrate Survey, Leiden, The Netherlands)
DENNIS HEUPINK and UDO PRINS (Louis Bolk Institute, The Netherlands)

13:20 **LUNCH**

Session 3: Pathogens

CHAIR: THOMAS WOOD (NIAB, Cambridge, UK)

- 14:00 **The challenge of pest and disease management in pulses.**
DIEGO RUBIALES (Institute for Sustainable Agriculture, CSIC, Córdoba, Spain)
- 14:25 **Potential for improvement of resistance to downy mildew in pea (*Pisum sativum*) and faba bean (*Vicia faba*)**
SANU ARORA (John Innes Centre, Norwich, UK), J E THOMAS, T A WOOD (NIAB, Cambridge, UK), M VIGOUROUX, J CHEEMA, B STEUERNAGEL, G ROBINSON, C MOREAU & C DOMONEY (John Innes Centre, Norwich, UK)

- 14:40 **Identification of sources of partial resistance to foot rot caused by *Fusarium* spp. in *Vicia faba***
ANNE WEBB, T A WOOD & J E THOMAS (NIAB, Cambridge, UK)
- 14:55 **Evidence that the faba bean pathogen, *Botrytis fabae*, reproduces sexually in the UK**
TOM REYNOLDS, ANNE WEBB, JANE THOMAS & THOMAS WOOD (NIAB, Cambridge, UK)
- 15:10 **Mechanisms and resistance sources of *Pisum* spp. collection against *Uromyces pisi***
SALVADOR OSUNA-CABALLERO, NICOLAS RISPAIL & DIEGO RUBIALES (Institute for Sustainable Agriculture (CSIC), Córdoba, Spain)
- 15:25 **Comparative amplicon sequencing to explore the relationship among land use history, plant health and disease management**
ASFAKUN SIDDIKA, NILOOFAR VAGHEFI, DANTE ADORADA (University of Southern Queensland, Toowoomba, Australia), KHONDOKER DASTOGEER (Tokyo University of Agriculture and Technology, Japan) & Prof GAVIN ASH (University of Southern Queensland, Toowoomba, Australia)
- 15:40 **COMFORT BREAK**

Parallel Session 4A: Physiology and Genetics

CHAIR: CHRISTINE FOYER (University of Birmingham, UK)

Both parallel sessions will be recorded and made available to all attendees on a private YouTube channel before the end of the event

- 16:00 **The importance of tertiary roots in young peas for future service legume selection**
LAURE BOEGLIN (Ecole Supérieure d'Agricultures, Angers, France), ANIS M LIMAMI (University of Angers, France) & JOËLLE FUSTEC (Ecole Supérieure d'Agricultures, Angers, France)
- 16:15 **Genetic variation for seed quality traits in pea: generating novel germplasm**
T RAYNER (John Innes Centre, Norwich, UK), P G ISAAC (IDna Genetics Ltd, Norwich, UK), R OLIAS, A CLEMENTE (Estación Experimental del Zaidín, Granada, Spain) & **CLAIRE DOMONEY** (John Innes Centre, Norwich, UK)
- 16:30 **WHIRLY family in soybean (*Glycine max*): subcellular localisation and functional diversity**
BARBARA KARPINSKA (University of Birmingham, UK), SILVANA PINHEIRO DADALTO, AMANDA BONOTO GONÇALVES (Universidade Federal do Ceará, Fortaleza, Brazil), MURILO SIQUEIRA ALVES (Universidade Federal de Viçosa, Brazil), PATRÍCIA PEREIRA FONTESA, LUCIANO GOMES FIETT (Universidade Federal do Ceará, Fortaleza, Brazil) & CHRISTINE H FOYER (University of Birmingham, UK)
- 16:45 **Genetic variation in transpiration response to vapour pressure deficit (VPD) of two faba bean (Masterpiece & Robin Hood) cultivars using different methodologies**
HEND MANDOUR, IAN C DODD & ELIZABETE CARMO-SILVA (Lancaster University, UK)
- 17:00 **A new zoom location is open for discussions**

<https://us02web.zoom.us/j/86050919007?pwd=ZU5hSzdUc1FLK0ZBVC9WdGRwVEFSQT09r>

Parallel Session 4B: Legumes in Pasture

CHAIR: GERAINT PARRY (Executive Officer, *Association of Applied Biologists*, UK)

Zoom Link for Parallel Session:

<https://us02web.zoom.us/j/86050919007?pwd=ZU5hSzdUc1FLK0ZBVC9WdGRwVEFSQT09>

Both parallel sessions will be recorded and made available to all attendees on a private YouTube channel before the end of the event

16:00 **Mixed grass-legume sward nutritional quality improvement as a result of soil liming application**
ROSE BOYKO (Scotland's Rural College, Aberdeen, Scotland; University of Aberdeen, Scotland),
ROBIN WALKER (Scotland's Rural College, Aberdeen, Scotland), **GARETH NORTON**,
GRAEME PATON (University of Aberdeen, Scotland) & **CHRISTINE WATSON** (Scotland's Rural
College, Aberdeen, Scotland)

16:15 **Multi-species grasslands stimulate productivity and resilience of a temperate crop-grassland rotation**
GUYLAIN GRANGE (Teagasc, Crop, Environment and Land Use Research Centre, Wexford,
Ireland; School of Statistics and Computer Science, Trinity College Dublin, Ireland),
CAROLINE BROPHY (School of Statistics and Computer Science, Trinity College Dublin, Ireland)
& **JOHN A FINN** (Teagasc, Crop, Environment and Land Use Research Centre, Wexford, Ireland)

16:30 **Positive legacy effect of previous legume proportion in a ley on the performance of a following crop of *Lolium multiflorum***
AARON FOX (Agroscope, Forage Production and Grassland Systems, Zürich, Switzerland; Agroscope,
Molecular Ecology, Zürich, Switzerland), **M SUTER** (Agroscope, Forage Production and Grassland
Systems, Zürich, Switzerland), **F WIDMER** (Agroscope, Molecular Ecology, Zürich, Switzerland) &
VA LÜSCHER (Agroscope, Forage Production and Grassland Systems, Zürich, Switzerland)

16:45 **¹⁵N natural abundance and ¹⁵N leaf labelling methods provide similar magnitudes of nitrogen transfer from clover to associated grass**
ANDREAS HAMMELEHLE, **JOCHEN MAYER** (Agroscope, Water Protection and Substance
Flows, Zurich, Switzerland), **ANDREAS LÜSCHER** (Agroscope, Forage Production and Grassland
Systems, Zurich, Switzerland), **PAUL MÄDER** (Research Institute of Organic Agriculture (FiBL),
Frick, Switzerland) & **ASTRID OBERSON** (ETH Zurich, Institute of Agricultural Sciences, Group of
Plant Nutrition, Lindau, Switzerland)

17:00 **A new zoom location is open for discussion**

<https://us02web.zoom.us/j/86050919007?pwd=ZU5hSzdUc1FLK0ZBVC9WdGRwVEFSQT09>

17:30 **DAY END**

THURSDAY 2nd SEPTEMBER 2021

09:50 WELCOME and INTRODUCTION

Session 5: Legumes in Africa One

CHAIR: TARIRAI MUONI (Swedish University of Agricultural Sciences, Sweden)

10:00 **Productivity and resilience merits of maize-legume rotation and intercrop systems in Eastern and Southern Africa**

ISAAH NYAGUMBO (CIMMYT, Mount Pleasant, Harare, Zimbabwe, Africa)

10:25 **Broadening farmer options through legume rotational and intercrop diversity in maize-based cropping systems of central Malawi**

CHIWIMBO P GWENAMBIRA-MWIKWA, SIEGLINDE S SNAPP (Michigan State University, USA) & **REGIS CHIKOWO** (Michigan State University, USA; University of Zimbabwe, Harare, Africa)

10:50 **Integration of tropical legume species into smallholder conservation agriculture systems of southern Africa**

CHRISTIAN THIERFELDER (CIMMYT, Mount Pleasant, Harare, Zimbabwe, Africa)

11:15 **Using functional traits to inform selection of multipurpose legumes for African smallholders**

BEN JACKSON (University of Edinburgh, UK), ERIC PATERSON (The James Hutton Institute, Dundee, UK), HANNAH COOPER, CRAIG STURROCK, SACHA MOONEY (University of Nottingham, UK), ALAN DUNCAN (University of Edinburgh, UK; International Livestock Research Institute, Nairobi, Kenya) & LIZ BAGGS (University of Edinburgh, UK)

11:30 **Biogenic amines in African locust bean (*Parkia biglobosa*) fermented seeds**

NADEGE T KONE, MICHEL Y ESSE, TAGRO GUEHI (Université Nangui, Côte d'Ivoire, West Africa), CAROLINE STRUB (Polytech Montpellier, France), NAWEL ACHIR (Institut Agro, IRC, Montpellier, France), JOEL GRABULOS, CHRISTIAN MESTRES & ELODIE ARNAUD (CIRAD Montpellier, France)

11:45 GENERAL DISCUSSION

12:00 ***Recorded short talks to introduce Poster Presentations***

Personal zoom rooms are open for discussion with poster presenters. Please ask the organisers if you would like to have a discussion with a poster presenter

6. Management of rust in faba bean by crop diversification

ÁNGEL M VILLEGAS-FERNÁNDEZ, AHMAD AMARNA (Institute for Sustainable Agriculture, CSIC, Córdoba, Spain), JUAN MORAL (University of Córdoba, Spain) & DIEGO RUBIALES (Institute for Sustainable Agriculture, CSIC, Córdoba, Spain)

7. Is the regulation of nodulation conserved between species at the cell type level?

HELEN WILKINSON & M L GIFFORD (University of Warwick, Coventry, UK)

8. Identifying the research gaps in cereal-grain legume intercropping

ROSA HOLT, CHRISTINE WATSON (SRUC, Aberdeen, UK) & CAIRISTIONA TOPP (SRUC, Edinburgh, UK)

9. **UK-grown potato bean (*Apios americana Medik*): Potential for diet diversification and revalorisation as well as suitability for larger scale production**
MADALINA NEACSU (Rowett Institute, University of Aberdeen, UK), **ROBIN WALKER** (SRUC, Aberdeen, UK), **MANDY BARBER** (Incredible Vegetables, Ashburton, Devon, UK), **MAX COLEMAN** (Royal Botanic Garden Edinburgh, UK), **CHRISTINE WATSON** (SRUC, Aberdeen, UK) & **WENDY RUSSELL** (Rowett Institute, University of Aberdeen, UK)
10. **Maximisation of production of intercropping pea/cereal crops**
CAIRISTIONA TOPP (SRUC, Edinburgh, UK), **JOHN BADDELEY** & **CHRISTINE WATSON** (SRUC, Aberdeen, UK)



12:15 LUNCH

Session 6: Legumes in Africa Two

CHAIR: CHRISTINE WATSON (SRUC, Aberdeen, UK)

- 13:30 **The Legacy of N2Africa: Putting nitrogen fixation to work for smallholder farmers in Africa**
KEN GILLER (Wageningen University & Research, The Netherlands)
- 13:55 **Rhizobial N₂-fixing efficiency is the elicitor of micronutrient accumulation in symbiotic African legumes**
FELIX DAPARE DAKORA (Tshwane University of Technology, South Africa)
- 14:10 **Panacea: Pathogenomics for enhancing food security in East Africa**
THOMAS WOOD (NIAB, Cambridge, UK), **P PAPARU** (National Crop Resources Research Institute, Kampala, Uganda), **A WEBB**, **B CORSI** & **J E THOMAS** (NIAB, Cambridge, UK)
- 14:25 **Closing the yield gaps of Ethiopian faba bean (*Vicia faba* L.) and common bean (*Phaseolus vulgaris* L.)**
KIFLEMARIAM Y BELACHEW (Department of Agricultural Sciences and Helsinki Institute of Sustainability Science, University of Helsinki, Finland; Bahir Dar University, Bahir Dar, Ethiopia; Department of Food and Nutrition, University of Helsinki, Finland), **HENRY N MAINA** (Department of Food and Nutrition, University of Helsinki, Finland) & **FREDERICK L STODDARD** (Department of Agricultural Sciences and Helsinki Institute of Sustainability Science, University of Helsinki, Finland)
- 14:40 **Development of marama bean (*Tylosema esculentum*), an orphan legume, as a crop**
CHRISTOPHER CULLIS (Case Western Reserve University, Cleveland, Ohio, USA), **KARL KUNERT**, **JUAN VORSTER** (University of Pretoria, South Africa) & **PERCY CHIMWAMUROMBE** (University of Science and Technology, Windhoek, Namibia, South West Africa)
- 14:55 **Evolution of biochemical and nutritional compounds of African locust bean (*Parkia biglobosa*) seeds during their transformation in “Soumbala” in Côte d’Ivoire**
YAVO MICHEL OLIVIER ESSE (Université Nangui, Côte d’Ivoire, West Africa; CIRAD, Institut Agro, Montpellier, France), **NAWEL ACHIR** (Institut Agro, IRC, Montpellier, France), **JOËL GRABULOS**, **GILLES MOREL**, **ERIC TARDAN**, **CHRISTIAN MESTRES** (CIRAD, Montpellier, France) & **TAGRO SIMPLICE GUEHI** (Université Nangui, Côte d’Ivoire, West Africa)

15:10 GENERAL DISCUSSION and NEXT STEPS

15:30 A new zoom location is open for discussions

<https://us02web.zoom.us/j/85642431158?pwd=ejRLVktEaktKUHU5RGRwWTd3b0hCQT09>

16:00 DAY END

FRIDAY 3rd SEPTEMBER 2021

09:50 WELCOME and INTRODUCTION

Session 7: Ecosystem services and Intercropping

CHAIR: CAIRISTIONA TOPP (SRUC, Edinburgh, UK)

10:00 **Biomass accumulation dynamic in soybean-based intercrops: effects of species choice and spatial arrangement**

TIMOTHEE CHERIERE, MATHIEU LORIN & GUENAELE CORRE-HELLOU (Ecole Supérieure d'Agricultures, Angers, France)

10:15 **Choosing legume as service plant for intercropping with rapeseed based on plant-plant and plant-soil interactions**

XAVIER BOUSSELIN (Agroscope, Nyon, Switzerland), NATHALIE CASSAGNE (Ecole Supérieure d'Agricultures (ESA) Angers, France), ALICE BAUX (Agroscope, Nyon, Switzerland), MURIEL VALANTIN-MORISON (French National Research Institute for Agriculture, Food and Environment, Thiverval-Grignon, France), MARIE HEDAN, MARIO CANNAVACCIUOLO, MATHIEU LORIN & JOËLLE FUSTEC (Ecole Supérieure d'Agricultures (ESA) Angers, France)

10:30 **Assessing the contribution of legume inclusion in crop rotations to soil health and ecosystem services: A case study from UK field trials**

CATRIONA WILLOUGHBY, CHRISTINE WATSON (SRUC, Aberdeen, UK), KAIRSTY TOPP (SRUC, Edinburgh, UK), ROBIN WALKER, ALEX HILTON (SRUC, Aberdeen, UK), PAUL HALLETT, GRAEME PATON (University of Aberdeen, UK) & ELIZABETH STOCKDALE (National Institute of Agricultural Botany (NIAB), Cambridge, UK)

10:45 **Multispecies for multiple functions: Combining four grass and legume species enhances multifunctionality of sown grassland**

MATTHIAS SUTER, OLIVIER HUGUENIN-ELIE & ANDREAS LÜSCHER (Agroscope, Forage Production and Grassland Systems, Zürich, Switzerland)

11:00 **Intercropping heritage and modern wheat varieties with grain legumes**

MERLETTI ARIELE & STEFANO TAVOLETTI (Università Politecnica delle Marche, Ancona, Italy)

11:15 **Evaluation of the effect of grain legumes compared to wheat and oilseed rape on the soil biological functioning: Study of a bio-indicator, the soil nematofauna**

CECILE VILLENAVE, C CHAUVIN (ELISOL Environnement, Congenies, France), A-S PERRIN, T PERROT and A SCHNEIDER (Terres Inovia, Paris, France)

11:30 GENERAL DISCUSSION

12:00 LUNCH

Session 8: Yield increases and Benefits

CHAIR: ROB CARLTON (De Pinte, Belgium)

13:00 **Managing faba bean to reduce the yield gap: a synthesis from the Legume Gap project**
CHRISTINE WATSON (SRUC, Aberdeen, UK)



13:25 **Bridging the Gap – the Bean Yield Enhancement Network**

CHARLOTTE WHITE, THOMAS WILKINSON (ADAS Gleadthorpe, Mansfield, UK), DANIEL KINDRED (ADAS Boxworth, Cambridge, UK), STEVE BELCHER, BECKY HOWARD (PGRO, Peterborough, UK) & ROGER SYLVESTER-BRADLEY (ADAS Boxworth, Cambridge, UK)

13:40 **Impact of climate on soybean yield stability in Europe**

MORITZ RECKLING & CRISTOPH MÖLLER (Leibniz Centre for Agricultural Landscape Research, Germany)

13:55 **Effect of high CO₂ on the growth and stress tolerance of soybean**

CHRISTINE FOYER (University of Birmingham, UK)

14:10 ***In vitro* and *In vivo* screening through seed defense biopriming with PGPR, Trichoderma and Rhizobia for enhancing green pod quality, growth, production and health of *Phaseolus vulgaris* L. in mid-hill zone of Himachal Pradesh, India**

SHIVANGI NEGI, NARENDRA K BHARAT & HIMANSHU PANDEY (Dr. Y S Parmar University of Horticulture and Forestry, Nauni, Solan India)

14:25 **Forage legumes for future dry climates: Relative yield totals under drought conditions**

MARTIN KOMAINDA (Georg-August-University Göttingen, Germany), MANFRED KAYSER (Georg-August-University Göttingen, Germany; University of Vechta, Germany) & JOHANNES ISSELSTEIN (Georg-August-University Göttingen, Germany; Centre of Biodiversity & Sustainable Land Use, Göttingen, Germany)

14:40 **Secondary agriculture perspectives zinc and iron bio-fortification in chickpea**

GANAJAXI MATH, VIJAYA KUMAR AG & GURUPAD BALOL (AICRP on MULLaRP, University of Agricultural Sciences, Karnataka, India)

14:55 **GENERAL DISCUSSION and NEXT STEPS**

15:15 **END OF CONFERENCE**



**Legumes
Translated**





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ENQUIRIES

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Multi-criteria assessment of integrating legumes into cropping systems across Europe

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ABSTRACT

Integration of legumes into European agricultural systems would diversify the highly specialized cropping systems that are dominated by cereals and increase resource-efficiency of agricultural systems. By providing high quality protein for food and feed as well as regulating and supporting services, legumes contribute essential ecosystem services.

In order to assess the overall effects of legumes in agricultural systems, it is necessary to consider how legumes are integrated in cropping systems and evaluate the impacts of this integration. As legumes influence the production of other crops in the rotation and as the interaction of legumes are multiplex, an assessment of the cropping system that considers multiple criteria is required.

The objective of this work was to assess the impacts of changes in crop rotations through the integration of legumes using cropping systems implemented in practice. We used a multi-actor approach to incorporate the knowledge of a range of legume-experienced actors representing value chains with soybean, pea, faba bean, lupin and forages for food and feed and evaluate thereby the role of legumes in crop rotations of diverse systems from Ireland in the West to Ukraine in the East.

Within the research process we firstly identified region-specific crop rotations with cultivation techniques based on expert opinion in the 17 different study areas. One rotation representing the current farming without legumes and at least one alternative legume-based crop rotation was specified per region. Secondly, a valid set of indicators was developed, including environmental, economic and agronomic

indicators. The indicators were calculated for each cropping system at the rotational level, considering pre-crop effects i.e. adapted N fertilizer application rates and yields. Finally, the cropping system assessment compared current farming practices to legume-based alternatives. Trade-offs and synergies between different indicators e.g. gross margins and N fertilizer use were identified.

On average, crop rotations with legumes reduced nitrous oxide emissions by 21% and 26% and N fertilizer use by 26% and 45% in arable and forage systems, respectively. While protein output was increased by 13% and 5%, energy output was reduced by 10% and 9% in arable and forage systems. Gross margin effects of introducing legumes were variable and site specific. Consideration of the full economic value of the crops as feed, subsidies for legumes, and the application of carbon taxes increased the relative performance of the legume-supported systems.

The presented cropping system assessment within a multi-actor approach enables an exploration of the opportunities and challenges for integrating legumes in European crop rotations considering the views of local actors and can thereby provide multi-criteria guidance on the validation of potential alternative strategies.