



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

ARCHIVIO ISTITUZIONALE DELLA RICERCA

Alma Mater Studiorum Università di Bologna Archivio istituzionale della ricerca

FALL SEEDING OF SPRING CAMELINA: AN OPPORTUNITY FOR FARMERS IN NORTHERN ITALY

This is the final peer-reviewed author's accepted manuscript (postprint) of the following publication:

Published Version:

Federica Zanetti, C.E. (2017). FALL SEEDING OF SPRING CAMELINA: AN OPPORTUNITY FOR FARMERS IN NORTHERN ITALY.

Availability:

This version is available at: <https://hdl.handle.net/11585/631198> since: 2019-07-12

Published:

DOI: <http://doi.org/>

Terms of use:

Some rights reserved. The terms and conditions for the reuse of this version of the manuscript are specified in the publishing policy. For all terms of use and more information see the publisher's website.

This item was downloaded from IRIS Università di Bologna (<https://cris.unibo.it/>).
When citing, please refer to the published version.

(Article begins on next page)



ASSOCIATION FOR THE ADVANCEMENT OF INDUSTRIAL CROPS

29th Annual Meeting

Miscanthus ETHANOL Biodiesel Canola Succinic acid Packaging FDCA Insulation
 Detergents Feed Camelina LUBRICANT Sugars Emulsifiers Pennycress Gums
 Adhesives Kenaf Flavoring Lactic acid Fibers 3-HPA POLYMERS Solvents Rubber
 Sunflower Cra... s Fabric Crambe
 Bio-oils Preserv... el Coatings Castor
 Cosmetics Che... nts Kraft lignin
 Hemp Pharmac... Linseed Corrosion
 inhibitor Mold... arnishes Waxes
 Jojoba Essential oils Biogas Dicarboxylic acids Cottonseed Epionitrone Surfactants
 Levulinic acid Switchgrass Propylene glycol Sebacic acid Ethylene Guayule Varnish FT
 diesel Soybean Tung Glucaric acid Methanol DME CUPHEA Indigo Polyurethane

Industrial Crops and Products: *Renewable Feedstocks for a Sustainable Bioeconomy*

Gateway Hotel & Conference Center
Ames, Iowa USA
September 10-13, 2017



AAIC BOARD OF DIRECTORS

President	Roque L. Evangelista USDA-ARS, NCAUR, Peoria, IL, USA
President-Elect	Jim Todd OMAFRA, Simcoe, Ontario, CANADA
Past-President	Marisol T. Berti North Dakota State University, Fargo, ND, USA
Secretary	Dilpreet Bajwa North Dakota State University, Fargo, ND, USA
Treasurer	Burton L. Johnson North Dakota State University, Fargo, ND, USA
Registrar	Valerie H. Teetor University of Arizona, Tucson, AZ, USA
Webmaster	Von Mark Cruz Bridgestone Americas, Eloy, AZ, USA
Division Chairs:	
Natural Rubber & Resins	Hussein Abdel-Haleem USDA-ARS, ALARC, Maricopa, AZ, USA
Fibers & Cellulosics	Dilpreet Bajwa North Dakota State University, Fargo, ND, USA
Oilseeds	Efthymia Alexopoulou Centre for Renewable Energy Sources, Pikermi, GREECE
General Crops & Products	Ana Luisa Fernando Universidade Nova de Lisboa, Caparica, PORTUGAL
Medicinal & Nutraceutical Plants	H Rodolfo Juliani Rutgers, The State University of New Jersey, New Brunswick, NJ, USA



Association for the Advancement of Industrial Crops

29th Annual Meeting

**Gateway Hotel & Conference Center
Iowa State University
Ames, Iowa USA
September 10-13, 2017**

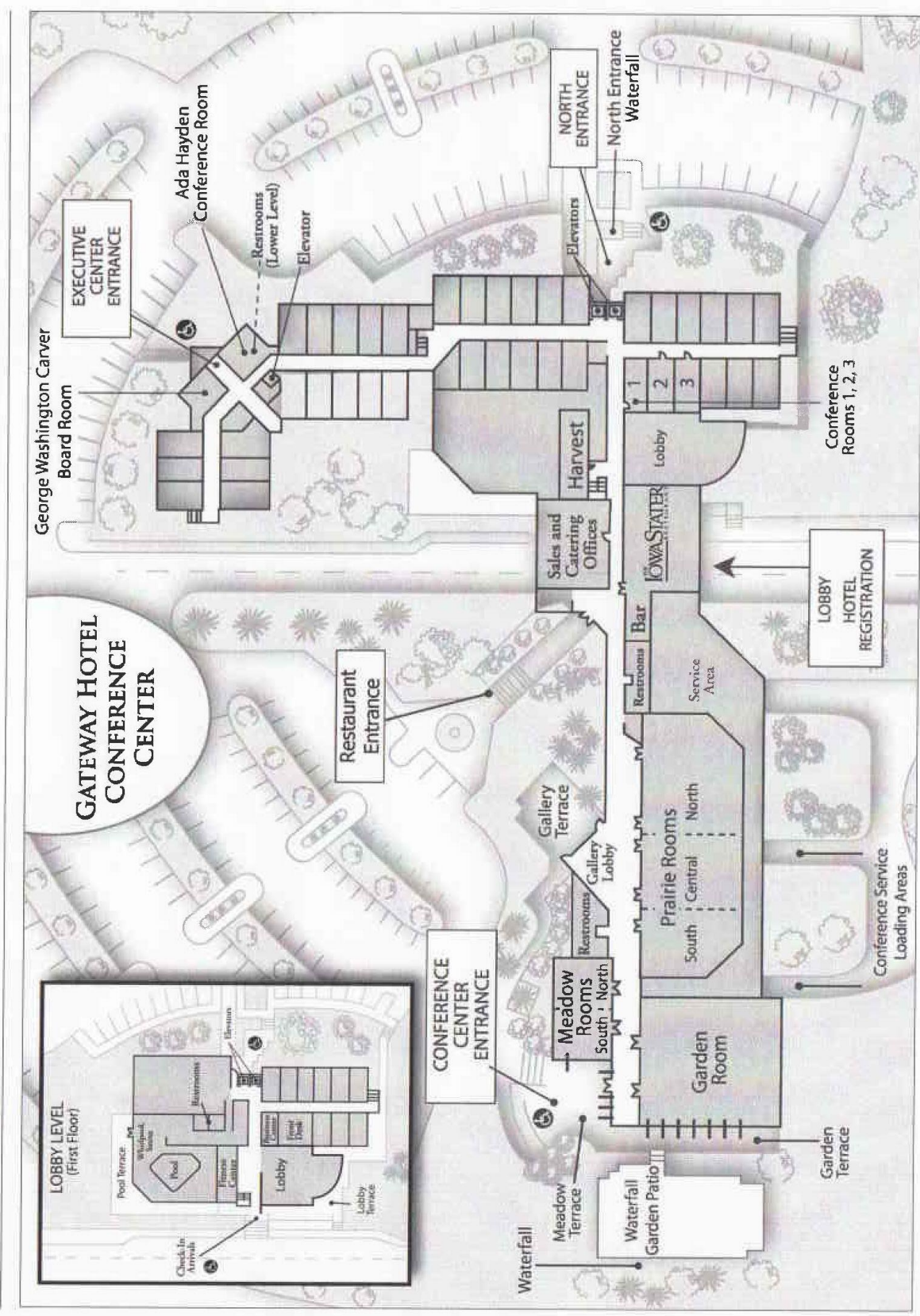
**Industrial Crops and Products:
*Renewable Feedstocks for a
Sustainable Bioeconomy***

CONFERENCE ORGANIZATION

General Co-Chairs	
Roque L. Evangelista USDA-ARS, NCAUR, Peoria, IL	Laura Marek Iowa State University, Ames, IA
Registration Valerie H. Teetor University of Arizona, Tucson, AZ	Awards Marisol T. Berti North Dakota State University, Fargo, ND
Finance Burton L. Johnson North Dakota State University, Fargo, ND	Webmaster Von Mark Cruz Bridgestone Americas, Eloy, AZ
Abstracts Roque L. Evangelista Mila P. Hojilla-Evangelista USDA-ARS, NCAUR, Peoria, IL	Logistics Aubrey Robertson Jennifer Vit Iowa State University, Ames, IA
Division Chairs	
Oilseeds Efthymia Alexopoulou Centre for Renewable Energy Sources and Saving, Athens, Greece	Natural Rubber & Resins Hussein Abdel-Haleem USDA-ARS, ALARC Maricopa, AZ
Fiber & Cellulosic Crops Dilpreet Bajwa North Dakota State University, Fargo, ND	General Crops & Products Ana Luisa Fernando Universidade NOVA de Lisboa Caparica, Portugal
Medicinal & Nutraceutical Crops H Rodolfo Juliani Rutgers, The State University of New Jersey, New Brunswick, NJ	

To cite this publication: R.L. Evangelista and M.P. Hojilla-Evangelista (Eds.). 2017. Industrial Crops and Products: Renewable Feedstocks for a Sustainable Bioeconomy, Program and Abstracts - 29th Annual Meeting of the Association for the Advancement of Industrial Crops. September 10-13, 2017, Ames, Iowa, USA.

Gateway Hotel & Conference Center



CONFERENCE PROGRAM

SUNDAY – September 10, 2017

Registration	Garden Lobby	1:00 - 6:00 PM
Crop Germplasm Committee Meeting	North Meadow	2:00-4:00 PM
AAIC Board Meeting	Conference Room 1	4:00 - 5:00 PM
Poster Set-up	Garden Room	4:00 - 6:00 PM
Opening Reception & Poster Viewing	Garden Room	6:00- 9:00 PM

POSTERS

Productive performance of winter camelina grown in contrasting environments: Northern Italy vs. Minnesota, USA

Federica Zanetti, Russ W. Gesch, Jane M.F. Johnson, Giuseppe Di Girolamo, and Andrea Monti

Progress towards developing early maturing winter varieties of *Camelina sativa* as oilseed cover crops for northern climates

James V. Anderson, Wun S. Chao, David P. Horvath, Russ W. Gesch, and Marisol T. Berti

Acetyl-diacylglycerides produced by modified camelina (*Camelina sativa*)

Roque Evangelista, John Ohlrogge, Terry Isbell, Bryan Moser, Timothy Durrett, and Steven Cermak

Oil concentration and fatty acid profile of naturalized wild *Helianthus annuus* populations from Australia

Gerald J. Seiler

Biobased lubricant from used cooking oils

Steven C. Cermak, Jill K. Moser, Terry A. Isbell, Jakob W. Bredsguard, Gene E. Lester, and Rex E. Murray

Screening forage sorghum [*Sorghum bicolor* (L.) Moench] genotypes for cold tolerance

Swarup Podder, Marisol Berti, Alan Peterson, Sergio Cabello, Bryce Andersen, Dulan Samarappuli, and James Anderson

Yield and biomass quality of kenaf (*Hibiscus cannabinus* L.) irrigated with wastewaters – The effect of ammonium ions and nitrates

A.L. Fernando, M. Ferreira, B. Barbosa, and E. Alexopoulou

Guar, roselle, and sesame genetic resources currently used as ingredients in some medicinal products and several potentially new medicinal uses

J.B. Morris, M.L. Wang, and B. Tonnis

Development of edible nano-laminated coatings with antimicrobial resins of *Flourensia cernua* and their application to extend the shelf-life of tomato (*Solanum lycopersicum* L.) fruits

Diana Jasso de Rodríguez, Esperanza de J. Salas-Méndez, António A. Vicente, Ana Pinheiro, L. F. Ballesteros Giraldo, P. Silva, Raúl Rodríguez-García, F. Daniel Hernández-Castillo, M. Lourdes V. Díaz-Jimenez, José A. Villarreal-Quintanilla, María L. Flores-López, and Dennise A. Carrillo-Lomelí

Apoptotic activity of *Flourensia* spp

Diana Jasso de Rodríguez, Dennise A. Carrillo-Lomelí, Nuria E. Rocha-Guzmán, M. Rocío Moreno-Jiménez, José A. Villarreal-Quintanilla, Raúl Rodríguez-García, and M. Lourdes V. Díaz-Jimenez

Physical characterization of chitosan/montmorillonite incorporated with *Rosmarinus officinalis* l. essential oil

V.G.L. Souza, J.R.A. Pires, P.F. Rodrigues, A.A.S. Lopes, F.M.B Fernandes, and A.L. Fernando

Multi-environment performance of *Taraxacum kok-saghyz* (Rodin) clones to validate indirect selection

Sarah K. McNulty, Zinan Luo, Nikita Amstutz, and Katrina Cornish

MONDAY – September 11, 2017**MORNING**

PLENARY SESSION (Garden Room)

Chair: Roque Evangelista

8:00- 8:55	Robert Brown, Bioeconomy Institute, Iowa State University <i>Overcoming the barriers to a sustainable bioeconomy</i>
8:55- 9:50	Emily Heaton, Department of Agronomy, Iowa State University <i>Perennial solutions to annual problems?</i>
9:50-10:10	Coffee Break
10:10-11:05	David Grewell, Agricultural and Biosystems Engineering, Iowa State University <i>Bio-based construction adhesives</i>
11:05-12:00	Norman Cloud, Kemin Industries, Inc., Des Moines, IA <i>Kemin Specialty Crops: Vertically integrated, sustainably grown crops for extraction of bioactive molecules</i>

AFTERNOON**Tour Schedule**

12:00pm	Board bus - Gateway Underpass, by entrance across from the hotel front desk
12:10	Bus departs Gateway
12:30	Boxed lunch served at Plant Introduction Station
1:00-3:00	Plant Introduction Station Tour
3:00	Board bus
3:10	Bus Departs Plant Introduction Station
3:25-5:25	BioCentury Research Farm Tour
5:25	Board Bus
5:35	Bus Departs BioCentury Research Farm – Returns to Gateway

Dinner on Your Own: Shuttle provided to Ames restaurants from 6:00 to 8:00 pm – Shuttle picks up at Gateway Underpass

TUESDAY – September 12, 2017**MORNING**

OILSEED DIVISION (Garden Room)

Chair: Efthymia Alexopoulou

8:00-8:30	Research on oilseeds in Europe <i>Efthymia Alexopoulou</i>
8:30-8:50	Winter camelina root system under contrasting environments <i>Federica Zanetti, Jane M.F. Johnson, Russ W. Gesch, Nancy Barbour, and Andrea Monti</i>
8:50-9:10	Winter camelina: Cultivar variation and sowing rate <i>Russ Gesch, Heather Mathew, Adriana Alvarez De la Hoz, and Robert D. Gardner</i>
9:10-9:30	Fall seeding of spring camelina: an opportunity for farmers in Northern Italy <i>Federica Zanetti, Christina Eynck, Giuseppe Di Girolamo, Daria Righini, Deb Puttick, and Andrea Monti</i>
9:30-9:50	Industrial oilseed crop germination in response to salinity <i>Heather L. Matthees, Matthew D. Thom, and Russ W. Gesch</i>
9:50-10:10	COFFEE BREAK
10:10-10:30	Crambe: A widely adaptable spring oilcrop for Europe <i>Michal Krzyżaniak, Federica Zanetti, Efthymia Alexopoulou, Myrsini Christou, Mariusz J. Stolarski, Eibertus N. Van Loo, Jacek Kwiatkowski, and Andrea Monti</i>
10:30-10:50	Developing a method for measuring toxicity of castor (<i>Ricinus communis</i>) meal using domestic fly <i>Liv S. Severino, Bruna S.S. Mendes, and Antonio S.E. Vasconcelos</i>
10:50-11:10	Relay cover crops in soybean (<i>Glycine max</i> (L.) Merr.) cropping systems in eastern North Dakota <i>Nicholas J. Steffl, K.A. Aasand, B.L. Johnson, P.J. Petersen, and M.T. Berti</i>
11:10-11:30	Corn relay cropping with winter rye, field pennycress, and winter camelina <i>Kyle A. Aasand, N.J. Steffl, B.L. Johnson, P.J. Petersen, and M.T. Berti</i>
11:30-12:00	Division Meeting

LUNCH (South Prairie)

AFTERNOON**GENERAL CROPS & PRODUCTS (Garden Room)**

Chair: Ana Luisa Fernando

1:00-1:20	Pros and cons of irrigating perennial grasses with wastewaters <i>J. Costa, B. Barbosa, and A.L. Fernando</i>
1:20-1:40	Effect of irrigation and plant density on yields of <i>Miscanthus x giganteus</i> <i>Efthymia Alexopoulou and Myrsini Christou</i>
1:40-2:00	Marginal land for growing industrial crops: Turning a burden into an opportunity <i>Efthymia Alexopoulou, Myrsini Christou, Ioannis Eleftheriadis, Ioanna Papamichael, and Kostas Tsiotas</i>
2:00-2:20	Yield and phytoremediation potential of perennial grasses in heavy metal contaminated soils under low irrigation <i>B. Barbosa, S. Boléo, S. Sidella, J. Costa, M. P. Duarte, S.L. Cosentino, and A.L. Fernando</i>
2:20-2:40	NH₃ ENERGY+: Optimal fuel, fertilizer, and energy storage medium <i>Norman Olson</i>
2:40-3:00	COFFEE BREAK
3:00-3:20	Status of genetic resources of guayule and other industrial crops at the USDA National Arid Land Plant Genetic Resources Unit in Parlier, CA <i>Claire Heinitz</i>
3:20-3:40	Physical and chemical properties of biochars produced from MWRDGC biosolids for utilization in sand-based turfgrass rootzones <i>Steven F. Vaughn, F.D. Dinelli, J.A. Kenar, M.A. Jackson, and S.C. Peterson.</i>

MEDICINAL & NUTRACEUTICAL PLANTS (Garden Room)

Chair: H. Rodolfo Juliani

3:40-4:00	Effect of semi-desert plants as growth regulators in tomato plants (<i>Solanum lycopersicum</i> L.) <i>Diana Jasso de Rodríguez, Alejandro Reyes-Sebastián, Raúl Rodríguez-García, Homero Ramírez-Rodríguez, José A. Villarreal-Quintanilla, M. Lourdes V. Díaz-Jimenez, Antonio Juárez-Maldonado, Norma A. Ruiz-Torres, Fidel M. Peña-Ramos, and Dennise A. Carrillo-Lomelí</i>
4:00-4:20	The chemistry and quality of Liberian spices <i>Larry Hwang, Jim Simon and H. Rodolfo Juliani</i>
4:20-5:00	Division Meetings

Dinner on Your Own: Shuttle provided to Ames Restaurants from 6:00 to 8:00 pm - Shuttle picks up at Gateway Underpass.

WEDNESDAY – September 13, 2017

MORNING

NATURAL RUBBER & RESINS (Garden Room)

Chair: Hussein Abdel-Haleem

8:00-8:30	Current prospects for a natural rubber industry in the U.S. <i>David Dierig, William Niaura, V. Mark V. Cruz, and Guangyao (Sam) Wang</i>
8:30-8:50	Efficient guayule latex extraction <i>Katrina Cornish</i>
8:50-9:10	Guayule latex supports production of the first medical radiation attenuation glove <i>Katrina Cornish and Zhenyu Li</i>
9:10-9:30	Differential expression of drought-stress associated genes and their impact on rubber synthesis in guayule (<i>Parthenium argentatum</i>) <i>Grisel Ponciano, Arcadio Valdez Franco, William Belknap, Yong Gu, Yi Wang, Naxin Huo1, Doug Hunsaker, Daa Elshikha, and Colleen McMahan</i>
9:30-9:50	Negative regulation of allene oxide synthase in guayule by salicylic acid increases natural rubber content <i>Dante F. Placido, N. Dong, G. Ponciano, C. Dong, B.G. Kang, V.M.V. Cruz, D. Dierig, M. Whalen, and C. McMahan</i>
9:50-10:10	COFFEE BREAK
10:10-10:30	Silica and egg shells synergistically reinforce guayule (<i>Parthenium argentatum</i>) natural rubber composites <i>Xianjie (Tony) Ren and Katrina Cornish</i>
10:30-10:50	Heredity of taproot phenotype in <i>Taraxacum kok-saghyz</i> (Rodin) <i>Sarah K. McNulty, Nikita Amstutz, and Katrina Cornish</i>
10:50-11:10	Water-based processes for the extraction of natural rubber from <i>Taraxacum kok-saghyz</i> (TK) roots <i>David A. Ramirez-Cadavid, Frederick Michel Jr.1, and Katrina Cornish</i>
11:00-11:40	Division Meeting

AFTERNOON

GENERAL MEMBERSHIP LUNCHEON MEETING (South Prairie)

12:00 Noon – 1:20 PM

FIBER & CELLULOSIC CROPS (Garden Room)

Chair: Dilpreet Bajwa

1:30-1:50	Comparative studies among several kenaf varieties in Greece <i>Efthymia Alexopoulou, Defang Li, and Federica Zanetti</i>
1:50-2:10	Investigation of kenaf foliage as a potential biocide in compositon panels <i>D.S. Bajwa, A. Norris, E. Alexopoulou, R. Ibach, and S.G. Bajwa</i>
2:10-2:30	Seeding date, cultivar, and seed treatment effects on industrial hemp (<i>Cannabis sativa</i> L.) stand establishment in North Dakota <i>B.K. Hanson, V. Chapara, T. Hakanson, L. Henry, J. Kostuik, M.T. Berti, P.J. Petersen, and B.L. Johnson</i>
2:30-2:50	Compatibilization improves performance of biodegradable biopolymer composites without affecting UV weathering characteristics <i>N.S. Yatigala, D.S. Bajwa, and S.G. Bajwa</i>
2:50-3:10	Epoxidized sucrose soyate as a primary binder in particleboard manufacturing <i>A.J. Norris and D.S. Bajwa</i>
3:10-3:30	Techno-economic analysis and life cycle assessment of bioadhesive derived from glycerol <i>Minliang Yang</i>
3:30-4:00	Division Meeting

BOARD MEETING (Conference Room 1)

4:00-5:00 PM

AWARDS BANQUET 5:30-8:30 PM (South Prairie)

ABSTRACTS

WINTER CAMELINA ROOT SYSTEM UNDER CONTRASTING ENVIRONMENTS

Federica Zanetti¹, Jane M.F. Johnson², Russ W. Gesch², Nancy Barbour², and Andrea Monti¹

¹ University of Bologna, Bologna, Italy

² USDA-ARS-NCSCRL, Morris, MN, USA

Keen interest in developing camelina (*Camelina sativa* [L.] Crantz) as a viable oil crop is demonstrated by more than 450 publications on this species since 2013. Nonetheless, studies focusing on the root development of camelina are still lacking. In order to improve the knowledge on camelina root development, and to investigate the effect of contrasting environments on its morphology, a common field experiment was set up in Morris, Minnesota (USA, 45°35' N, 95°54' W) and in Bologna (Italy, 44°30' N, 11°21' E) during 2015-16 growing season. Winter camelina, Joelle, was sown at the two locations comparing two contrasting seeding densities: high density (HD) vs. low density (LD). The experimental design was a randomized complete block with three replications in Bologna and four in Morris. Roots were sampled when camelina reached full flowering stage. Two cores per plot were taken in Morris and four in Bologna and were split into five depth increments (0-0.10, 0.10-0.20, 0.20-0.30, 0.30-0.60, and 0.60-0.90 m), prior to root determinations. Simultaneously with root sampling, camelina plants were sampled from 0.50 m of row at the same site as the soil samples to obtain aboveground biomass. Camelina root biomass was significantly affected by location, with Bologna producing 250% higher biomass than at Morris ($P \leq 0.05$). Root biomass decreased with depth, although intermediate layers (0.10 to 0.60 m) did not significantly differ from each other. Sowing density significantly impacted root biomass, with plants grown at lower density presenting the highest root biomass ($P \leq 0.05$). A significant “location x soil depth” interaction was detected: Bologna had three-fold greater root biomass than in Morris down to 0.60 m depth. Camelina shoot biomass at flowering followed the same trend as root biomass, with plants grown at Bologna accumulating 190% more biomass compared to those grown in Morris. The increased root and aboveground biomass of camelina when grown under a milder Mediterranean environment such as Bologna, likely explains the higher productive potential achievable by this species compared to cold temperate sites, like Morris.

Contact: Federica Zanetti, Dept. of Agricultural Sciences, Alma Mater Studiorum, University of Bologna, Viale G. Fanin 44, 40127 Bologna (Italy). E-mail: federica.zanetti5@unibo.it

FALL SEEDING OF SPRING CAMELINA: AN OPPORTUNITY FOR FARMERS IN NORTHERN ITALY

Federica Zanetti¹, Christina Eynck^{2,3}, Giuseppe Di Girolamo¹, Daria Righini¹,
Deb Puttick², and Andrea Monti¹

¹University of Bologna, Italy

²Linnaeus Plant Sciences, Saskatoon, Canada

³Agriculture and Agri-Food Canada, Saskatoon, Canada

Camelina (*Camelina sativa* [L.] Crantz) is a member of the *Brassicaceae* family, encompassing both spring and winter types, with the latter requiring vernalization to produce seed. It has been shown that spring camelina is highly adaptable, able to grow in a wide range of different environmental conditions. In particular, there is evidence that in locations characterized by mild winters, as prevalent in the Mediterranean area, spring camelina can be successfully grown as a winter crop. In the framework of the European project COSMOS (Camelina & crambe Oil crops as Sources for Medium-chain Oils for Specialty oleochemicals) a 2-year plot experiment (2015-2017) was established at the experimental farm of the University of Bologna (44° 30' N, 11° 23' E). The aim of the study was to compare a spring (Midas) and a winter (Luna) camelina cultivar in response to two fall seeding dates (early and late October) and two seeding rates (conventional vs. reduced) in a randomized complete block design with four replications. Bologna has a North Mediterranean climate; deep soil, fertile, and classified as silt-clay-loam with an organic matter content of 1.6%. The two growing seasons showed different meteorological conditions: in 2015/16, winter was characterized by mild temperatures (5.3°C) and 230 mm of precipitation; in 2016/17, winter temperatures were lower (3.6°C) and rainfall was only 89 mm. Although remarkably less developed in the second year (-50% of aboveground biomass compared to first year), camelina was confirmed to be well adapted to local conditions. The rate of winter survival was high (83%), even for Midas, and was not influenced by seeding rate nor by sowing date. Growth cycle of camelina was very short (~1200 growing degree days, GDD, from sowing to harvest). In both seasons, the spring cultivar Midas reached maturity at the end of May, 5-7 days earlier than the winter cultivar Luna. In the first season, seed yield of both genotypes exceeded 2 Mg DM ha⁻¹; there was no significant effect of seeding date, seeding rate or cultivar. Midas presented significantly higher harvest index than Luna (0.26 vs. 0.23, $P \leq 0.05$). Seed oil yield was confirmed stable and averaged 0.86 Mg DM oil ha⁻¹. The amount of polyunsaturated fatty acids (PUFAs) in the oil was found to be significantly affected by seeding date and cultivar, with Midas presenting higher C18:3 and lower C18:2 contents than Luna. The early maturity of camelina, particularly when spring camelina was grown as a winter crop, could be appreciated by local farmers as it would allow them to grow a second crop (i.e., corn, soybean) in the same season (double cropping).

Contact: Federica Zanetti, Dept. of Agricultural Sciences, Alma Mater Studiorum, University of Bologna, Viale G. Fanin 44, 40127 Bologna, Italy. E-mail: federica.zanetti5@unibo.it