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# trafo0n

**TRADITIONAL FOOD NETWORK TO IMPROVE THE  
TRANSFER OF KNOWLEDGE FOR INNOVATION**

TWS Warsaw 29-06-2016

WP2 Grains

## **Oats 2020: needs and lessons from an international perspective**



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Birmingham 2015
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of Nutrition 2014, **112**
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# Whole grain Oat kernel

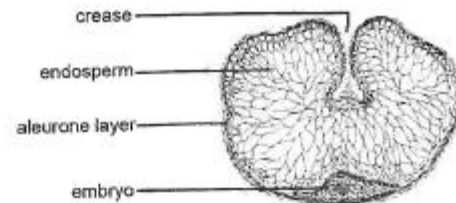
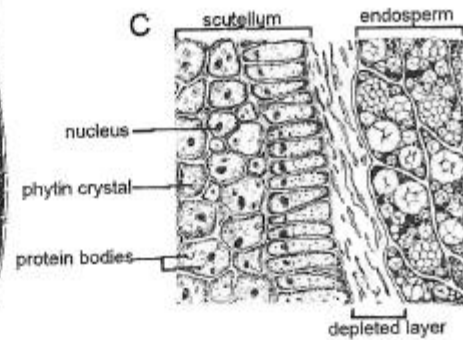
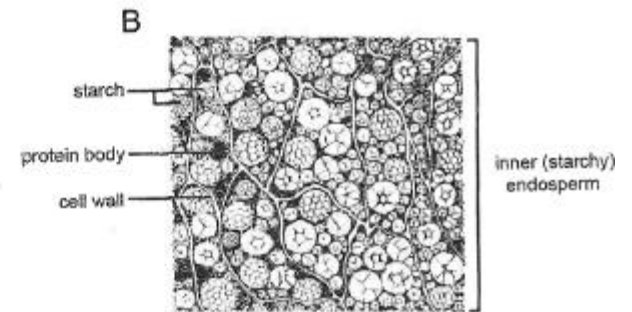
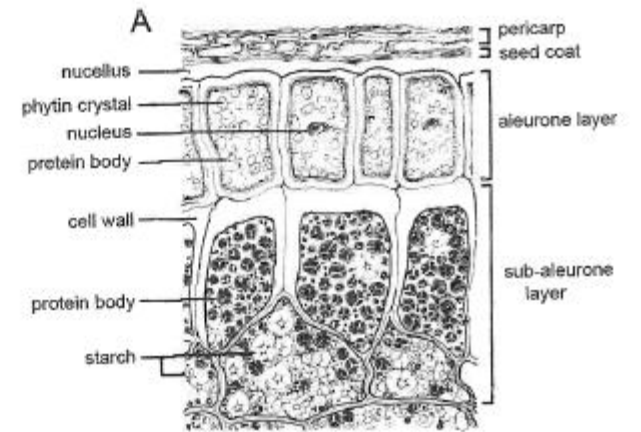
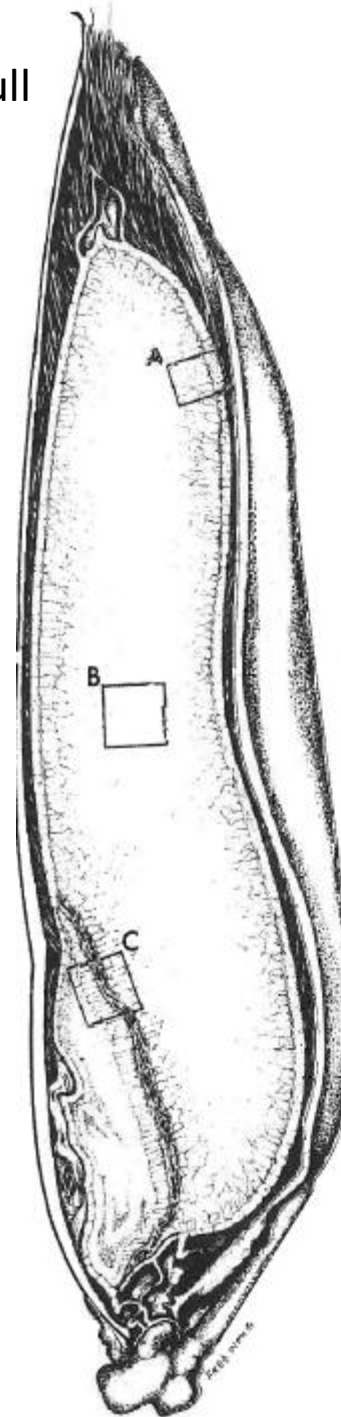


Endosperm [B]

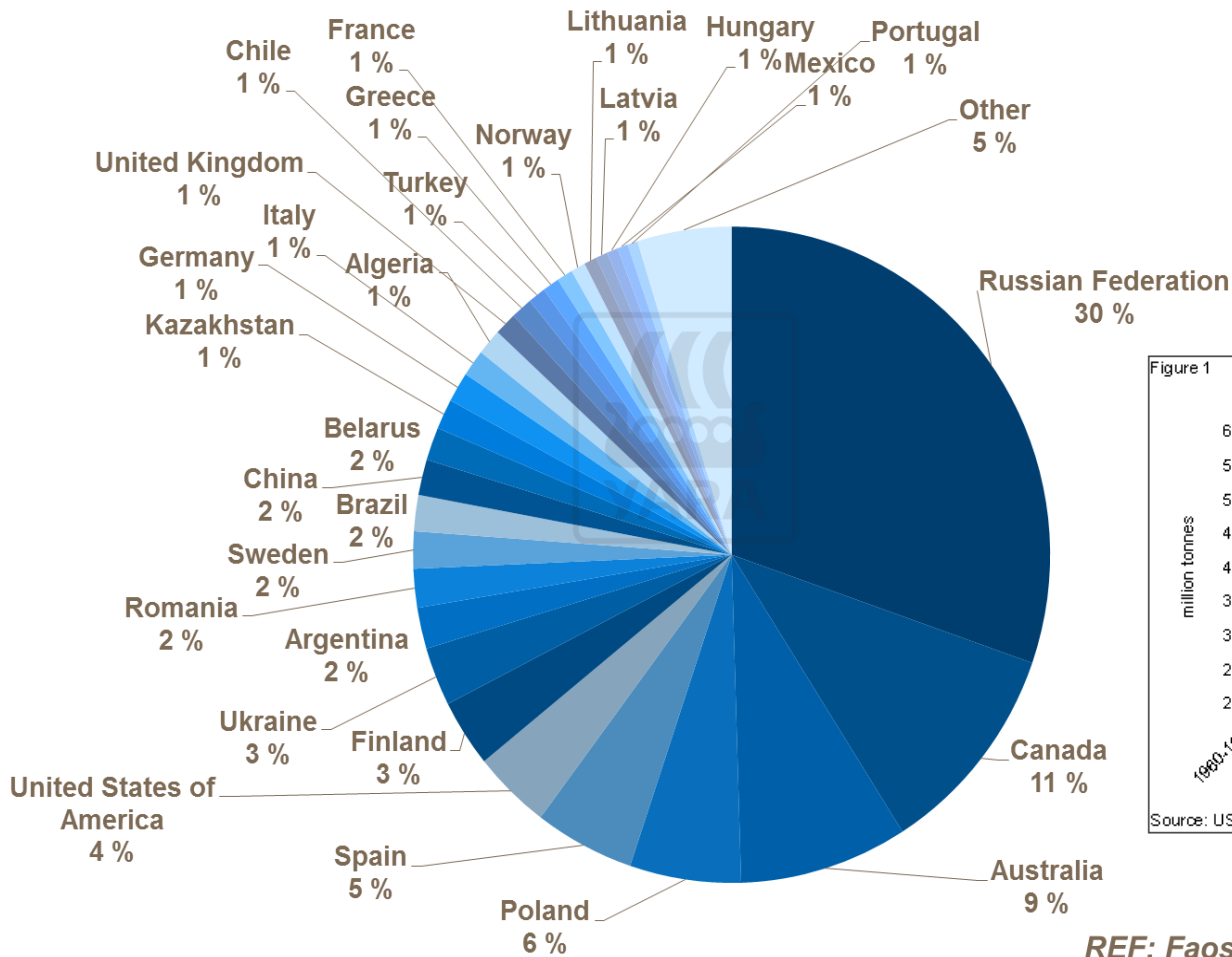
Bran [A]

Germ

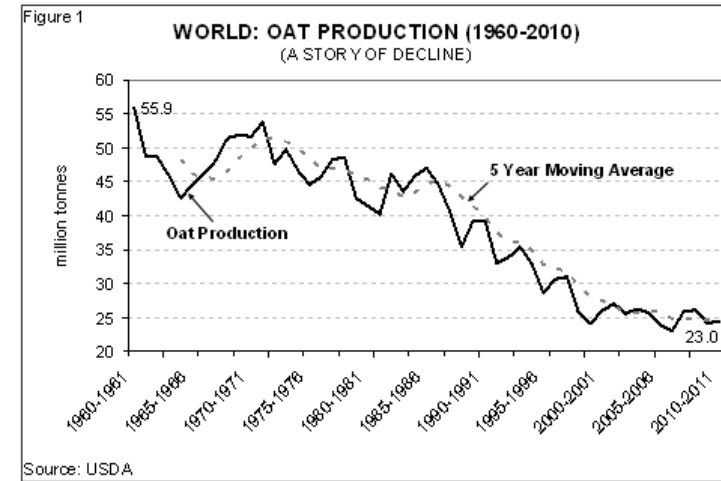
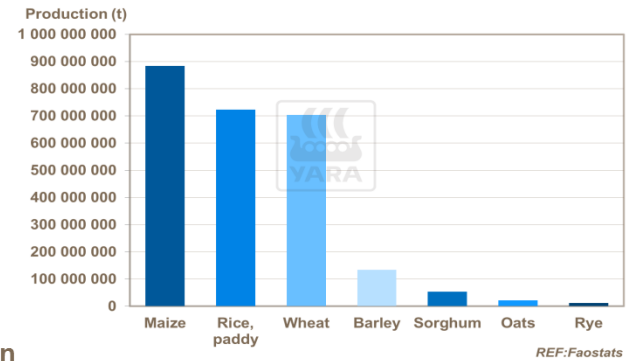
Hull



# World Oat Production as a % per Country - 2011



World Cereal Production 2011



REF: Faostats 2011

# Oats 2020 Conference Birmingham 2015

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- Organised by IBERS (Aberystwyth University UK) and SENOVA (breeding company UK)
- 34 presentations; 27 posters
- Participants' ratio Agriculture/Food: 71/35
- Program:
  - Oats: current status and future perspectives (8);
  - Opportunities for oats: health, milling, feed, industrial uses and new technologies (16);
  - Challenges facing oats: disease, mycotoxins, and agronomy (9);
  - Oat Global: strategy platform to support the public and private oat community (in North and Latin America; Australia and Europe) (1).

# British Journal of Nutrition 2014, vol 112

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- Special issue on Oats (10 publications)
- Based on discussions of international experts (14) at the New York Workshop on Oat (medical/health (5); food (4); agri (4); government (1))

Discussing dynamics, research and future applications of oats:

- Physical and chemical characteristics
- Role of oat beta-glucan in human physiology
- Nutritional composition compared with other grains
- Putative health benefits (CVD, blood pressure, cholesterol lowering, bowel function, inflammatory bowel disorders, IBS, diabetes, cancer) (systematic reviews)
- Intestinal microbiome
- Coeliac disease
- Oats in a changing global environment
- Oats genomics, cultivar selection, breeding programs
- Health claims and governmental nutrition-policy development

# Summary of needs and lessons

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Presentations (Oats 2020) and publications (BJN) have been reviewed according to the TRAF00N SRIA topics (Athens 2015):

- Primary production: Agronomy; Breeding
- Processing
- Product: Health
- Business: Value chain; Communication

# Primary production: Agronomy

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- Oat Crop Growth, Cultivation and Management Manual is needed; global approach with focus on regional (climate; soil) factors and crop management (NL manual from 1994)
- Adaptations to climate change; increased knowledge on crop physiology
- GxE and crop management effects on compound composition
- Make N-fertilisation in oats more efficient
- Development of short straw varieties
- Improve weed control
- Improve disease control (especially *Fusarium* and linked mycotoxin production)
- Oats fit in sustainable (organic) agriculture



# Primary production: Breeding

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- Lack of an integrated oat genetic map
- Development of double haploids for improvement of breeding and genetics
- Open access T3/Oat database (including phenotype/genotype data) of the Oat Global Project is growing and available
- Reassessment and integration (introgression) of wild material into breeding programs for agronomic improvements (yield; biotic & abiotic stress tolerances)
- Solve the genotype-to-phenotype bottleneck (GxE)
- Breeding targets for output (end product) traits:
  - Beta-glucan, protein, unsaturated fatty acids
  - Organoleptic properties (in relation to processing/cooking)

# Processing

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- De-hulling (to produce groats), steel cutting, flaking, milling into flour, separation of bran fraction are generally carried out to increase digestibility
- Kilning (heat treatment) is necessary to prevent rancidity during storage
- The potentials to apply oat and oat-based components/compounds into food products needs further exploration
- Research on the impacts of oat processing on nutritive and healthy values is in its infancy
  - Effects of heating on health efficacy (especially fibre)
  - Possibly positive effects of extrusion on food functional properties
  - Possible negative effects of extrusion on fibre functionality (lowering MW)

# Product: Health

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- Development and (proper) application of health claims on oat food products (see also Processing)
- Improve knowledge on dose-response health effects of oat compounds in food products (starch, protein, oil, fibre, phenolics) and feed (low lignin and relatively high oil)
  - Physiological efficacy (blood glucose and cholesterol-lowering properties) of beta glucan depends on sufficiently high doses plus suitably high MW; MW depends on processing: boiling [+ effect]; baking [-]; extruding [+/-]; freezing [-]
  - Unique composition in oats of non-soluble polysaccharides (NSP), resistant starch, unsaturated fat and complex lipids, and phenolics (avenanthramides) may contribute to gut (microbiota) health
- Epidemiological studies based on existing large-scale cohorts are needed to confirm health effects from observational studies
- Improving nutritional profile to target organisms ('personalising' food and feed)
- More attention needed to oat in the feed sector
- Adequate monitoring of hazardous chemicals (pesticide residues; mycotoxins)

# Business: Value chain

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- Development of high yielding varieties; focus on needs in breeding, genomics, physiology and metabolism, GxE, agronomy, BBE (Bio-based economy)
- Development of innovative products; consider the price-value pyramid
- Reverse of the progressive decrease in global oat production; decrease is due to
  - Lack of product innovation
  - Dominance of wheat and barley (oat yields lagging behind these cereals)
  - Slow application in marketing of approved health claims on products and product development chain
  - Decline in feed use
  - Fragmented market

# Business: Communication

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- Better communication needed down to the consumer
- Filling knowledge gaps and disconnections (lack in communication, lack in continuity/co-operation) between various stakeholders along the chain
- Precompetitive sharing of raw data on genotypes, metabolism and phenotypes through <http://oatglobal.org> (T3/oat database) becomes available
- Adequate food labelling: translation of nutritional and health-beneficial messages in line with current food industrial (global and local) developments
  - Proper use of health claims
- Filling food- and agriculture-related policy gaps
  - Better consideration for consumers preferences and perceptions of population health
  - Sustainable human health with concomitantly sustainable agriculture with oats
- “It is incumbent on scientists from different disciplines to advance research on oats in a spectrum of arenas contributing to global food policies”:
  - Physico-chemical properties
  - Impact on an array of non-communicable diseases and human microbiome
  - Agricultural practices and environments
  - Processing technologies

# Summary of major needs and lessons

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The major issues relevant for the SRIA on Oats:

## **Primary Production**

- Oats cultivation manual (including growth, and role of oats in crop management)
- Inclusion of old varieties and wild/diverse oat species in breeding programs
- Integration of Genomics+ in oat breeding

## **Processing**

- Impact of processing on nutritive and health values (application of health claims)

## **Products**

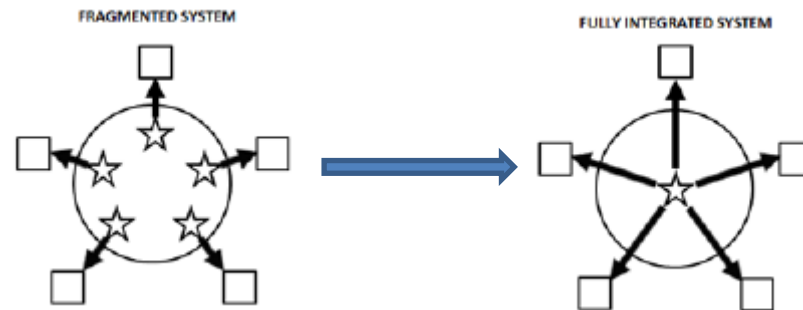
- Product innovations
- Health effects: from observational to cohort data
- Impact of oat consumption on gut microbiome (human; animal)
- Economics of applications oat in animal feed

## **Business**

- Consumer's awareness about oats' health advantages (communication)
- Interdisciplinary research to support product and market development
- Oats consumption in prevention of chronic diseases (linking food and medical strategies; reducing costs for health care)
- Cooperation on oats in global food policies (economic strength of oats; sustainable human health with sustainable agriculture)

# Oats as a fragmented global system

Oats, viewed from a global perspective, is a typical example of a fragmented system. Fragmentation hampers a system towards economic growth, development and strength. Fragmentation is a major reason of the continuous decrease of the role of oats in global food policy.



From fragmented to integrated system.

(Star = Actor/Stakeholder level; Circle = Global oat system; Box = Oat Strategy; Oat Activity in Primary production, Processing, Products, Business). (Fig adapted from Gilissen HK et al 2016. The Journal of Water Law, in press)

# Oats fragmented in:

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- Chain development
  - Gluten-free
  - Local initiatives
  - Organic agriculture
  - Food policies
- Breeding
  - Lack of cooperation in breeding goals
- Processing
  - Limited scientific attention
- Product development
  - Use of health claim
  - Development of new health claims
- EU FP7 and Horizon 2020
  - Four proposals on oats were rejected



# Bridging the fragments

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Proposed strategies to integrate oat system fragments aiming at increase global economic strength:

- (1) *transfer* of knowledge to fill identified knowledge and experience gaps (i.e. the goal of the present TraFooN project); to be extended
- (2) *coordination* to tune in the policies/strategies of the various actors/stakeholders (e.g. Oat Global shares data for breeders, growers, millers; financial support required); role for EU, national governments
- (3) *cooperation* to realize, integrate and implement coordinated actions concerning primary production, processing, products and business of oat towards a global oat chain; concerted role for EU and national governments, research organisations and food industries.

Especially coordination and cooperation activities will be relevant to the Strategic Research and Innovation Agenda (SRIA).



# trafoon

Thanks for your  
attention



# ***Buckwheat*** in Eastern Europe (Slovenia, Poland, Slovakia)

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## Raspor

Highly promising pseudo-cereal for traditional and health food products (nutritional value)	<b>3.7</b>
Product quality and safety are challenges (specific subjects not specified in abstract)	<b>3.7 4.11</b>
Further innovations needed for new product market opportunities	<b>3.7</b>
Competitiveness with other products requires innovation	<b>3.7</b>
R & D necessary for further developing cereal processing industry	<b>4.5</b>

## Amarowicz

Health-related compounds	<b>3.3</b>
Local Polish kitchen	<b>4.3</b>

## Wrangkowska

Small-scale research should be increased through increase of knowledge transfer in joints projects with SMEs	<b>4.5</b>
Application of roasted buckwheat ingredients (hulls, flour) increased content of health related compounds and improved product sensory and shelf life	<b>2.3 2.6</b>

## Ciesarova

Product portfolio of industrially produced buckwheat-based bakery products is poor	<b>3.7</b>
Health and safety (low acrylamide) benefits on the one hand, negative organoleptic properties on the other (but several ways of improving that, are discussed)	<b>3.7</b>

# Oats in Netherlands and global

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## Littlejohn

Examination of the grain supply chain leading to nationally peaked interest in oat products with bakers **4.4**  
'Back to basics' in ingredients, technical skills and entrepreneurship expressed in the philosophy of the Institute and in the practice of the student training courses **4.13** (new: Education)

Bakery Society and Bakery Institute are the result of:

**4.14** (new: Network)

mutual trust and friendship among the partners,  
in search for common goals funded in idealistic perspective,  
building knowledge network among the partners,  
continuous active participation,  
believe in the end result,  
and radiating enthusiasm

## Van Dinter

Partners in the newly established gluten-free oat chain  
gluten-free guarantee

**4.14**  
**3.8**

## Gilissen

Improvement of primary production requires a European (global) Manual for oat cultivation and management **1.1 1.3**  
Increased knowledge on the impact of processing on nutritive and health values of oats is required **2.5/6**  
Product innovations are needed with focus on health; economic evaluation of application of oat products in animal feed **3.7**  
Better communication and cooperation (government – research organisations – food industries) should lead to improved consumer's awareness and (global) food policy; interdisciplinary research should support product and market development **4.4 4.8**

# Gluten-free

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## *Ciesarova*

Buckwheat in gluten-free products **2.9 3.7**  
(how is gluten-free production guaranteed?) **3.8**

## *Horstmann*

Techno-functional properties of different ingredients (fibres, hydrocolloids, sourdough, enzymes) in gluten-free bread quality **2.10 3.9**  
Still increasing sales of gluten-free products **4.4**  
Fundamental understanding on compound interaction **2.10**  
Wheat flour (gluten) cannot be simply replaced by alternative flours/ingredients  
Gluten-free formulations are complex and fragile systems  
Interactions of ingredients play the key role in gluten-free formulations  
Starch is the main structuring ingredient in gluten-free products; effects of starch origin/source

## *Souren*

Food companies prefer R&D inside and not (toll manufactured with higher costs) outside the company (also for IP protection) **4.14**  
Lack of information and contradictory visions **4.4 4.14**  
Focus should be on higher nutritive value and better taste (and wide array of products) **3.7**  
Establishment of a solid market position is essential; but toll manufacturing in gluten-free is vulnerable (logistics, prizes) **4.4**

## *Van Dinter*

Direct contact with farmers is essential (basic seed quality kept in own hands; dedicated machineries; field control) and good contract (mutual agreement on payment system) **1.5 4.4 4.14**  
In-factory need for **1.5**  
Dedicated machineries for cleaning, de-hulling, seed separation, dust absorption)  
gluten-free detection (sampling and control technique)

## *Smole Mozina*

Carob enriched buckwheat bread: a new alternative (innovation) in the gluten-free diet **3.7**  
(nutritional: fibre, minerals, vitamins, phenolics; better taste; dough easier to handle)