Oct 29th-30th University of Minnesota St. Paul, MN

2019 Oat Strategy Meeting

Oat Global and POGA

Meeting Agenda

Time/room	Agenda (facilitator)	Room
	Day 1	
8:00	Check in outside room 62, welcome and housekeeping, introductions around the room (Jim Bradeen)	CECC room 62
8:10	How we got here (Dale Nellor)	CECC room 62
8:30	Priority setting panel (Dale Nellor)	CECC room 62
9:00	Updates from South Dakota Agronomy team (Papiernik/Osborne) and T3 (Jean Luc, remote)	CECC room 62
9:30	Coffee and snacks on the way to your breakout	Lobby
9:30-11:15	A) Seed quality (Jae-Bom Ohm and Tom Rabaey)	CECC room 77
9:30-11:15	B) Genomics* (Jason Fiedler and Gabe Gusmini)	CECC room 62
9:30-11:15	C) Oat Rust (Shahryar Kianian, Bruce Roskens and Eric DeBlieck)	CECC room 55
11:15	Whole Group discussion	CECC room 62
12:00	Lunch (Buffet in the upper lobby)	Upper lobby

1:00-3:15	Continue concurrent breakout sessions Seed quality (A), Genomics (B), Oat Rust (C)	Same groups and rooms
3:15- 4:00/:15	Report back to the whole group. Day 1 wrap up	CECC room 62
Time	Agenda (facilitator)	Room
Day 2 (change to room 83)		
8:00	Coffee and light morning refreshments	Lobby
8:10	Review of Day 1, housekeeping (TBD)	CECC room 83
8:30-11:30	Additional team working sessions A)Seed quality room 77 B)Genomics*, room 83 C)Oat Rust room 55	
11:30 12:00	Wrap up and meeting adjourned	CECC room 83

Genomics

The group settled on two near-term and one long-term goal to focus on:

Genomic Selection in Oats is very important to push genetic gain forward.

1. Design a pilot-scale SNP chip and assay representative breeding lines. Spring 2020
2. Invest in a low-cost genotyping SNP chip to enable high-quality, quick turnaround data. Summer 2020
3. Goal is to utilize predicted breeding values for new crosses in Fall of 2020

Reference genome is essential to support molecular efforts

1. Pick representative North American lines to contribute to global Oat Pan-Genome effort. Summer 2020

High-density genotyping platform will be possible once we have reference genome information.

Seed Quality

Priority 1 near term - Oat Quality Analysis

- High throughput oat grain analysis
    - 1000s of samples at 10x speed at reasonable cost
    - 20 – 40,000 samples not likely in the near term
- Traits of interest (suggested, but not complete)
    - NIR – Bg, Fat, Protein
    - Mechanical: %Groat, Ease of dehull, breakage, plumps/thins/mids,
- Establish quality advisory committee
    - Standardized protocol for sample submission and analysis (range of measurements)
- Need to better coordinate oat quality analysis to build database of traits of interest
- Better coordination of oat quality with genomics/T3
    - Take advantage of public oat nurseries; ION (advanced lines), UOPN
    - Capture GxExM metadata around locations
- What is the role of public/private oat quality data that is out there?

Research priorities long term - future

- Research topics TBD
    - MIRS – protein globulins
    - Grain utilization ARS lab in Peoria
        - Hi value oil – for health? Some oil's found only in oat.

        - Other traits – micro nutrients, Iron, copper, selenium, folate
    - Avenanthramides
    - Mycotoxins
- Pet foods
- Winter oat breeding & quality
- Rancidity issue? Tocopherols
- Public ARS collaborations on research
- Panicle formation?

Novel/new utilization of oats

- Winter oats. Was in CORE, not sure of quality data.
- Human health and oat quality traits
- Other traits – micro nutrients, Iron, copper, selenium, folate
- Pet foods
- Iron in oats.
- Rancidity issue? Fat,
- Hi value oil – for health? Some oil's found only in oat.

High volume milling phenotypes of the 'oat universe'

- Test weight: K / wts
- Groat characteristics:
    - Plumps, thins
    - Groat crease
- Ease of dehulling
    - % Groat (Hull to groat ratio)
    - Broken groats

Consumer Traits of interest

- Immediate Consumer needs?
    - NIR evaluation of Bg, fat, protein
- Lesser needs
    - Avenanthramides
    - Other

Tom's Notes (Morning Session | October 29th, 2019)

- ION and UNOP top of mind as need for grain quality evaluation
    - ION does not have all data analyzed
- Antioxidant oil levels, rancidity, labeling, avenanthramides
    - How do you measure Avenanthramides
- NIR for Bg. Is it approved by AACI?
- $100,000 to develop rapid throughput 10X cheaper
- Does bg testing range meet needs of breeders
- FT – Fourier Transformation NIR
    - Higher throughput than NIR
- MIRS – Mid Infra RED Spec (MIRS) not used much due to concerns about labor intensive, time
  consuming sample preparation procedures
    - Beyond BG, Protein, Fat
    - Can be used for Avenanthramides
    - Maybe protein structure?
- Beneficial carbs in oats-
    - Proteins for Impossible burger
- Oat protein characterization
    - Analysis of oat globulins
- Specialization in Utilization Lab – Peoria
    - Host of food and non food use of protein from oat?
    - Do you need targets, or do you just start looking
    - How do you start looking for globulins
- Who is the owner of the UON? Sharyar, Roger Caspers?
- Single Kernel Characterization – ex uniform groat size
    - Is it a technology need? A breeder need??
- TDF?? – no
- Dehulling characteristics, %groat, breakage, plump/mid/thins
- Equipment needs

How are we going to analyze (20 - 40,000 samples / year)?

- How do you get oat quality phenotype data to Jason F
- There are only 3 breeders in Canada, 4 in the US., can we come up with a standard phenotype lab.
- There was a joint agreement between AAFC and USDA ARS to work on oats, is that still out there?
- Uniform phenotyping is very important to POOL and T3 – Nick Tinker.
- Public breeders would submit ~1000 or entries/year
- We need to coordinate oat quality and Genome data – Jason F
    - Take advantage of public trials: UOPN, ION
    - Upload into T3

Oat Quality Advisory Committee:

- 5 members
    - Jo Heuschele
    - Wade Hainstock
    - Eric DeBlieck
    - Tom Rabaey
    - Dan Ward

Action Items

- More processing samples through Jae's lab
    - Jae will coordinate with three public breeding programs for advanced breeding samples as well
      as samples from the ION
- Research on Oat Quality
    - Padu, Nancy and Jae will coordinate their research
- Gene will coordinate Peoria efforts with the Advisory committee
- Gene and Eric will coordinate efforts / testing for mycotoxins
- Advisory Board will coordinate tocopherol research
- Jae will investigate hulless oat rancidity / unique aspects

- Mike will analyze mineral components of UOPN /ION samples
- Need to talk to Charlene about new Scientist

Oat Rust

Tuesday AM session – Identify Gaps, Issues

- Good phenotypic data for oat-rust interaction in areas where infection is not consistent (e.g., possible screening using buckthorn nurseries/locations - suggestions include South Dakota, Minnesota, Wisconsin, LSU)
- More collections of crown and stem rust from all locations, including international, are needed
    - Need more mechanisms – cooperators/sources to collect material
    - Recommend oat grower samples!!
        - Certified Seed growers?
        - Prairie Oat Growers Assn
        - Ontario Grain Growers
        - State seed certification agencies/Foundation seed groups
        - Crop Inspection/hail insurance agencies/representatives
        - Provide statement of need, expectations, WHY
- Need new sources of resistance identified, including wild oat species
    - Utilize "AgRenSeq" – U of Minnesota
    - Identify what we already have samples of, and what can we obtain?
- Single Gene resistance versus Adult Gene Resistance – what is faster, better for quicker results? – Likely BOTH
    - Develop "gene cassettes" or stacks
- Markers developed for resistance
    - Develop effective combinations of genes – identify resistance capability – RELEASE
    - Recycle known crown rust genes for testing
- Identify and leverage other sources of inoculum and potential resistance – roadways, pastures, leverage highway departments, livestock producers, cover crop users

Tuesday PM Session – Refine Needs:

- Develop more Genetic Material and a Common Repository – including segregating populations
    - Seed Storage of susceptible and resistant lines AND inoculum needed
- Long term Pathogen Backup system needs to be developed (currently CDL rust collection is not backed up)
    - Fort Collins?
    - Location capable of storage of material without distribution due to APHIS regulation and pathogenicity of certain historic rust samples
    - Distribution should be handled by current repositories with knowledge of pathogen isolates
- Can we leverage the Livestock Industry, conservationists, cover crop users, etc. to explain need and benefits to them, and utilize to develop sources of genetic material? How?
- Staffing needs –
    - "Dr. Howard Rines – 2.0"
    - Serious need to replace position vacated by Dr. Melanie Figueroa departure
- Leverage our need with USDA/ARS and AAFC and CFIA as a "Food Security Issue", given the favorable image of oats as a healthy food source
- Canadian limitations need attention – personnel, locations, space. Rust is increasing in intensity and geographic area. More resources will need to be identified and supported SOON.
- Develop a STEM RUST nursery in U.S. – recommended locations in Southern US states that include breeding materials and advanced varieties from all North America and International sources. Screening, scoring, and sampling needs to be conducted and communicated ASAP to cooperators.
- Coordinate with T3 leaders to include genome information readily available for rust genes. "Gene Browser" capability for rusts?
- Serious need for more phenotyping – both information and resources available.
- NEW GENES identified
    - Capture "low hanging fruit" from
        - Hexaploid variety plots across North America
        - USDA trials
        - International—especially EU and Scandinavian sources
        - Explore more Avena Sterilis resistance
- Again – multiple mentions of more strategic sampling from multiple locations and communicating results and observations GLOBALLY.

DAY 2 – Pathology Breakout Session – Refine Needs – Next Steps

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- Agreement that more consistent phenotyping is critical
- Identify inoculum loads – sources, carryover issues, pathways
- Stem rust recognized as a food security risk in the future as climate changes affect primary source locations and mutations occur
- Utilize best mapping tools available to refine and intensify Major Gene Map
- Expand and Utilize International Nursery resources to accumulate, score, report, and share resistance materials
    - Include differential lines for better understanding of pathogen population?
    - Expand screening locations including buckthorn and barberry nurseries
    - SHARE RUST SAMPLES as much as possible, especially within countries
    - Expand collection opportunities including Trap nurseries, US nurseries, Canadian nurseries, and international nurseries. Follow "Borlaug" strategy of international collections
    - Funding of nurseries should be strategic to avoid duplication but facilitate collaborative exchanges of material and knowledge.
    - GIVE FEEDBACK on data collected
    - All info should be posted in T3 ASAP, but needs to be more user friendly and easily accessible by the community
- Develop and employ a common North American PROTOCOL for sample collection of all rusts. Define and explain objectives in brief statements, provide envelopes and mailing instructions, and facilitate postage. Use POGA, seed companies, certifying agencies, milling companies, NAMA, etc.
    - Advertise the need via POGA, Oat Global, Oat Newsletter, USDA sites, Ontario Grain Growers, multiple sources of info dissemination.
- Develop common prioritization strategy across North American resources for testing protocols and sample testing
    - Avoid duplication but provide broad identification.
        - Requires collaboration between USDA, university, and AAFC
    - Allows entire Oat industry to identify and manage risk by location, provide emphasis on development tools

NEXT STEPS:

- GERMPLASM SCREENING AND INTROGRESSION – STRATEGY NEEDED
- Leverage International Pathology connections – not just oats
- Germplasm collection
- Collaborative testing, leveraging all other resources for other screenings

- SHARE ALL KNOWN technologies for sharing of germplasm and data – T3 sites and other locations of information – VITAL for other pathologists and oat breeders
- As an aide to discuss the REAL NEED among USDA/ARS and AAFA/CFIA administration across North America, we have identified the following acronym:
- **PAIR** –
- **Phenomics of Avirulance effectors In oat Rust**

Meeting Participants

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