WASHINGTON TURFGRASS SEED COMMISSION
PROGRESS REPORT FOR 2017 PROJECTS

Project No.:_____

Title: Integrated Disease Management of Ergot in Kentucky Bluegrass

Personnel: Jeremiah Dung, Oregon State University (OSU), Madras, OR; Kenneth Frost, OSU, Hermiston, OR; Navneet Kaur, OSU, Hermiston, OR; Qunkang Cheng, OSU, Madras, OR; Darrin Walenta, OSU, La Grande, OR; Stephen Alderman, USDA-ARS, Corvallis, OR; and Tracy Wilson, OSU, Madras, OR.

Reporting Period: November 2016-November 2017

Accomplishments:

Objective 1:

a) *Screening new fungicide chemistries for ergot control during anthesis*. At COARC, pyraclostrobin+fluxapyroxad (Priaxor®) reduced sclerotia incidence and severity in Kentucky bluegrass by ≥ 50% and significantly reduced overall disease ($P = 0.03$). Adepidyn®, Aproach®, Trivapro®, and Luna® also provided ergot control similar to the industry standard, Quilt Xcel®. Ergot was only detected at trace levels in field plots located at HAREC, so product evaluations could not be performed. However, data collected from field trials over 3 years suggest Priaxor® is effective at reducing ergot control in perennial ryegrass and Kentucky bluegrass seed crops. Powdery mildew and rust were only detected at trace levels in plots this year, preventing the evaluation of these products for mildew and rust control in grass grown for seed.
b) *Evaluation of commercial biocontrol products for ergot control.* Although SoilGard® applied in the fall reduced AUCPC values by 55%, a large amount of plot-to-plot variability was observed and significant effects of biocontrol products were not detected ($P = 0.95$).
c) *Evaluation of micronutrients to improve pollination and reduce ergot*. Foliar treatments of copper sulfate, TriPlex Boron®, or copper sulfate + TriPlex Boron® did not significantly reduce ergot incidence ($P = 1.00$), severity ($P = 0.62$), or ergot disease index ($P = 0.80$). ManKocide®, a combination of copper hydroxide (CuOH) and the fungicide mancozeb, also did not significantly reduce ergot compared to the control ($P > 0.05$). Significant effects on yield were also not observed ($P = 0.28$).

Objective 2:

a) *Predictive model refinement and validation.* In 2017, the previously published predictive degree-day period (414 to 727) occurred between May 22 and June 13 and accounted for 72% of the total spores captured at both sites in the Columbia Basin. The model did not perform as well in central Oregon, where most spores (>97%) were captured between May 15 and June 11 when air degree-days were between 189 and 459. Ninety-three percent of spores were captured between May 4 and June 9 at the two sites in La Grande, when air cumulative degree-days were between 119 and 418. Soil moisture, as measured by volumetric water content, was positively correlated with spore counts in 4 out of 5 fields measured between 2015 and 2017 ($P \leq 0.0068$). Wind speed and wind direction were negatively correlated with spore counts in La Grande (3 of 6 years) and the Columbia Basin (9 of 15 years) but not in

central OR (0 of 3 years). Updated models will be available for the final report and the 2018 growing season.

b) In 2017, seven spore traps were placed in central Oregon (1), the Columbia Basin of OR (2) and WA (2), and La Grande, OR (2). Spore traps were monitored weekly and samples were analyzed using microscopy and quantitative PCR to obtain spore counts. Collectively, four issues of the electronic Ergot Alert Newsletter were distributed to over 400 PNW grass seed growers and stakeholders in the three production regions (central OR, Columbia Basin, and La Grande). We integrated our degree-day model into the newsletter to provide growers with predictive assessments of ergot risk based on the degree-day model and spore trapping results.

Summary:

Data collected from field trials over three years suggest Priaxor® is effective at reducing ergot control in grass seed crops; several other fungicides also have the potential to reduce ergot. A large amount of variability was observed among plots treated with commercial biocontrol products and significant effects were not detected. Applications of copper and/or boron did not significantly decrease ergot or increase yield. Seven spore traps were placed in perennial ryegrass and Kentucky bluegrass seed fields in three production regions of Oregon and Washington. Preliminary results suggest that predictive degree-day models in central and northeast Oregon will differ than the model previously developed for the Columbia Basin. New weather data are currently being analyzed and incorporated to develop, validate, and/or improve regional predictive models. Differences among calendar-, scouting-, and model-based spray programs were not detected this year. The Ergot Alert Newsletter was sent to over 400 growers and stakeholders and included spore counts from statewide trapping efforts, prediction model updates, and regionally-focused disease management recommendations. Together, this research contributes towards the development of comprehensive integrated disease management strategies for ergot in grass seed crops of Oregon.

ACKNOWLEDGEMENTS:

Additional funding for this research was provided by the Oregon Seed Council, the Columbia Basin Grass Seed Association, and the Union County Grass Seed Growers. The researchers would like to thank the following companies for providing in-kind support: BASF, Bayer Crop Science, Central Oregon Seeds, Inc., Columbia River Seed, Syngenta, DuPont, and Riverview Seed. The technical support provided by Javier Almaguer, Hoyt Downing, Kelly Duggan, Travis Klopp, and Tim Weinke, was greatly appreciated.

PUBLICATIONS:

1. Dung, J.K.S., Alderman, S.C., Kaur, N., Walenta, D.L., Frost, K.E., and Hamm, P.B. 2017. Identification of weather factors related to *Claviceps purpurea* ascospore production and development and validation of predictive environmental favorability index models. Plant Disease 101(6):895-906.
2. Dung, J., Kaur, N., Walenta, D.L., Frost, K.E., Duringer, J., and Craig, A.M. An Update on Ergot Research at OSU. Oregon Seed Magazine (Winter 2017): 36-38.
3. Dung, J.K.S., Alderman, S.C., Walenta, D.L., and Hamm, P.B. 2016. Spatial patterns of ergot and quantification of sclerotia in perennial ryegrass seed fields in eastern Oregon. Plant Disease 100(6):1110-1117. ***June 2016 Plant Disease Editor's Pick.***
4. Walenta, D., Dung, J., Kaur, N., Alderman, S., Frost, K. and Hamm, P. 2016. Evaluating impact of a new information technology tool for ergot (*Claviceps purpurea*) management in Kentucky bluegrass and perennial ryegrass seed production systems of eastern Oregon. Proceedings of

the 2016 National Association of County Agricultural Agents Western Region Annual Meeting and Professional Improvement Conference: 31-32

5. Kaur, N., Dung, J.K.S., Walenta, D.L., and Frost, K.E. 2016. Prospects for ergot disease management with biocontrol products. Pages 38-40 in: 2016 Seed Production Research at Oregon State University USDA-ARS Cooperating. N. Anderson, A. Hulting, D. Walenta, and M. Flowers, eds. Oregon State University, Ext/CrS 153.
6. Dung, J.K.S., Alderman, S.C., Kaur, N., Walenta, D.L., Frost, K.E., and Hamm, P.B. 2016. Development of a predictive degree-day model for airborne ergot ascospores in perennial ryegrass seed production systems of eastern Oregon. Pages 35-37 in: 2016 Seed Production Research at Oregon State University USDA-ARS Cooperating. N. Anderson, A. Hulting, D. Walenta, and M. Flowers, eds. Oregon State University, Ext/CrS 153.
7. Walenta, D.L., Kaur, N., Dung, J.K.S., Alderman, S.C., and Frost, K.E. 2016. Monitoring ergot infection potential in commercial cultivars of Kentucky bluegrass, Grande Ronde Valley of Northeastern Oregon. Pages 32-34 in: 2016 Seed Production Research at Oregon State University USDA-ARS Cooperating. N. Anderson, A. Hulting, D. Walenta, and M. Flowers, eds. Oregon State University, Ext/CrS 153.

TALKS AND OUTREACH:

1. *Disease Management in Kentucky Bluegrass Seed Production*. Oral presentation. Central Oregon Farm Fair and Trade Show. February 2, 2017**.** Madras, OR (~50 attendees)
2. *Ergot Control – Labeled Chemical Products and Other Management Options.* Invited speaker. Oregon Seed Growers League 76th Annual Convention. December 13, 2016. Salem, OR (~75 attendees)

WASHINGTON TURFGRASS SEED COMMISSION PROGRESS REPORT FORMAT FOR 2016 PROJECTS

Instructions:

1. Record information for active and pending projects.
2. All current research to which principal investigator(s) and other senior personnel have committed a portion of their time must be listed whether or not salary for the person(s) involved is included in the budgets of the various projects.
3. Provide analogous information for all proposed research which is being considered by, or which will be submitted in the near future to, other possible sponsors.

Name (List PI#1 first)	Supporting Agency and Project #	Total $ Amount	Effective and Expiration Dates	% of Time Committed	Title of Project
J. Dung, K. Frost	**Current**: Union County Grass Seed Growers	$10,000	July 2017 - June 2018	1.0%	Understanding the Biology and Control of Ergot in Grass Grown for Seed
J. Dung, K. Frost,	Columbia Basin Grass Seed Growers Association	$10,000	July 2017 - June 2018	1.0%	Understanding the Biology and Control of Ergot in Grass Grown for Seed
J. Dung, K. Frost	Oregon Seed Council	$8,000	July 2017 - June 2018	1.0%	Biology and Control of Ergot in Grass Grown for Seed
J. Dung, K. Frost	Washington Turfgrass Seed Commission	$26,000	July 2017 – June 2018	1.0%	Controlling Ergot in Kentucky Bluegrass
J. Dung, M. Weber	Oregon Agricultural Research Foundation	$12,500	March 2016 – February 2018	0.5%	Characterizing the Incidence and Distribution of Bacterial Blight Infestation in Individual Carrot Seeds

R. Wilson, J. Dung, T. Turini	California Department of Pesticide Regulation	$104,300	July 2015 – March 2018	2.0%	Evaluation of Alternatives to Soil Fumigants and Diallyl Disulfide for the Management of White Rot in Onion and Garlic
J. Dung, D. Johnson	Mint Industry Research Council	$16,960	July 2017 - June 2018	0.5%	Integrated Disease Management of Verticillium Wilt
K. Vining, J. Dung	Mint Industry Research Council and Oregon Mint Commission	$26,023	July 2017 - June 2018	0.5%	Improvement of Mint Reference Genome, and Further Analysis of *Verticillium dahliae* Genetic Diversity
J. Weiland, J. Dung	USDA-ARS CRIS	$142,200	September 2015 – September 2018	0.5%	Identification, Detection, and Diagnostics of Verticillium Species of the Pacific Northwest
Goyer, Rondon, DeBano, Wooster, Frost, Sathuvalli	USDA-NIFA-NNF	$246,000	August 2016 – July 2018	1.0%	Enhancing Professional Quality of Future Leaders in Agriculture and Natural Resources: New Strategies for Graduate Student Training

DeJong, Gray, Charkowski, Alyokhin, Dwyer, Douches, Frost, Gevens, Groves, Jansky, Gudmestad, Yan, Zidack, Karasev, McIntosh, Olsen, Pappu, Hamm, Rondon, Novy, Whitworth	USDA-NIFA-SCRI	$8,399,472	October 2014 – September 2019	1.0%	Biological and economic impacts of emerging potato tuber necrotic viruses and the development of comprehensive and sustainable management practices
Frost	Oregon Potato Commission	$19,700	July 2017 – June 2018	1.0%	Potato Pathology Extension Program
Karasev, Kuhl, Wenninger, Nolte, Frost, Goyer, Sathuvalli, Rondon, Pavek, Inglis	Northwest Potato Research Consortium	$176,961	July 2017 – June 2018	1.0%	Management of potato viruses in the Pacific Northwest
Johnson, Frost, Thornton, Wharton	Northwest Potato Research Consortium	$75,070	July 2017 – June 2018	1.0%	Development of Verticillium wilt-suppressive soils and evaluation of fungicidal and biorational products for Northwest potato production

Frost, DeBano, Cooper, Swisher	Northwest Potato Research Consortium	$22,000	July 2017 – June 2018	1.0%	Molecular diet analysis of insects known to vector pathogens of potato
Frost, DeBano	Oregon Agricultural Research Foundation	$12,490	July 2016 – June 2018	1.0%	Molecular diet analysis of insects that vector vegetable pathogens
Frost	Western IPM	$29,990	March 2017-February 2018	1%	Distribution and diversity of barley yellow dwarf virus in Eastern Oregon grass seed production
Frost, Dung	USDA-NIFA-CARE	$294,000	November 2016-November 2018	5%	Integrating grower maintained and publically held data to improve potato early dying management
DeBano, Wooster, Frost	Oregon Agricultural Research Foundation	$12,500	July 2017-June 2019	1%	Using molecular techniques to enhance farm management for pollinators
Wooster, DeBano, Frost	Oregon Agricultural Research Foundation	$12,500	July 2017-June 2019	1%	Using molecular techniques to determine the importance of predatory invertebrates consuming potato pests
Wharton, Woodhall, Frost, Inglis, McMoran	Northwest Potato Research Consortium	$39,200	July 2017-June 2018	1%	Characterizing Fusarium species associated with and refining management of potato dry rot in the Pacific Northwest

Charkowski, Hao, Secor, McIntosh, Heuberger, Fuller, Johnson, Perna, Perry, Frost, Russell, Swingle, Kinzer, Rozenzweig, Fillatrault	USDA-NIFA-SCRI	$2.5M	October 2017-September 2022	4%	Integrating next-generation technologies for blackleg and soft rot management in potato
Gray, Charkowski, Gudmestad, Frost, McIntosh, Dwyer	Farm Bill 10007 (USDA APHIS PPQ S&T)	$425,453	April 2017 – October 2018	1%	Safeguarding the US seed potato industry against emerging seed potato-borne pathogens that impact trade and farm viability
J. Dung, K. Frost,	**Pending**: Washington Turfgrass Seed Commission	$26,000	July 2018 – June 2019	1.0%	Integrated Disease Management of Ergot in Kentucky Bluegrass
J. Dung, M. Weber	Oregon Agricultural Research Foundation	$12,500	March 2018 – February 2020	0.5%	Development of Epidemiological Models for IPM of Bacterial Blight in Carrot Seed Crops
J. Dung, D. Johnson	Mint Industry Research Council	$49,424	July 2018 - June 2019	0.5%	Understanding Strain-Specific Interactions to Improve Management of Verticillium wilt of Peppermint
Dung, Duringer, Frost, Craig	USDA-NIFA-AFRI Foundational	$499,000	September 2017-August 2018	1%	Evolutionary potential and ecological plasticity in Claviceps purpurea: a model system to study mating systems, mismatched phylogenies, and mycotoxins

Rosenzweig, Frost, Gudmestad	USDA-NIFA-AFRI Foundational	$499,000	September 2017-August 2018	1%	A systems approach to soil borne disease management for potato production
Higgins, Chad et al.	USDA NIFA AFRI (this proposal)	$5.2M	January 2018–December 2022	8%	An assessment of agri-voltaic systems for technical feasibility, economic sustainability and environmental sustainability in dry land wheat