

PROJECT NO: BJKX60

TITLE: Efficacy trials of Biostimulant products

PERSONNEL: Dr. Juliet Marshall, Ext. Crop Mgmt. Specialist (SC and E Idaho)
Dr. Kurt Schroeder, Ext. Cropping Systems Agronomist (Moscow)
Staff: Program staff, Collaborator: Ross Nielson, Business Development,
AgriGrow

ADDRESS: Dr. Juliet Marshall, 1776 Science Center Dr, Suite 205, Idaho Falls, ID, 83402;
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JUSTIFICATION: Biostimulants are a new category of products aimed to promote root health and stimulate beneficial microbial activity in the soil. These products are often a complex mix of multiple components. The abundance of products on the market claiming to improve yields is mind boggling. Although some products (organic certified fungicides, biocontrol agents, microbial biostimulants, organic teas) marketed to agricultural producers are beneficial, some of these products purported to stimulate plant health and improve yield in fact do neither. Unbiased research testing is required to validate efficacy of product claims and to test the feasibility of using biostimulant products in wheat production.

HYPOTHESIS & OBJECTIVES: Our hypothesis is that improvements in soil health and plant growth can be achieved by application of biostimulant products, and that multiple years of application to the same sites will have a cumulative benefit to plant health. Our specific objectives are to:

- 1) Determine the efficacy of biostimulant products after the first year of testing (2013-2014).
- 2) Reapply products to the same portions of the field that they were applied in the fall of 2013 to look for cumulative effects of multiple applications to a field.

PROCEDURES: Biostimulant products were applied in two locations in 2013. The first was in a field in Aberdeen that had been fallowed for three years, and the second at a research site on the Kambitsch Farm in Genesee. The treatments were applied as described in the table below and include two Agri-Gro products, IgniteS² and FoliarBlend. A 30 ft buffer with no treatment was seeded between each of the treatments to prevent carryover. These same treatments will be reapplied in the fall of 2014 and spring/summer of 2015.

Treatment	Seed treatment		Foliar blend protocol		
	Vibrance Extreme	Ignite ^x	Tillering	Flag leaf emergence	Boot stage
1	Yes	No	-	-	-
2	Yes	Yes	-	-	-
3	Yes	No	FoliarBlend ^y	FoliarBlend	FoliarBlend
4	Yes	Yes	FoliarBlend	FoliarBlend	FoliarBlend
5	No	Yes	FoliarBlend	FoliarBlend	FoliarBlend
6	Yes	No	Micro + N-P-K ^z	Micro + N-P-K	Micro + N-P-K

^xIgniteS² applied at 8 oz/cwt.

^yFoliarBlend will be applied at a rate of 24 oz/A at tillering and flag leaf emergence, and at 16 oz/A at boot stage.

^zThe Micro + N-P-K will be a foliar spray of the same concentration of micronutrients and macronutrients that are found in the FoliarBlend product.

Each of the above treatments was applied in a randomized complete block design with six replicate blocks. For the 2014-2015 crop season, additional applications of the same products to the same sites within each plot locations will be made as described above. This will allow for the testing of cumulative effects of multiple applications to a field over multiple years. Parameters to be measured will include plant stand, root mass (biomass), date of active spring growth, plant height, heading date and maturation date. Measurements of active soil carbon will also be made to assess soil health and microbial activity. Plots will be monitored for disease and pest issues and differences between treatments will be documented. At harvest, yield, test weight and protein data will be collected. Additional products will likely be added to expand the project in the fall of 2014 or fall of 2015.

DURATION: Second of three years. FY2014 was initiated in the fall of 2013 in Aberdeen and Genesee. Funding was obtained in an off-year cycle in order to initiate the research. The proposed research is for the second year (FY2015) of the study.

COOPERATION: Ross Nielson, Business Development with Agri-Gro, is providing product for testing.

ANTICIPATED BENEFITS/EXPECTED OUTCOMES/INFORMATION TRANSFER: Multiple applications of biostimulants are expected to have a cumulative effect and benefits of these applications may be more likely in the second and/or third year of application. Testing of biostimulant products will provide growers and the wheat industry with unbiased, replicated research results that will highlight the potential benefits of biostimulant products. The results of this research may be presented at field days or cereal schools and will be made available through published material and the websites.

LITERATURE REVIEW: Biostimulant products have been used for many years on a variety of crops. The traditional biostimulants consisted of live microorganisms applied to seed or in furrow (plant growth-promoting rhizobacteria). Although these types of treatments were beneficial in suppressing pathogens and improving plant vigor, they were difficult to formulate, often had poor shelf lives and required care when applying to seed or soil. Seed meals, such as those from canola were used to stimulate microbial activity for the purpose of disease suppression and improvement in plant vigor; however, large quantities of these materials are required, making this method uneconomical for wheat production. More recently, many new biostimulant products have come onto the market, spurred by the expanding organic industry and public demand for safer food. These are often quite complex formulations that may consist of ingredients such as humic acid, amino acids, seaweed extracts, micronutrient and many other substances. The majority of use for these products is in the organic production markets. There may be benefits to using some of these products as seed treatments or foliar sprays in non-organic farming systems. However, very little information exists for the benefits of these products on wheat.

- Chen, S.-K., Edwards, C.A, and Subler, S. The influence of two agricultural biostimulants on nitrogen transformation, microbial activity, and plant growth in soil microcosms. *Soil Biology and Biochemistry* 35:9-19.
- Mazzola, M., Granatstein, D.M., Elfving, D.C., Mullinix, K. 2001. Suppression of specific apple root pathogens by *Brassica napus* seed meal amendment regardless of glucosinolate content. *Phytopathology* 91:673-679.
- Weller, D.M. 1988. Biological control of soilborne plant pathogens in the rhizosphere with bacteria. *Ann. Rev. Phytopathol.* 26:379-407.

COMMODITY COMMISSION BUDGET FORM

Allocated by	Idaho Wheat Commission	during FY 2013	\$	-
Allocated by	Idaho Wheat Commission	during FY 2014	\$	14,000

REQUESTED FY 2015 SUPPORT:

	Salary	Temporary Help	Fringe	Travel	OE	CO	Grad Fees	TOTALS
Idaho Wheat Commission	\$ -	\$ 5,404	\$ 1,596	\$ 1,000	\$ 6,000	\$ -	\$ -	\$ 14,000

OTHER RESOURCES (not considered cost sharing or match):

a) Industry	\$ -
b) UI (salaries, operating)	\$ -
c) Other (local, state)	\$ -
d)	\$ -
e)	\$ -
TOTAL OTHER RESOURCES	\$ -

TOTAL PROJECT ESTIMATE FOR FY 2015:	\$ 14,000 <i>(Requested)</i>	\$ - <i>(Other)</i>	\$ 14,000 <i>(Total)</i>
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BREAKDOWN FOR MULTIPLE SUB-BUDGETS:

	(PI name)	(PI name)	(PI name)	(PI name)
Salary	\$ -	\$ -	\$ -	\$ -
Temporary Help	\$ 2,702	\$ 2,702	\$ -	\$ -
Fringe Benefits	\$ 798	\$ 798	\$ -	\$ -
Travel	\$ 500	\$ 500	\$ -	\$ -
Operating Expenses	\$ 3,000	\$ 3,000	\$ -	\$ -
Capital Outlay	\$ -	\$ -	\$ -	\$ -
Graduate Student Fees	\$ -	\$ -	\$ -	\$ -
TOTALS	\$ 7,000	\$ 7,000	\$ -	\$ -
Total Sub-budgets				\$ 14,000

CURRENT AND PENDING SUPPORT Form:

Name: Juliet Marshall

NAME (List PI/PD #1 first)	SUPPORTING AGENCY AND AGENCY NUMBER	TOTAL \$ AMOUNT	EFFECTIVE AND EXPIRATION DATES	% OF TIME COMMITT- ED	TITLE OF PROJECT
	Current:				
Marshall, J.M., and Johnson (Schroeder)	Idaho Wheat Commission	\$29,090	7/1/13 - 6/30/14	10	Extension Wheat Nurseries
Marshall, J.M. and Johnson (Schroeder)	Idaho Barley Commission	\$13,000	7/1/13 - 6/30/14	8	Education for Barley Production / Extension Nurseries
Marshall, J.M. and Patterson, P.	Idaho Wheat Commission	\$9,746	7/1/13 - 6/30/14	7	Production Systems and Wheat Varieties for Dryland Grain
Marshall, J.M.	USDA-ARS SCA	\$9,000	10/1/13 - 9/31/14	10	Management of Wheat and Barley Root Pathogens in Idaho
Marshall, J.M.	Monsanto, Syngenta, Limagrain, etc	\$28,250	7/1/13 - 6/30/14	2	Private breeding company entries into the Extension Variety Trials
Marshall, J.M.	Bayer Crop Sciences, BASF, Syngenta, etc	\$53,092	8/1/13- 7/31/14	8	Seed Treatment / Specialty Trials / Product Evaluation
Marshall, J.M.	Federal 047	\$1800		1	South Idaho Crop Management
Marshall, J.M.	Idaho State Funding	\$17,847	7/1/13 - 6/30/14	10	Barley Enhancement
Marshall, J.M.	Hatch Funding	\$1118	10/1/13 - 9/31/14	10	Foot Rot
Rashed, A. and Marshall, J.M.	Idaho Wheat Commission	\$7,800	7/1/13 - 6/30/14	2	Variety Screening for BYDV Resistance in Idaho

Marshall, J.M. and Schroeder, K.	Idaho Wheat Commission	\$9,000	7/1/13 – 6/30/14	5	Collaborative Nitrogen by Variety Interaction Study with LCS
Marshall, J.M. and Schroeder, J.	Idaho Wheat Commission	\$14,000	7/1/13 – 6/30/14	5	Biostimulant Efficacy Field Trial
Moore, A., and Marshall, J.M.	Idaho Barley Commission	\$16,000 (SA \$547)	2013-2014	1	Long-Term Impacts of Manure Application on Production of Barley and Other Crops
Moore, A. and Marshall, J.M.	Idaho Wheat Commission	\$18,210 (SA \$547)	2013-2014	1	Long-Term Impacts of Manure Application on Production of Wheat and Other Crops
Chen J., Wang, Y., and Marshall, J.M.	Idaho Wheat Commission	\$44,973 (SA \$7462.35)	7/1/13 – 6/30/14	2	Digging the genetic factors underlying LMA in wheat
Murray, T., Carter, A., and Marshall, J.M.	Idaho Wheat Commission	\$52,980 (SA \$4000)	7/1/13 – 6/30/14	1	Enhancing Resistance to Snow Mold Diseases in Winter Wheat
Marshall, J.M.	Idaho Wheat Commission	\$12,888	7/1/13- 6/30/15	1	Endowment funding
	Pending:				
Marshall, J.M., and Schroeder, K,	Idaho Wheat Commission	\$31,437	7/1/14 - 6/30/15	10	Extension Wheat Nurseries
Marshall, J.M. and Schroeder, K.	Idaho Barley Commission	\$14,672	7/1/14 - 6/30/15	8	Education for Barley Production / Extension Nurseries
Marshall, J.M. and Patterson, P.	Idaho Wheat Commission	\$9,746	7/1/14 - 6/30/15	7	Production Systems and Wheat Varieties for Dryland Grain

Marshall, J.M.	USDA-ARS SCA	\$6,042	10/1/14 - 9/31/15	10	Management of Wheat and Barley Root Pathogens in Idaho
Rashed, Marshall, Bosque-Perez, Pappu, Wallis, Eigenbrode	Idaho Wheat Commission	\$19,069	7/1/14 - 6/30/15	2	Wheat variety response to BYDV infection at different developmental stages
Rashed, A and Marshall, J.M.	Idaho Wheat Commission	\$36,400	7/1/14 - 6/30/15	2	A survey of central and eastern Idaho wireworm species and evaluating ecological and chemical approaches to maximize cereal production
Rashed, A and Marshall, J.M.	Idaho Barley Commission	\$15,540	7/1/14 - 6/30/15	2	A survey of central and eastern Idaho wireworm species and evaluating combinations of ecological and chemical approaches to limit damage to barley crops
Marshall, J.M. and Schroeder, K.	Idaho Wheat Commission	\$9,000	7/1/14 – 6/30/15	5	Collaborative Nitrogen by Variety Interaction Study with LCS
Marshall, J.M. and Schroeder, K.	Idaho Wheat Commission	\$14,000	7/1/13 – 6/30/15	5	Biostimulant Efficacy Field Trial
Moore, A. and Marshall, J.M.	Idaho Wheat Commission	\$19,110 (SA \$547)	2014-2015	5	Long-Term Impacts of Manure Application on Production of Wheat and Other Crops

Moore, A. and Marshall, J.M.	Idaho Barley Commission	\$16,000 (SA \$547)	2014-2015	5	Long-Term Impacts of Manure Application on Production of Barley and Other Crops
Rashed, Marshall, Bosque-Perez, Pappu, Wallis, Eigenbrode	Idaho Wheat Commission	\$19,069	2014-2016	3	Wheat variety response to BYDV infection at different developmental stages
Strawn, D., Chen, J., McDaniel, P., and Marshall, J.M.	Idaho Wheat Commission	\$73,907	7/1/14-6/30/15	2	Field-based study of factors affecting cadmium uptake by wheat from Idaho Soils
Chen, J., Wang, Y., and Marshall, J.M.	Idaho Wheat Commission	\$64,205	7/1/14 – 6/30/15	2	Digging the genetic factors underlying LMA in wheat

CURRENT AND PENDING SUPPORT Form:

Name: Kurtis Schroeder

NAME (List PI/PD #1 First)	SUPPORTING AGENCY AND AGENCY NUMBER	TOTAL \$ AMOUNT	EFFECTIVE AND EXPIRATION DATES	% OF TIME COMMITTED	TITLE OF PROJECT
Schroeder, K.	Current: U.S. Dry Pea and Lentil Council	\$18,338	7/1/13-12/31/14	2%	Pea, Lentil and Chickpea Extension Variety Trials in Northern Idaho
Schroeder, K.	Idaho Barley Commission	\$5,040	7/1/13-6/30/14	2%	Support Scientist Funding
Marshall, J. and Schroeder, K.	Idaho Barley Commission	\$14,672	7/1/13-6/30/14	2%	Education for Idaho Barley Production: Extension Cereal Nurseries
Schroeder, K.	Idaho Wheat Commission	\$9,800	7/1/13-6/30/14	2%	Support Scientist funding

Marshall, J. and Schroeder, K.	Idaho Wheat Commission	\$31,114	7/1/13-6/30/14	2%	Extension Wheat Nurseries
Marshall, J. and Schroeder, K.	Idaho Wheat Commission	\$14,000	7/1/13-6/30/14	2%	Biostimulant Efficacy Field Trial
Marshall, J. and Schroeder, K.	Idaho Wheat Commission	\$9,000	7/1/13-6/30/14	2%	Collaborative Nitrogen x Variety Interaction Study with LCS
Schroeder, K.	Pending: U.S. Dry Pea and Lentil Council	\$19,532	7/1/14-12/31/15	2%	Pea, Lentil and Chickpea Extension Variety Trials in Northern Idaho
Schroeder, K.	Idaho Barley Commission	\$5,040	7/1/14-6/30/15	2%	Support Scientist Funding
Marshall, J. and Schroeder, K.	Idaho Barley Commission	\$14,672	7/1/14-6/30/15	2%	Education for Idaho Barley Production: Extension Cereal Nurseries
Schroeder, K. and Hu, G.	Idaho Barley Commission	\$4,025	7/1/14-6/30/15	2%	Evaluation of Advanced Barley Lines in Northern Idaho
Schroeder, K.	Idaho Wheat Commission	\$9,800	7/1/14-6/30/15	2%	Support Scientist funding: Education for Idaho Wheat Production in Northern Idaho: Extension Cereal Nurseries
Marshall, J. and Schroeder, K.	Idaho Wheat Commission	\$31,437	7/1/14-6/30/15	2%	Extension Wheat Nurseries
Schroeder, K. and Painter, K.	Idaho Wheat Commission	\$20,288	7/1/14-6/30/15	2%	Managing Soil Acidity and Aluminum Toxicity in Northern Idaho
Marshall, J.M. and Schroeder, K.	Idaho Wheat Commission	\$9,000	7/1/14-6/30/15	2%	Tailoring nitrogen recommendations by variety: winter wheat response to fertilizer application timings

Marshall, J.M.
and Schroeder,
K.

Idaho Wheat
Commission

\$14,000

7/1/14-
6/30/15

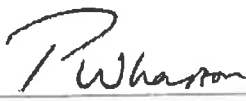
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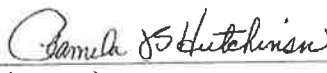
Biostimulant Efficacy
Field Trials

INTERNAL PEER REVIEW/PRINCIPAL INVESTIGATOR VERIFICATION FORM

INTERNAL PEER REVIEW VERIFICATION

Commodity commissions/organizations require internal peer review by colleagues familiar with the subject matter. This proposal has been peer reviewed by the following individuals:

Reviewer 1: Dr. Phillip Wharton  1/2/14
 (Type/Print name) (Signature) (Date)

Reviewer 2: Dr. Pamela J.S. Hutchinson  1/2/14
 (Type/Print name) (Signature) (Date)

Dept. Head/ Dr. Paul McDaniel  1/7/14
 Unit Administrator (Type/Print name) (Signature) (Date)

PROGRESS REPORT

PROJECT NO: BJKX60

TITLE: Efficacy Trials of Biostimulant Products

PERSONNEL: Dr. Juliet Marshall, Ext. Crop Mgmt. Specialist (SC and E Idaho)
 Dr. Kurtis Schroeder, Ext. Cropping Systems Agronomist (Moscow)
Staff: Program staff
Collaborator: Ross Nielson, Business Development, AgriGrow

ADDRESS: Dr. Juliet Marshall, 1776 Science Center Dr, Suite 205, Idaho Falls, ID, 83402;
 208-529-8376; jmarshall@uidaho.edu

ACCOMPLISHMENTS: Funding for FY14 was obtained in an off-year cycle in order to initiate the research in the fall of 2013. Therefore, this report is only for a small portion of the FY14 cycle. Research trials were initiated in a field in Aberdeen and at the Kambitsch research farm in Genesee. Each trial consists of six treatments that include the biostimulant IgniteS², with and without chemical seed treatment. An additional biostimulant will be applied as a foliar product in the spring/summer of 2014 as outlined below. Each individual plot is 5 feet wide by 30 feet long, with six replicate plots for each treatment. A 30 foot buffer of winter wheat without biostimulant product was seeded between each plot.

Treatment	Seed treatment		Foliar blend protocol		
	Vibrance	Ignite ^x	Tillering	Flag leaf emergence	Boot stage
1	Yes	No	-	-	-
2	Yes	Yes	-	-	-
3	Yes	No	FoliarBlend ^y	FoliarBlend	FoliarBlend
4	Yes	Yes	FoliarBlend	FoliarBlend	FoliarBlend
5	No	Yes	FoliarBlend	FoliarBlend	FoliarBlend
6	Yes	No	Micro + N-P-K ^z	Micro + N-P-K	Micro + N-P-K

^xIgniteS² applied at 8 oz/cwt.

^yFoliarBlend will be applied at a rate of 24 oz/A at tillering and flag leaf emergence, and at 16 oz/A at boot stage.

^zThe Micro + N-P-K will be a foliar spray of the same concentration of micronutrients and macronutrients that are found in the FoliarBlend product.

PROJECTIONS: Further applications of biostimulants will be made in the fall of 2014 to the same locations within each trial. It is expected that multiple applications should have a cumulative effect and benefits are more likely or may be more pronounced in the 2014/2015 crop season. Based on the information gained in this study, additional biostimulants might be compared in coming years, and may include examining potential impacts of biostimulants on seedling diseases of wheat. It is expected that the results of this study will provide information on the feasibility of using biostimulants in wheat production and will allow growers to make educated decisions about which products to use and how best to apply them.

PUBLICATIONS: None.