Malt Barley Grain Yield and Quality Response to Repeated Dairy Manure Applications in Southern Idaho

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UNIVERSITY of Idaho soil fertility specialist, Amber Moore, and University of Idaho barley agronomist, Christopher Rogers, are entering the fourth year of an eight-year study to evaluate the use of dairy manure for various crops in a rotational cropping systems study. The goal of the study is to gain a better understanding of how repeated dairy manure applications impact a wide variety of factors related to crop yield and quality, soil health, and environmental quality in a wheat-potato-barley-sugar-beet crop rotation.

Dairy manure was applied at rates of 7.7, 15.4, and 23.2 ton/acre (dry weight basis) either annually or biennially from 2012 to 2015 on irrigated research plots located on the USDA ARS research station in Kimberly, Idaho. Annual treatments are applied fall-applied every year, while biennial treatments are fall-applied every other year prior to planting of the small grain crop (i.e., wheat or barley). A fertilizer-only treatment based on current University of Idaho Extension recommendations for each crop was also included, to help understand how manure systems compare to non-manured systems. A control treatment (no supplemental fertilizer or manure added) was also included. All treatments will continue until 2020.

Moderate applications of dairy manure (up to 20 ton/acre/year) had negligible effects on barley yield and quality in comparison to fertilizer-only treatments (Table 1). However, as manure applications and/or frequency of applications increases, increased proteins, increased lodging, decreased percentage plumps, and even yield loss started to occur (Table 1). We speculate that increasing pools of soil N and other manure nutrients resulted in increased plant height and was, at least partially, responsible for increased lodging. Increased N also likely increased protein levels, although protein levels were still under the 12% protein threshold recommended by the American Malt Barley Association. Decreases in percentage plumps and other quality issues may be attributed to excessive N availability later in the growing season and/or accumulations of K (potassium) and other salts in the soil. We will be further evaluating relationships between soil parameters, plant nutrient uptake, and other yield components to better understand why and how the barley crop responds to dairy manure applications. The final goal of the project is the development of models to help growers predict barley crop response to manure applications. Through studies such as this, we can help ensure sustainable production practices are being implemented in Idaho by improving our understanding of dairy manure applications in a rotational setting, thus resulting in high yields and quality while minimizing potentially negative impacts.

This project is jointly funded by the Idaho Barley Commission, the Idaho Dairymen's Association, the Idaho Wheat Commission, the Northwest Potato Coalition, and the USDA Agricultural Research Service (ARS), and the USDA-NIFA hatch program.

Table 1. Moravian-69 spring malt barley responses in 2015, year 3 of an eight year long term dairy-manure application study in Kimberly, Idaho. Soil nutrients tested at the 0-12 inch soil depth. The protected LSD multiple comparison (alpha=0.05) was used for statistical analysis.

Dairy manure rate (ton/acre, dry basis)	Frequency of Applications	Yield (bu/acre)	Protein (%)	Plumps (6/64) (%)	Lodging rating (1-9)	Plant height (inch)	Preplant soil nitrate-N (ppm)	Preplant soil K (ppm)
Control	NA	102 c	9.7 d	94 a	1 c	24 d	16 d	127 d
Fertilizer	NA	146 a	10.1 c	91 ab	1 c	29 c	19 d	145 d
7.7	Biennial (Applied in 2012 and 2014)	141 a	10.2 c	90 ab	2 bc	29 bc	26 cd	280 cd
15.4		140 a	10.5 ab	83 c	4 b	32 a	36 bc	427 c
23.2		122 b	10.8 a	81 c	7 a	32 a	53 a	665 b
7.7	Annual (Applied in 2012, 2013, and 2014)	145 a	10.3 bc	89 b	2 bc	31 ab	26 cd	410 c
15.4		138 ab	10.6 a	83 c	6 a	32 a	45 a	777 b
23.2		131 ab	10.8 a	76 d	8 a	32 a	53 a	1110 a

Global Grain Market Outlook, November 2015

MY 2015/16 World Grain Supply & Demand

USDA, Nov. 10, 2015 (million metric tons, MMT)

	BARLEY		CORN		WHEAT	
	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16
Carryin	23.9	23.8	174.9	208.2	193.6	211.7
Production MMT	141.2	144.8	1,008.8	974.9	725.1	732.9
Total Supply	165.1	168.6	1,183.7	1,183.1	918.7	944.6
Export trade	29.8	25.5	132.3	128.0	161.3	160.9
Total Usage	141.2	144.9	975.5	971.2	707.0	717.4
Ending Stocks	23.8	23.7	208.2	211.9	211.7	227.3
Stocks / Use	17%	16%	21%	22%	30%	32%

MY 2015/16 U.S. Grain Supply & Demand

USDA, Nov. 10, 2015 (million bushels)

	BARLEY		CORN		WHEAT	
	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16
Harvested Acres (mln)	2.5	3.1	83.1	80.7	46.4	47.1
Carryin	82	79	1,232	1,731	590	753
Production (mln bu)	182	214	14,216	13,654	2,026	2,052
Imports	24	18	32	30	149	125
Total Supply	287	311	15,479	15,415	2,766	2,930
Food, seed & industrial	151	153	6,568	6,555	1,039	1,039
Ethanol			5,209	5,175		
Feed	43	50	5,315	5,300	120	180
Exports	14	12	1,864	1,800	854	800
Total Usage	209	215	13,748	13,655	2,013	2,019
Ending Stocks	79	96	1,731	1,760	753	911
Stocks / Use	38%	45%	13%	13%	37%	45%