



## **Testing N Efficient, High Methionine Corn Hybrids with Organic Farmers**

#### Background

Corn is the most productive cereal crop in the Midwest, and nitrogen (N) fertilizer application to corn fields has polluted ground and surface waters and caused hypoxia in the Gulf of Mexico.

Mandaamin Institute has developed N efficient, high-protein, high methionine corn hybrids that will: 1) reduce the use of nitrogenous fertilizers, thereby reducing both input costs and pollution; 2) replace or reduce feeding of synthetic methionine to organic poultry, a common practice which is being phased out by federal mandate.

Under N-limited conditions, Mandaamin's N-efficient inbreds and hybrids show strong growth, greater chlorophyll production, greater root production in the topsoil, and higher mineral content in their grain relative to standard cultivars and they compete better with weeds. Small plot research in 2015 and 2016 indicates that Mandaamin's top hybrids are competitive in yield with conventional hybrids and produce considerably greater nutrient density and higher protein per acre than standard cultivars, especially under low input conditions.

Results in 2016 on two low fertilility and low fertilizer organic sites					
Near Elkhorn, Wisconsin.					
Site and Pedigree	grain yield	protein	lysine	methionine	Protein yield
	bu/acre	percent total dry matter		pounds/acre	
JR3 site, low fertilization rate					
Mandaamin ave 5 hybrids	125	9.00	0.36	0.26	535
Conventional ave 4 hybrids	115	6.97	0.30	0.19	381
diff NGSC vs checks in %	9	29	18	35	40
BP site, low fertilization rate					
Mandaamin ave 5 hybrids	150	8.88	0.36	0.27	627
Conventional ave 1 hybrid	124	6.96	0.29	0.19	411
diff NGSC vs check in %	21	28	20	38	53
Zinniker site very heavily manured					
Mandaamin ave 10 hybrids	178	11.28	0.39	0.30	951
Conventional ave 6 hybrids	180	10.40	0.33	0.25	885
diff NGSC vs checks in %	-1	8	19	23	7



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# **Our Farms, Our Future Conference**

#### SARE PROJECT LNC17-389

### Methods

Mandaamin Institute and it seed licensing arm (Nokomis Gold Seed Company, LLC (NGSC), Elkhorn, WI) have partnered with a commercial seed company (Foundation Organic Seeds, LLC, Onalaska, WI) and an organic farmer John Pounder (Pounder Brothers, Inc., Delavan, WI) to produce seed in 2017 and in the winter of 2017/2018 for larger-scale strip testing of these top hybrids. We will testing these hybrids with 7 organic farmers on their farms in the southern Wisconsin region. Research will take place on 4 farms in 2018 and 2019 and 3 farms in 2020. We will compare a normal hybrid and a N-efficient/putative  $N_2$ fixing hybrid and inoculate with and without a consortium of N<sub>2</sub>-fixing bacteria produced by TerraMax Co (Minneapolis, MN) for our hybrids. Testing will involve determining the impact of these hybrids on N uptake, N balance, N efficiency, N pollution, grain quality, and feed value under fertilized and unfertilized conditions on replicated strips. Soil research will estimate effects of plants on obtaining N from organic matter and N fixation.

We will work with poultry consultants and organic poultry producers to formulate diets and encourage the testing of diets on small flocks with grain from the experiments.



Conventional inbreds LH206, LH123, S7, S5 grown on JR or Creek field (S5) in 2017 without fertilizer. LH206 and 123 were bred by Monsanto; S7 and S5 are commercial inbreds from a seed licensing company.

NokomisGold Seed Company inbreds C4-6, LAT-7, NG2-3-2, and C2-B bred at the Mandaamin Institute and grown on JR or Creek field (C2-B) in 2017 without fertilizer.



Part of our nutrient efficiency is that we selected inbreds with broad, fibrous rooting systems adapted to extracting nutrients from soil.







Nokomis Gold variety without N fertilizer.

The (N2 fixation?) trait is heritable. Early July 2016: picture shows related inbred (S6) families grown on a nitrogen deficient field. The lines on the left appear to not be as highly N efficient as those on the right, but the two sets are closely related (Mex 1 x Inbred 1(BC) 1-B-6 family on left and 1-B-4 family on the right).







#### Walter Goldstein

#### Commercial variety without N fertilizer.



