

Contract No. R-037-046
“Barley Protein Concentrate”
Submitted by: Midwest AgEnergy Group
Principal Investigator: Jeff Zueger

PARTICIPANTS

Sponsor	Cost Share	
Midwest AgEnergy Group (cash)	\$ 66,410	
Montana Microbial Products (in-kind)	\$ 12,000	
North Dakota Barley Council (in-kind)	\$ 3,000	
Proton OnSite (in-kind)	<u>\$ 2,400</u>	
Subtotal Cash and In-Kind Cost Share		\$ 83,810
North Dakota Industrial Commission	<u>\$ 83,810</u>	
Total Project Cost		\$167,620

Project Schedule – 3 years	Project Deliverables:
Contract Date – 7/10/2018	Final Report: September 1, 2018 ✓
Start Date – 7/1/2018	
Completion Date – 9/1/2018	

OBJECTIVE/STATEMENT OF WORK:

The objective of this project is to conduct preliminary studies regarding using North Dakota barley to produce a high value protein concentrate designed for aquaculture and a low carbon advanced biofuel at Dakota Spirit AgEnergy. The project would scale up technology developed and owned by Montana Microbial Products and integrate it into Dakota Spirit AgEnergy. This first phase of the project will provide a market analysis of protein feed ingredients in aquaculture, conduct and analysis of barley availability as a feedstock in North Dakota, complete Front End Engineering and Design (FEED) and integration opportunities, and develop an understanding of the regulatory requirements necessary to move forward with construction.

Proposed deliverables include:

- A study of the supply and costs of feed barley grown in ND and its availability as a feedstock for protein concentrate and advanced biofuels;
- A market opportunity study for barley protein concentrate in aquaculture, including the size, scale, logistics, and dynamics of the aquaculture market;
- An engineering study regarding integration feasibility and design equipment specifications with a +/- 30% cost estimate.
- A report on the likelihood of receiving an advanced biofuel designation and the pathway for achieving all required regulatory approvals.

If successful, this project will provide additional markets for barley. Increased barley production could benefit soil fertility by reducing salinity. It would enhance diversification at a North Dakota ethanol plant while enabling North Dakota to get a foothold in the aquaculture industry.

STATUS:

The contract has been executed.

September 1, 2018

Final report received. A copy of the full final report is available on the website. The Executive Summary of the project includes the following information.

Significant Findings: Market conditions over the last three years suggest a protein concentration project can offer a competitive cash flow cropping option for barley growers and maintain feedstock costs low enough to achieve satisfactory processing margins.

There is a strong demand for high protein products in commercial animal raising operations. BPC value is believed to correlate to #2 fishmeal as it has unique characteristics which may allow it to serve as direct replacement in carnivorous fish diets. Fishmeal has traded in the range of \$750-\$2000/ton since 2008. World demand for fish meal substitute is estimated at about 650,000 metric tons.

Multiple integration opportunities for the BPC process into DSA's current operation were determined. Capital cost estimates provided by Fluid Quip Process Engineering (FQPT) for feasibility level design and integration were higher than anticipated at about \$65 million for primary case.

BPC in existing form has cleared regulatory requirements to be marketed in the US. Additional approvals are required to market in Canada and worldwide. The production of ethanol from barley meeting the definition of an advanced biofuel is likely.

Next Steps: As this was only feasibility level, further discovery will be required. Areas requiring additional research or expertise identified in this project include the value of the BPC product in the aquaculture market and strategies for reducing capital expenditures. It is our intention to continue to refine value model assumptions on fishmeal substitutes in the aquaculture market and further evaluate options to reduce the expected capital and operational costs.

This contract is now closed.

Updated 9/28/2018