AGRICULTURAL PROFITABILITY

Increasing Profitability by Improving Efficiency of Montana's Farm and Ranch Lands

Principal Investigator:

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Funding Amount: $2,276,734

Economic Impacts:

In a year of research, built on multiple years of previous research, this project has focused on replacing 3.38 million acres of Montana land currently left fallow with pulse or cover crop mixes. Initial data analysis generated statewide indicates a projected increased gross income for rural Montana of $90 million if 25% of previously fallow land is cropped to cover crop mixes, $101 million if cropped to peas, and $253 million if cropped to lentils. Precision agriculture technologies have proven to increase profitability by $8-50 million annually if adopted on 25% of wheat acres. Additionally, new optics-based technologies have been developed and demonstrated to identify herbicide-resistant weeds and reduce herbicide use by >30%.

This project focuses on improving the economic and environmental sustainability of crop and livestock agriculture, Montana's highest-grossing industry, by intensifying pulse and cover crop production on 4.6 million acres of Montana land traditionally left fallow. Information derived from this project will help give farmers confidence as they change cropping practices. All data will be used for professional economic analysis by MSU agricultural economist faculty. Additional objectives:

- Optimize profit potentials for new and improved crops that fit localized needs statewide.
- Develop new markets and offer opportunities for value-added processing. Data on pea protein content will support business plans for a pea protein fractionation plant in Montana. Durum wheat production, marketing, and processing will be supported by better durum varieties.
- Develop new products, including optical sensor-based nozzles for the precision spraying of weeds, and increase the adoption of precision ag technologies by helping farmers access and process data to provide optimal prescriptions for variety selection, fertility, weed management, and re-plant decisions via an automated on-farm precision experimentation system.

Objectives and Progress:

1. **Improve income from lands previously fallowed.**
   The research on cover crop mixes, pulse crops (pea, lentil and chickpea) has been conducted statewide utilizing the seven MAES Research Centers, in addition to MSU's research center in Bozeman. This research identified specific pulse varieties that are best-adapted to each region of Montana and include data tailored for regional profit potential from different cover crop mixes, soil water use, pea protein content, soil microbiology effects

continued

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and better wheat stem sawfly control by parasites supported by flowering plants in the landscape, and weed control strategies that will safely allow pulse crop production in wheat rotations. An important output of this work is the statewide agricultural expertise and experience with these new cropping systems. In addition, the hay production from cover crop mixes has the potential to replace hay supplies now provided in times of drought by the Conservation Reserve Program (CRP) which is being phased out as a producer option.

2. **Develop new, improved or quality differentiated products or crops.** A Montana-focused durum variety development program was initiated in a partnership between MSU and Northern Seed. New and promising lines with high yield, high quality and low cadmium content have been identified that will fit traditional durum production areas of Montana as well as the "Golden Triangle Region". A Montana durum variety from this program will be released in 2017/2018. Microbial inoculants to combat nitrate poisoning in livestock have been researched and optical sensors have been developed for the detection of herbicide resistant weeds and precision weed control methods have been identified. A bacterium that can fix nitrogen on a wide range of crops and new bacterial strains associated with peas has also been identified.
3. **Develop on-farm precision agriculture tools and technologies.** OFPE (On-Farm Precision Experiments) have been planted and harvested with accompanying data on optimal fertility relative to yield, grain protein and weed management. This data will be used in an economic analysis and in the development of computer software to ultimately develop predictive, and optimal, economic and sustainable recommendations for crop fallow and continuous crop scenarios. In support of this effort, a weather and soil moisture network has been developed and linked to the University of Montana Climate Center in an effort to develop better predictions on soil moisture content for re-cropping, and fertility modeling for predictive yield and protein models. Finally, a research network comprised of producers, suppliers, Extension educators and MUS researchers has been created to evaluate this project and to address constraints for wider adoption by producers.

Return on Investment:

- **Jobs**
  - Research scientists & technicians: 19 faculty (2.6 FTE), 9 technicians (5.0 FTE)
  - Undergraduate and Graduate Assistants: 17
  - Postdoctoral scholars: 1
  - Private industry: 3 FTE
- **Connections—private sector partnerships:**
  - Northern Seed LLC—Great Falls
  - NWB Sensors Inc.—Bozeman
  - Salish & Kootenai Electronics—Ronan
- **Leverage**
  - $4.5 million in grants funded
- **Output**
  - Patentable technologies have been identified for hyperspectral optics to identify herbicide resistant weeds and weeds in crop canopies, nitrogen fixing bacteria that can be used in grain crops, and new software for precision agriculture. In addition, the work in precision agriculture will result in new crop consultant job opportunities in the private sector.
  - Durum wheat variety specifically adapted to Montana released in 2017/2018.
  - Patent filed on hyperspectral optical sensors for use in weed control.