**2013 PROPOSAL FOR COLORADO POTATO ADMINISTRATIVE COMMITTEE, AREA II**

**TITLE: Low Water Use Rotational Crop Options for San Luis Valley Potato Cropping Systems**

**FUNDING SOURCE: CPAC**

**INVESTIGATOR:**
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**COOPERATORS:**
San Luis Valley Potato Growers
San Luis Valley Soil Health Working Group

**NATURE, SCOPE AND OBJECTIVES OF PROPOSED RESEARCH:**
Planting of novel and/or multi-species cover, green manure, hay and forage crops for use in potato rotations has increased greatly among farmers in the San Luis Valley, with increasing attention given to water consumption during our prolonged drought. Primary concerns in moving to alternate cover crops, either as single or multi-species mixes, include potential water savings over traditional rotational crops, improvement of soil health, and improved pest management. Previous research initiatives in the San Luis Valley and abroad have documented the host status for *Spongospora subterranean*, the fungus which causes Powdery Scab of potatoes, and of the Columbia Root-Knot Nematode (*Meloidogyne chitwoodi*, CRKN) for several potential rotational crops for potato farmers of the San Luis Valley. Further study of the cover crops which have proven of benefit to potato rotations is merited, to determine how efficiently each of these crops will perform when grown under water-limited conditions. Future planting and management decisions for reduced water use on-farm, for improved soil health, for potato crop growth, and for potato quality will be informed by the results of this research. The study will track crop growth and biomass accumulation through the season relative to plant population, water use, soil fertility and weather conditions, to establish baseline data for the studied crops and cultivars.

**OBJECTIVES:**
1. Evaluate rotational crops and cultivars available to San Luis Valley potato farmers for water use efficiency. Evaluate secondary effects of crop growth on soil health and pest pressure.
2. Host mid-season tour of plots for CPAC and farmers, held in conjunction with SLV Soil Health Working Group annual summer field tour.
3. Revise guidelines for best utilization of cover crops tested during 2012 and 2013, relative to goals pertinent to potato rotations of the SLV.
4. Inform SLV farmers of the utilization of specific crops and cultivars for potato rotations and the resources required to produce the same.

**JUSTIFICATION, METHODS, PROCEDURES AND FACILITIES (BY OBJECTIVE)**

**Objective 1: Evaluate rotational crops and cultivars available to San Luis Valley potato farmers for water use efficiency. Evaluate secondary effects of crop growth on soil health and pest pressure.**

San Luis Valley trials conducted in 2012 tested the growth of particular crops and cultivars in a field environment under optimized nutrient and water conditions, testing for changes to the soil environment and pathogen load in response to the growth of these particular plants. The 2013 trials will be performed under water- and nutrient-limited conditions, planted in a field surrounded by a cover crop, in a field in rotation with potatoes. The primary goal of this trial is to test the capacity of novel cover crops and cultivars to produce biomass under stress conditions. Seeding of cover crops will be done in mid-June using a small-plot drill, to allow for establishment of five replicates of 30'x12' for each crop entry. Soil moisture, irrigation amounts, percent cover, insect pest infestation, weed pressure and crop height will be tracked incrementally through the season. Soil health status will be assessed using physical assessment and chemical analysis of soils before and after the trial to determine effects of crop entries.

Rotational Crops & Cultivars to Be Evaluated:

| |
|---|
| Anaconda Oilseed Radish |
| Biofum Summer Brassica Blend |
| Saia Black Oats |
| Buckwheat VNS |
| Caliente 61 Indian Mustard |
| Cassius Oilseed Radish |
| Corrine Ethiopian Cabbage |
| Dawn Proso Millet |
| Defender Oilseed Radish |
| Doublet Oilseed Radish |
| Elbon Cereal Rye |
| Fava Beans VNS |
| Monida Forage Oats |
| Pearl Millet Hybrid VNS |
| Polyculture 2013 - Sordan 79 Blend |
| Polyculture 2013 - Terra Nova Blend |
| Sordan 79 Sorghum/Sudangrass |
| Terra Nova Oilseed Radish |
| Trio Brassica Blend |
| Winfred Turnip Hybrid |
| Madrid Yellow Sweet Clover |

**Objective 2: Host mid-season tour of plots for farmers, held in conjunction with SLV Soil Health Working Group annual summer field tour.**

Relating information and experiences gained from the cover crop trial while it is growing in mid-summer, and joining educational / demonstration efforts of the SLV Soil Health Working Group through an organized field tour allows for increased dialogue between farmers and researchers regarding benefits and drawbacks of particular rotational cropping options. Annually, the SLV

Soil Health Working Group organizes a summer tour of SLV fields to demonstrate unique efforts made at improving soil health and to test new techniques / crops that could suit farms of our region. Partnering with the SLV Soil Health Working Group in this effort gives CPAC-members and funded researchers a chance to make known CPAC's contributions to water-conservation research for the region, while visiting a variety of other cover crop demonstrations across the region.

**Objective 3: Revise guidelines for best utilization of cover crops tested during 2012 and 2013, relative to goals pertinent to potato rotations of the SLV.**
Findings from 2012 research study will be reviewed and updated to include 2013 results. Final written report of research findings and guidelines will be submitted to CPAC by December 2013.

**Objective 4: Inform SLV farmers of the utilization of specific crops and cultivars for potato rotations and the resources required to produce the same.**
Data and experiences gained from studies in 2012-2013 on rotational crop options for potato farmers in the San Luis Valley will be formally presented to CPAC growers following publication of guidelines from Objective 3, to an audience of CPAC's choosing.

**ENHANCEMENT OF COMPETITIVENESS OF COLORADO POTATO GROWERS**
Development of high water use efficiency rotational crop options, which could reduce pesticide-intensive measures for nematode and powdery scab control, are required to maintain Colorado's competitive advantage relative to other potato growing regions. Research in drought-survival practices, while allowing maximum economic return to farms through crop rotation options, is critical for the long-term viability of the state's potato producers. Information currently available from research on high water use efficiency crops for use in potato rotations is very limited. This lack of information also limits the options Colorado potato farmers have for making informed decisions to minimize risk, maximize economic returns, and build soil health.

**EXTENSION-OUTREACH PLAN**
Outcomes will include recommendations for the most effective and economical use of alternative crops and cultivars, relative to criteria funded by 2012-2013 rotational crop trials. Provisional data from this study will be communicated to potato growers during the SLV Soil Health Working Group Summer Tour. Final results and recommendations will be made available to CPAC for communication to its membership electronically in December 2013. Final conclusions will be available for presentation to CPAC membership, as designated by CPAC (e.g. 2014 Southern Rocky Mountain Agricultural Conference).

**POTENTIAL OF PROPOSED RESEARCH TO OBTAIN FURTHER FUNDING**
Demand for more diverse rotational crop options for the San Luis Valley has given additional incentive for seed suppliers to provide crops and cultivars best suited to local potato rotations. The number of crop types and cultivars proposed for evaluation through this study is not exhaustive, but is a starting point for this line of inquiry. Additional crop types and cultivars beyond those already listed in this proposal will be included in this trial, provided seed suppliers fund the cost of these additions. Rio Grande Commodities, Colorado Seed, Wilbur Ellis, Farm Service Center, Monte Vista COOP, Green Cover Seeds and other prospective suppliers of

alternative crop seeds will be contacted for additional entries and funding, following review of this proposal by the Research Advisory Committee.

## TIMELINE AND OUTCOMES

All fieldwork associated with these trials will be completed by fall of 2013. The immediate (1-year) outcome of this study will be to better inform crop rotation decisions for the 2014 planting season. Longer-term (3-5 year) outcomes from the research completed in 2012-2013 will include reduced dependence on costly chemical controls of Powdery Scab and Columbia Root Knot Nematodes, increased potato market value due to exceptional quality, reduced water use from alternative rotational crop planting, increased crop diversity, and greater rotation opportunities for potato farmers.

**Budget & Justification**

| | | Rate Per Entry | Flat | Expense Category | | | Expense Amounts | | |
|---|---|---|---|---|---|---|---|---|---|
| ***Objective 1*** | | (=5 replicates) | Rate | Lab Fees | Labor | Equipment | Lab Fees | Labor | Equipment |
| Field Trials | Field Prep & Incorporation | | $100 | | | 100% | | | $100 |
| | Seeder | | $100 | | | 100% | | | $100 |
| | Plot Layout | | $400 | | 100% | | | $400 | |
| | Plot Planting | | $600 | | 100% | | | $600 | |
| | Preplant Soil Health Tests | $238 | | 79% | 21% | | $3,940 | $1,047 | |
| | In-Season Monitoring | $300 | | | 100% | | | $6,300 | |
| | End-Of-Crop Soil Health Tests | $305 | | 38% | 62% | | $2,430 | $3,965 | |
| | objective totals: | ***$842*** | ***$1,200*** | | | | | | |
| ***Objective 2*** | | | | | | | | | |
| Field Trials | Field Tour | | $200 | | 100% | | | $200 | |
| | objective totals: | ***$0*** | ***$200*** | | | | | | |
| ***Objective 3*** | Final Report | | $2,800 | | 100% | | | $2,800 | |
| | objective totals: | ***$0*** | ***$2,800*** | | | | | | |
| ***Objective 4*** | | | | | | | | | |
| Data Analysis | Presentation of Findings | | $400 | | 100% | | | $400 | |
| | objective totals: | ***$0*** | ***$400*** | | | | | | |
| | | | | | | Category Totals: | $6,370 | $15,712 | $200 |
| | | | | | | Percent of Budget: | 29% | 71% | 1% |
| | | | | | | Expense Category: | Lab Fees | Labor | Equipment |
| ***To Complete All Objectives*** | | | | | | | | | |
| | Number of Entries | 21 | | | | | | | |
| | Flat Fees | $4,600 | | | | | | | |
| | Per Entry Fees | $842 | | | | | | | |
| | Total Cost Per Entry | **$1,061** | | | | | | | |
| | Total Cost | **$22,282** | | | | | | | |