

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Cropping Systems

2. Brief summary about Planned Program

Plant biology linking basic science with applied science is important to bring the results of basic plant science toward a usable form for applied agricultural sciences. Molecular biology and genomics are opening many new pathways for crop plant improvement and pest management, which will enhance the economic development of agricultural regions, enhance human health through more nutritious and safer food products, and find fundamental solutions to societal issues through renewable and sustainable crop production and pest management. Successful applied crop science, environmental science, and pest management only occur through collaboration with scientists actively involved in fundamental plant and pest sciences.

The Cropping Systems Extension Planning & Reporting Unit (PRU) strives for crop (grain, forage, vegetable, fruit, and specialty) and farm sustainability using a broad array of methodologies that provides education to producers and Team/Unit members. The concept of agricultural sustainability is multidimensional, as it applies to social, economic, and environmental dimensions simultaneously. This PRU is designed for Extension Programming for Crop & Produce producers who have, or are striving for, a significant portion of their personal income coming from the farm. These may be small farm or specialty crop producers or larger scale - primarily commodity crop - producers. They may also integrate plant and animal production systems.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	58%		0%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		10%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		10%	
205	Plant Management Systems	0%		20%	
206	Basic Plant Biology	0%		10%	
211	Insects, Mites, and Other Arthropods Affecting Plants	0%		10%	
212	Pathogens and Nematodes Affecting Plants	0%		10%	
213	Weeds Affecting Plants	0%		10%	
215	Biological Control of Pests Affecting Plants	0%		10%	
216	Integrated Pest Management Systems	34%		10%	
601	Economics of Agricultural Production and Farm Management	8%		0%	
	Total	100%		100%	

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Fundamental plant biology linking basic science with applied science is important to bring the results of basic plant science toward a usable form for applied agricultural sciences. Molecular biology and genomics are opening many new pathways for crop plant improvement and pest management, which will enhance the economic development of agricultural regions, enhance human health through more nutritious and safer food products, and find fundamental solutions to societal issues through renewable and sustainable crop production and pest management. Non-hybrid crop plants require public investment in genetic improvement to provide varieties of cultivars which improve yield, resist environmental and pest stresses, and serve the consuming public. Colorado State has a history of providing cultivar breeding for wheat, dry beans, and potatoes to serve the industries in climatic zones represented in Colorado.

Colorado crop producers generate over \$1.16 billion from the production of wheat, corn, and hay, according to the Colorado Department of Agriculture. Of crop production across the United States, Colorado ranks 6th in winter wheat (8th for all wheat), 15th in corn for grain, and 10th in alfalfa. Additionally, Colorado ranks 1st among all states in the production of proso millet and 7th in grain sorghum production. Colorado had just over 37,000 farms in 2007 accounting for 31,604,911 acres, 5.89 million acres of harvested cropland, and 2.9 million acres of irrigated land, according to the 2007 Census of Agriculture.

In 2011 Colorado produce growers sold \$250M worth of potatoes, \$204M worth of other vegetables, and \$32M worth of fruit (\$485M for all fruits and vegetables combined) according to the "Value Chain of Colorado Ag", Graff, et al, 2013, CSU. Local food sales accounted for \$22M in direct sales and \$66M in intermediated sales (Ibid).

Of the 37,054 Colorado farms captured in the 2007 Census of Agriculture, 33,404 were in the economic class of small farms (annual receipts less than \$250,000). That equates to 90% of all farms in Colorado classified as "small farms".

Many of these small farm operators are beginning farmers (0 - 10 years of experience as defined by the USDA). Since 2007, over 300 beginning farmers throughout Colorado launched businesses in produce, specialty crops, and niche livestock after having participated in the CSU program Building Farmers in the West program (<http://buildingfarmers.colostate.edu/>). These new clientele view CSU as a go-to source for business planning and management education. We also offer advice, experiential learning opportunities (mentorships and internships), and advanced classes in business management, soil fertility, irrigation management, pest management, and other resources for direct market enterprises.

Diagnostics and management of endemic and invasive weeds, insect pests and plant pathogens, as well as abiotic stress effects, are some of the most costly inputs that clientele in agriculture must finance every year in Colorado. It is important for growers, to acquire skills to identify pests and implement new and proven pest management technologies into an integrated approach.

Members of the work team have demonstrated expertise and recognition in areas of crop production, pest management, irrigation management, research, beginning farmer development, and educational programming. This is especially true for the production and marketing of winter wheat. Colorado State University researchers and educators have historically worked closely with producers and commodity groups (local, state, and national) to produce and market winter wheat.

2. Scope of the Program

- In-State Extension
- In-State Research
- Multistate Research
- Multistate Extension
- Integrated Research and Extension
- Multistate Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Successful applied crop science, environmental science, and pest management do not occur in the absence of scientists actively involved in fundamental plant and pest sciences. Colorado State has created the Cancer Prevention Laboratory (CPL) embedded among strong programs of plant breeding and crop production research to address the interactions between crop composition and human health.

Crop production is very significant to not only Colorado's agricultural economy but the economy of the entire state. In the recent decade, Colorado farmers have experienced an increase in frequency of drought, crop input cost and market price volatility, and greater demands on irrigation water. CSU's researchers and Extension educators need to be pro-active in their research and educational programming of pest control, seed varieties, irrigation water management, as well as additional production practices and marketing strategies.

- continued staffing of large & small farm & specialty crop Extension and research positions
- continued increase in population of Colorado

2. Ultimate goal(s) of this Program

- Molecular biology and genomics of crop plants and their pests, mechanisms of biological resistance

to pests, mechanisms of invasion of weed species, and understand the molecular and cellular foundations for crop improvement and crop pest management.

- Combine the knowledge of human nutrition and plant genetics to extend crop selection, germplasm screening, and crop improvement with the objective to build greater amounts of compounds relevant to improved human health and disease prevention into these crops.

- Research in plant selection and improvement, limited-irrigation landscape plant cultivation, and landscape policies, and outreach in landscape industry plant selection, cultivation management, and Master Gardener education and volunteer development.

- Research in genetic determinants of host plant resistance, fundamental mechanisms of biological invasions, and ecology, bio-informatics, genomics, and population genetics of pests. Extension will include applied research and education relevant to emerging issues of Colorado's agricultural industries, including bio-security, safe and effective pesticide use, and implementation of effective pest management strategies that do not rely on pesticides.

- Evaluate new crop, range, and livestock systems in semi-arid environments including disciplinary and interdisciplinary work in crop and soil sciences, animal sciences, pest sciences, range science, wildlife biology and ecology, forest science, water sciences, economics, and landscape design and policy applicable to the state and region.

- Disseminate findings through extension educational programs aimed at changing practices to control pests.

- Proper diagnosis of plant problems, entomology related to plants and structures, weed control and recommendations of integrated pest management strategies.

For Extension:

It is the goal of this Planning & Reporting Unit (PRU) for the producers of Colorado crops to adopt and implement improved, productive, and sustainable agricultural systems that will lead to the success of farms. Furthermore, these producer actions will improve the ability of farm operations to persist and thrive through successive generations of operators. Individuals, families, and communities will all benefit by having a safe, secure and sufficient food supply. Colorado crop producers will accommodate to the growth of demand for local and world crop production without compromising the natural resources upon which agriculture depends.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2015	12.0	0.0	26.0	0.0
2016	15.0	0.0	26.0	0.0
2017	15.0	0.0	26.0	0.0
2018	15.0	0.0	26.0	0.0
2019	15.0	0.0	26.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

- Conduct basic and applied research in plant productions systems.
- Workshops and educational classes for producers.

- Utilize demonstration plots and field days to communicate program results.
- Use individual counseling with producers and clientele on specific plant production problems.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

Direct Methods	Indirect Methods
<ul style="list-style-type: none"> • Education Class • Workshop • Group Discussion • One-on-One Intervention • Demonstrations • Other 1 (Field Days) 	<ul style="list-style-type: none"> • Public Service Announcement • Newsletters • Web sites other than eXtension • Other 1 (Radio reports)

3. Description of targeted audience

Individual agricultural producers, homeowners, agribusinesses, and commodity organizations.

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
 - Direct Adult Contacts
 - Indirect Adult Contacts
 - Direct Youth Contacts
 - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- 1. Number of group educational events: classes, trainings, workshops, demonstrations, field days, providing content expertise, fairs, shows, booths, other group events.
 - 2. Individual Education: one-on-one direct client contacts by site visit, office drop-in, e-mail, telephone, Ask an eXpert, etc.
 - 3. Number of meetings convened and/or facilitated; includes strategic participation that contributes to program development.
 - 4. Number of kits or similar resources loaned or provided.
 - 5. Number of Extension-related research and assessment projects. External funding proposals, including local, state, federal.
 - 6. Number of peer-reviewed publications including fact sheets, decision tools, curricula, multimedia, etc.
 - 7. Number of media releases: indirect contacts through media releases, appearances, newsletters, blog posts, other non-peer reviewed publications, kit development, non-peer reviewed curriculum, PowerPoints or videos.
 - 8. Number of online posts: Web posts, hits.
- Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	CS Outcome 1.1: Participants apply research-based techniques for improving soil quality and productivity, protecting and making the best uses of water resources, managing crop nutrients, and/or enhancing plant yields and quality in their farm fields.
2	CS Outcome 1.2: Participants use research-based knowledge of integrated pest management systems for the crops and cropping systems in their farmed fields and/or their adjacent landscapes within their property and right-of-ways.
3	CS Outcome 1.4: Participants write estate & farm transition plans with the intent to transfer farm management & eventual ownership to subsequent generations inside or outside families.
4	Improvement of Quality and Performance of Colorado wheat
5	Colorado Potato Breeding Program

Outcome # 1

1. Outcome Target

CS Outcome 1.1: Participants apply research-based techniques for improving soil quality and productivity, protecting and making the best uses of water resources, managing crop nutrients, and/or enhancing plant yields and quality in their farm fields.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 2

1. Outcome Target

CS Outcome 1.2: Participants use research-based knowledge of integrated pest management systems for the crops and cropping systems in their farmed fields and/or their adjacent landscapes within their property and right-of-ways.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 216 - Integrated Pest Management Systems

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 3

1. Outcome Target

CS Outcome 1.4: Participants write estate & farm transition plans with the intent to transfer farm management & eventual ownership to subsequent generations inside or outside families.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 601 - Economics of Agricultural Production and Farm Management

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 4

1. Outcome Target

Improvement of Quality and Performance of Colorado wheat

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 206 - Basic Plant Biology

4. Associated Institute Type(s)

- 1862 Research

Outcome # 5

1. Outcome Target

Colorado Potato Breeding Program

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 205 - Plant Management Systems
- 206 - Basic Plant Biology
- 212 - Pathogens and Nematodes Affecting Plants

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes

- Public Policy changes
- Government Regulations
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Description

The external factors marked above would cause changes in programming and the time Extension Agents and Specialists could devote to a specific program or topic. A natural disaster, such as drought, would cause additional programming to provide the education and information producers would need for their businesses to survive. Decreases in appropriated budgets - county and/or state - would likely force agents to alter their work on cropping issues. Members of the Crops Team would change the topics presented in a workshop, change educational programming, and/or develop new or different technologies and strategies for crop producers if there were changes in government regulations.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

- For this Planned Program, evaluation criteria will be adapted from the National Roadmap for Crop Management and will be performed by distributing written surveys to all program participants.
- The surveys will be done **pre and post program**.
- The surveys will ask questions focused primarily on crop, pest, and marketing management.
- The surveys will help us measure the percentage of program participants who increased their knowledge.
- The results of the surveys will be distributed to or will be used for program prioritization and reporting by team members.

Survey Tools: the following sets of questions can help team members capture and report relevant information that quantifies the impact and behavior changes of Crop and Pest Management as well as Produce Marketing programs and products on stakeholders as measured by the following indicators, outcomes and outputs. It is recommended that 5 to 10 question surveys be adapted to the event or program, and presented as a printed or electronic form (e.g., PowerPoint, Clicker technology, etc.).

The following are examples of questions that have been used or modified for Survey Tools:

- Place a pest management value on CSU extension and research from which you have benefitted - a) \$0, b) 25, c) 50, d) 100, e) more than \$125 per acre
- Has your crop management and/or pest management and/or alternative marketing knowledge increased as a result of this program by: a) 0, b) 25, c) 50, d) 75, e) 100%
- As a result of this program, will you change your action, behavior, or recommendations regarding the topics covered: a) 0, b) 25, c) 50, d) 75, e) 100% probability
- My participation at this program resulted in a total cost (travel, lodging, registration, food, etc.) and investment to the county of: a) 10, b) 25, c) 50, d) 100, e) more than \$125
- Today's speaker provided management or marketing information that I can and will use: a) strongly agree, b) agree, c) neutral, d) disagree, e) strongly disagree
- What monetary value would you place on today's workshop: a) \$0, b) \$50, c) \$200, d) \$800, e) \$2,000
- What value change have you gained by using farm & pest management or marketing knowledge learned from this and other CSU programs in [you add the crop of interest]: a) 0, b) 5, c) 10, d) 20, e) more than 25%
- Does CSU Extension and/or Research programs and services have a positive economic impact on the community in which you live: a) strongly agree, b) agree, c) neutral, d) disagree, e) strongly disagree
- Can you identify [you add the farm, crop, or pest management or marketing issue]: a) strongly agree, b) agree, c) neutral, d) disagree, e) strongly disagree.

CSU Extension Perceived Value Questionnaire(for use in programs when possible)

The intent of these following questions is to measure workshop participants' perceived value of Extension Programs so we can better serve you, improve our programs and better measure Extension program impacts. While not required of you, Extension would appreciate knowing your perception of our programs. We may also use the data we collect for research purposes. Please take a few minutes to answer the following questions. Please do not include your name.

1. Title of the workshop/program? _____
 - a. Date _____
 - b. Location _____

2. Based on the information presented today, will you change a behavior?
Yes _____
 - a. What habit or practice will you begin or improve upon? _____
 - b. What practice you will no longer do or what habit will you limit or eliminate? _____
No _____

3. Because of what you learned today what is your best estimate over the next year of
 - a. Money, if any, you will save _____
 - b. Amount your income will increase _____
 - c. Grow my business _____

4. Having participated in this educational event, are you more likely to attend trainings/workshops/classes or make use of Extension resources in the future?
Yes _____ Unsure _____ No _____

5. Colorado State University Extension is funded cooperatively among Counties, the State of Colorado, and the United States Department of Agriculture (USDA). The program you just attended was made possible, in part, by using your tax dollars to host it. Do you support the use of your tax dollars to present this educational event?
Yes _____ Unsure _____ No _____