

V(A). Planned Program (Summary)

Program #5

1. Name of the Planned Program

Plant Production 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. Extension has active work teams in:

- Pest Management, with a sub-team on Diagnostics and Pest Management
- Plant Introduction and Invasive Species
- Wheat-Based Dryland Cropping 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
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		10%	
202	Plant Genetic Resources	4%		0%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	3%		10%	
204	Plant Product Quality and Utility (Preharvest)	2%		0%	
205	Plant Management Systems	35%		20%	
206	Basic Plant Biology	8%		10%	
211	Insects, Mites, and Other Arthropods Affecting Plants	3%		10%	
212	Pathogens and Nematodes Affecting Plants	6%		10%	
213	Weeds Affecting Plants	9%		10%	
215	Biological Control of Pests Affecting Plants	3%		10%	
216	Integrated Pest Management Systems	27%		10%	
	Total	100%		100%	

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

1. Situation and priorities

Colorado State has a history of providing crop selection and testing in other agronomic crops and fruits and vegetables to support the development of these agricultural industries in Colorado. In 2006, wheat generated \$192 million in commodity sales, dry beans \$23 million, potatoes \$202 million, and other agronomic crops and vegetable and fruit crops generated \$1,117 million, in Colorado. The value of these industries to the Colorado economy through other related economic activity is at least double these combined amounts. Colorado expenditures on garden-related products, landscape and lawn service, and other related green industries (irrigation, botanical gardens, and outdoor equipment) have averaged 10 percent annual growth since 1993, resulting in \$2.0 billion in direct sales, in 2006. The value of the Colorado golf industry alone is \$1.2 billion. The landscape-related industries of Colorado employ nearly 34,000 positions (6 percent average annual growth) with a payroll of \$825 million annually (18 percent average

annual growth). Thirty percent of industry revenues are generated from out of state (domestic and international) sales. The Colorado Green Industry accounts for 25% of Colorado's total agriculture production, ranks second behind the cattle/dairy industry, and is 4 times larger than the corn and wheat industry. A diverse and expanding pest complex requires enhanced management skills that often increase production costs. A conservative loss estimate of 5 to 10% due to plant pests could cost Colorado producers in urban and rural settings \$50 to \$100 million annually. There is a long-term need for a comprehensive, high quality, integrated pest management system encompassing the disciplines of entomology, plant pathology and weed science.

- 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 is an urban and urbanizing state in which demographic evolution is changing the scope of "agriculture." The landscape (green) industry of Colorado, and the nation, is large and growing and comprises a significant part of Colorado agriculture.

- Management of weeds, insect pests and plant pathogens is one of the most costly inputs that clientele in agriculture, the green industry, and consuming households must finance every year in Colorado. A diverse and expanding pest complex requires enhanced management skills that often increase production costs.

- The Colorado ecosystem is shared by agricultural producers, a rapidly growing human population, and wildlife. As competition grows for finite water, land, and air resources, and as agricultural and natural resource policies and international markets change, opportunities to maximize the economic value of agriculture in Colorado will change continuously. The complex relationships of ecosystem variables must be well understood to predict these opportunities.

2. Scope of the Program

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

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) imbedded among strong programs of plant breeding and crop production research to address interactions between crop composition and human health.

- Professional agriculturalists and agribusiness people will require much more education in the relationships of ecosystem variables.

2. Ultimate goal(s) of this Program

PCProgram goals will emphasize the following areas:

- 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.

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
2009	21.0	0.0	26.0	0.0
2010	21.0	0.0	26.0	0.0
2011	21.0	0.0	26.0	0.0
2012	21.0	0.0	26.0	0.0
2013	21.0	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"> ● One-on-One Intervention ● Workshop ● Education Class ● Demonstrations ● Other 1 (Field Days) ● Group Discussion 	<ul style="list-style-type: none"> ● Other 1 (Radio reports) ● Web sites ● Public Service Announcement ● Newsletters

3. Description of targeted audience

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

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2009	50000	5000	0	0
2010	50000	5000	0	0
2011	50000	5000	0	0
2012	50000	5000	0	0
2013	50000	5000	0	0

2. (Standard Research Target) Number of Patent Applications Submitted

Expected Patent Applications

2009 :0 2010 :0 2011 :0 2012 :0 2013 :0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2009	25	5	0
2010	25	5	0
2011	25	5	0
2012	25	5	0
2013	25	5	0

V(H). State Defined Outputs

1. Output Target

- Release of technologies adopted by growers such as crop cultivars, crop germplasm, or components of crop production systems.

2009 :2 2010 :2 2011 :2 2012 :2 2013 :2

- Number of attendees at workshops/trainings/field days.

2009 :2000 2010 :2000 2011 :2000 2012 :2000 2013 :2000

- Amount of grant dollars garnered to support natural plant production systems research and outreach.

2009 :200000 2010 :250000 2011 :250000 2012 :250000 2013 :250000

- Technical publications in the topical area of plant production systems.

2009 :25 2010 :25 2011 :25 2012 :25 2013 :25

- Number of basic and applied research efforts in plant production systems: Number of workshops, educational classes for producers Number of demonstration plots and field days Number of individual consultations

2009 :50 2010 :50 2011 :50 2012 :50 2013 :50

- Number of Extension workshops focusing on plant production systems.

2009 :50

2010 :50

2011 :50

2012 :50

2013 :50

V(I). State Defined Outcome

O. No	Outcome Name
1	Percent of participants at workshops/trainings/field days indicating an increase in knowledge gained.
2	Percent of participants indicating change in behavior/best practices adopted.
3	Economic impact of the change in behavior reported.
4	Adoption of crop production technology as measured by agricultural statistics.
5	Adoption of improved wheat cultivars.
6	Potential of living mulches to decrease soil erosion.

Outcome #1

1. Outcome Target

Percent of participants at workshops/trainings/field days indicating an increase in knowledge gained.

2. Outcome Type : Change in Knowledge Outcome Measure

2009 :50 2010 : 50 2011 : 50 2012 :50 2013 : 50

3. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

4. Associated Knowledge Area(s)

- 205 - Plant Management Systems
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Pathogens and Nematodes Affecting Plants
- 213 - Weeds Affecting Plants
- 215 - Biological Control of Pests Affecting Plants
- 216 - Integrated Pest Management Systems

Outcome #2

1. Outcome Target

Percent of participants indicating change in behavior/best practices adopted.

2. Outcome Type : Change in Action Outcome Measure

2009 :50 2010 : 50 2011 : 50 2012 :50 2013 : 50

3. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

4. Associated Knowledge Area(s)

- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Pathogens and Nematodes Affecting Plants
- 213 - Weeds Affecting Plants
- 215 - Biological Control of Pests Affecting Plants
- 216 - Integrated Pest Management Systems

Outcome #3

1. Outcome Target

Economic impact of the change in behavior reported.

2. Outcome Type : Change in Condition Outcome Measure

2009 :300000 **2010 :** 450000 **2011 :** 500000 **2012 :**650000 **2013 :** 750000

3. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

4. Associated Knowledge Area(s)

- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems
- 206 - Basic Plant Biology
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Pathogens and Nematodes Affecting Plants
- 213 - Weeds Affecting Plants
- 215 - Biological Control of Pests Affecting Plants
- 216 - Integrated Pest Management Systems

Outcome #4

1. Outcome Target

Adoption of crop production technology as measured by agricultural statistics.

2. Outcome Type : Change in Condition Outcome Measure

2009 :1 **2010 :** 1 **2011 :** 1 **2012 :**1 **2013 :** 1

3. Associated Institute Type(s)

- 1862 Research

4. Associated Knowledge Area(s)

- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 205 - Plant Management Systems
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Pathogens and Nematodes Affecting Plants
- 213 - Weeds Affecting Plants
- 216 - Integrated Pest Management Systems

Outcome #5

1. Outcome Target

Adoption of improved wheat cultivars.

2. Outcome Type : Change in Condition Outcome Measure

2009 :0 **2010 :** 0 **2011 :** 0 **2012 :**0 **2013 :** 0

3. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

4. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems
- 206 - Basic Plant Biology
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Pathogens and Nematodes Affecting Plants
- 213 - Weeds Affecting Plants

Outcome #6

1. Outcome Target

Potential of living mulches to decrease soil erosion.

2. Outcome Type : Change in Knowledge Outcome Measure

2009 :0 2010 : 0 2011 : 0 2012 :0 2013 : 0

3. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

4. Associated Knowledge Area(s)

- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 205 - Plant Management Systems
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 213 - Weeds Affecting Plants
- 216 - Integrated Pest Management Systems

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Economy
- Government Regulations
- Natural Disasters (drought,weather extremes,etc.)
- Appropriations changes
- Competing Programatic Challenges
- Public Policy changes

Description

Public policies and weather and other natural diseases will affect the adoption of new crop production technologies. Most of the advances are multi-year activities and cumulative rather than episodic in nature.

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- During (during program)
- Before-After (before and after program)
- After Only (post program)
- Case Study

Description

Regular pre-post evaluations are used. Formative evaluations are often used during the program to adjust focus and direction. Case studies are used to clearly demonstrate impact.

2. Data Collection Methods

- Sampling
- On-Site
- Tests
- Case Study
- Observation

Description

Pre-post tests. Standard survey methods.