

**V(A). Planned Program (Summary)**

**Program # 12**

**1. Name of the Planned Program**

Global Food Security and Hunger: Potatoes

Reporting on this Program

**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                        | 10%             |                 | 15%            |                |
| 201     | Plant Genome, Genetics, and Genetic Mechanisms                    | 0%              |                 | 10%            |                |
| 202     | Plant Genetic Resources   | 10%             |                 | 15%            |                |
| 203     | Plant Biological Efficiency and Abiotic Stresses Affecting Plants | 10%             |                 | 10%            |                |
| 204     | Plant Product Quality and Utility (Preharvest)                    | 10%             |                 | 5%             |                |
| 205     | Plant Management Systems  | 20%             |                 | 15%            |                |
| 212     | Diseases and Nematodes Affecting Plants                           | 10%             |                 | 10%            |                |
| 216     | Integrated Pest Management Systems                                | 10%             |                 | 10%            |                |
| 503     | Quality Maintenance in Storing and Marketing Food Products        | 15%             |                 | 10%            |                |
| 603     | Market Economics  | 5%              |                 | 0%             |                |
|         | <b>Total</b>  | 100%            |                 | 100%           |                |

**V(C). Planned Program (Inputs)**

**1. Actual amount of FTE/SYs expended this Program**

| Year: 2014              | Extension |      | Research |      |
|-------------------------|-----------|------|----------|------|
|                         | 1862      | 1890 | 1862     | 1890 |
| <b>Plan</b>             | 5.0       | 0.0  | 10.0     | 0.0  |
| <b>Actual Paid</b>      | 4.0       | 0.0  | 17.0     | 0.0  |
| <b>Actual Volunteer</b> | 0.0       | 0.0  | 0.0      | 0.0  |

**2. Actual dollars expended in this Program (includes Carryover Funds from previous years)**

| Extension           |                | Research       |                |
|---------------------|----------------|----------------|----------------|
| Smith-Lever 3b & 3c | 1890 Extension | Hatch          | Evans-Allen    |
| 157505              | 0              | 286779         | 0              |
| 1862 Matching       | 1890 Matching  | 1862 Matching  | 1890 Matching  |
| 157505              | 0              | 286779         | 0              |
| 1862 All Other      | 1890 All Other | 1862 All Other | 1890 All Other |
| 115833              | 0              | 4484638        | 0              |

### V(D). Planned Program (Activity)

#### 1. Brief description of the Activity

Members of the Potato Team reported 8,129 direct educational contacts through Extension programs and 112,328 indirect contacts. Team members published 10 articles in refereed journals, one peer-reviewed Extension publication, and participated in projects supported by over \$4 million in grants.

The Potato Team is highly integrated, participating in active projects to discover new knowledge, demonstrate and transfer new technologies, and work to understand local variants that impact potato production and storage. Members of the Team include disease and insect experts, fertility, irrigation, and harvesting experts, and storage and marketing experts. Team members meet regularly and otherwise collaborate with industry associations and the Idaho Potato Commission to understand needs of stakeholders.

Zebra Chip continues to be an important topic for stakeholders and was included in the portfolio of research and Extension activities targeting diseases and pests. Work continued on Potato Viruses X and Y, wireworm, Late Blight, Early Blight, potato psyllids, aphids and Colorado potato beetles. Ongoing work includes field and greenhouse experiments to understand the ecology and treatment options for serious potato pests in the field and in storage, nutrient management questions, and the value of various soil amendments. Field demonstrations help growers and other stakeholders understand the impact of various planting and pest management practices and irrigation needs and strategies. These applied activities have been shared through the Idaho Potato Conference as well as a host of workshops and classes and numerous field days and tours. Spanish language workshops were delivered for the fifteenth consecutive year at the potato conference; attendance in the Spanish workshops has grown from fewer than 40 to more than 150 in 2014.

Dozens of workshops and articles in trade publications, presented or written by UI faculty, brought information to the industry about potato bruising and storage, costs of production, taxes, pathogens and disease control, best- irrigation, fertilization and fumigation practices, and many more. Faculty also produced an array of refereed and Extension publications, largely focusing on disease-related issues including resistant cultivars, weather-based management, and assessment of pathogen risks. Much of the Extension faculty's work is made possible through collaborations and participation on various citizen and professional alliances concerned with environmental quality and agricultural sustainability.

#### 2. Brief description of the target audience

Target audiences are potato producers, field agronomists, consultants, and industry representatives..

#### 3. How was eXtension used?

use of eXtension was not reported in this program

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

| 2014          | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|---------------|------------------------|--------------------------|-----------------------|-------------------------|
| <b>Actual</b> | 9329                   | 112143                   | 80                    | 185                     |

**2. Number of Patent Applications Submitted (Standard Research Output)**

**Patent Applications Submitted**

Year: 2014

Actual: 1

**Patents listed**

Yukon Nugget - Potato - PVP Number 201400308

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

| 2014          | Extension | Research | Total |
|---------------|-----------|----------|-------|
| <b>Actual</b> | 16        | 30       | 46    |

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Seminars, workshops, field day presentations.

|             |               |
|-------------|---------------|
| <b>Year</b> | <b>Actual</b> |
| 2014        | 65            |

**Output #2**

**Output Measure**

- Trade Journal Articles.

| <b>Year</b> | <b>Actual</b> |
|-------------|---------------|
| 2014        | 21            |

**Output #3**

**Output Measure**

- Field Days.

| <b>Year</b> | <b>Actual</b> |
|-------------|---------------|
| 2014        | 2             |

**Output #4**

**Output Measure**

- Individual Consultations.

| <b>Year</b> | <b>Actual</b> |
|-------------|---------------|
| 2014        | 285           |

**Output #5**

**Output Measure**

- Graduate Students.

| <b>Year</b> | <b>Actual</b> |
|-------------|---------------|
| 2014        | 2             |

**Output #6**

**Output Measure**

- Workshops conducted.

| <b>Year</b> | <b>Actual</b> |
|-------------|---------------|
| 2014        | 16            |

**Output #7**

**Output Measure**

- Email Information Dissemination.

| <b>Year</b> | <b>Actual</b> |
|-------------|---------------|
| 2014        | 695           |

**Output #8**

**Output Measure**

- Potato costs and return estimates  
Not reporting on this Output for this Annual Report

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

| O. No. | OUTCOME NAME   |
|--------|--|
| 1      | O: Growers apply best potato management practices. I: Number of growers adopting recommended practices   |
| 2      | O: Growers are aware of pest incidence. I: Number of Subscribers to pest alert website   |
| 3      | O: Growers are knowledgeable about best potato management practices. I: Number of growers gaining knowledge about practices who have attended workshops or seminars. |
| 4      | O: An increase in the number of trained graduate students prepared to enter the workforce. I: Number of M.S. and Ph.D. candidates relevant to this topic team.       |

## **Outcome #1**

### **1. Outcome Measures**

O: Growers apply best potato management practices. I: Number of growers adopting recommended practices

### **2. Associated Institution Types**

- 1862 Extension

### **3a. Outcome Type:**

Change in Action Outcome Measure

### **3b. Quantitative Outcome**

| <b>Year</b> | <b>Actual</b> |
|-------------|---------------|
| 2014        | 82            |

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Unusually wet weather in early August led to late blight affecting many growers in the eastern part of the state in 2014. Recommendations were needed on vine kill and storage management. Proper diagnosis of the disease was necessary for many to instigate management recommendations.

#### **What has been done**

Faculty published guidelines for growers on how to control late blight in Idaho. A newsletter article 'Checklist for Managing Late Blight Approaching Harvest and Into Storage' was disseminated to at least 500 growers and agronomists in the state. Faculty helped diagnose samples brought in to the lab and provided on-site information on the disease cycle and recommended fungicides for the management of the disease.

#### **Results**

Feedback from industry personnel indicated at least 20 growing operations followed the recommendations outlined in the checklist newsletter. Growers with diseased plants samples with suspected late blight were provided with rapid diagnostics to determine if their samples had the disease. All growers bringing in diseased samples were provided with information on how to manage the disease.

### **4. Associated Knowledge Areas**

| <b>KA Code</b> | <b>Knowledge Area</b>   |
|----------------|---|
| 102            | Soil, Plant, Water, Nutrient Relationships                        |
| 203            | Plant Biological Efficiency and Abiotic Stresses Affecting Plants |

|     |  |
|-----|--|
| 204 | Plant Product Quality and Utility (Preharvest)             |
| 205 | Plant Management Systems                                   |
| 212 | Diseases and Nematodes Affecting Plants                    |
| 216 | Integrated Pest Management Systems                         |
| 503 | Quality Maintenance in Storing and Marketing Food Products |

## **Outcome #2**

### **1. Outcome Measures**

O: Growers are aware of pest incidence. I: Number of Subscribers to pest alert website

### **2. Associated Institution Types**

- 1862 Extension

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

| <b>Year</b> | <b>Actual</b> |
|-------------|---------------|
| 2014        | 280           |

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Disease and seed potato problems have the potential to negatively impact all segments of the Idaho industry. Seed and commercial growers as well as fresh and process potato buyers are concerned about product quality in both raw and finished product. Effective insect pest management depends upon timely and accurate identification of target pests.

#### **What has been done**

Pest alerts were published on the potato pathology twitter account @potatodiseases with links to information on how to manage disease problems. Twitter was also used to alert growers to the discovery of psyllids in Idaho and whether or not they were positive for the zebra chip bacteria. The PNW PestAlert.net remains an important notification instrument.

#### **Results**

Rapid publication of information on disease outbreaks allowed growers to take management decisions to help control the problem, such as application of additional protective sprays. In some cases information was used to delay or prevent application of pesticides. In the 2013 evaluation for the PNWPestAlert.net website, 37% of survey respondents reported that as a result of information received through the website, they increased their field scouting to document pest levels before taking actions to control the pest.

#### 4. Associated Knowledge Areas

| KA Code | Knowledge Area                          |
|---------|---|
| 212     | Diseases and Nematodes Affecting Plants |
| 216     | Integrated Pest Management Systems      |

#### Outcome #3

##### 1. Outcome Measures

O: Growers are knowledgeable about best potato management practices. I: Number of growers gaining knowledge about practices who have attended workshops or seminars.

##### 2. Associated Institution Types

- 1862 Extension

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 2002   |

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Potato virus Y can lead to yield and quality reductions in commercial potatoes. Seed and commercial growers as well as process and fresh potato buyers are very concerned about internal tuber defects caused by the new tuber necrotic strains of this virus. Bacterial ring rot causes significant quality reduction in commercial potatoes due to significant decay that occurs with infection. This causes storage management issues.

###### **What has been done**

Extension presentations and magazine articles were delivered stressing the importance of very low levels of potato virus Y in the seed potatoes used for both seed and commercial production. Information on sanitation and BRR biology was extended to the potato industry via workshops, presentations, newsletters, articles, emails, phone calls and other extension materials.

###### **Results**

The amount of PVY in Idaho seed potatoes has gone down by more than 20% over the last 4 years. The number of submitted cultivars infected with BRR decreased from 7 in 2013 to 3 in 2014 indicating a shift in the number of seed lots infected with the disease. The number of fields infected remained the same as last year although the severity appears to be lessened.

#### 4. Associated Knowledge Areas

| KA Code | Knowledge Area                                 |
|---------|--|
| 102     | Soil, Plant, Water, Nutrient Relationships     |
| 202     | Plant Genetic Resources                        |
| 204     | Plant Product Quality and Utility (Preharvest) |
| 205     | Plant Management Systems                       |
| 212     | Diseases and Nematodes Affecting Plants        |

#### Outcome #4

##### 1. Outcome Measures

O: An increase in the number of trained graduate students prepared to enter the workforce. I: Number of M.S. and Ph.D. candidates relevant to this topic team.

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2014 | 5      |

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Idaho has a large and diverse crop production agriculture, with a significant impact on the state and national economies. The State of Idaho is the largest producer of potatoes in the U.S., with about one-third of the national production and more than 30% of the acreage in 2008. Other significant crops grown in Idaho include sugar beet, dry beans, peas and other cool season food legumes. In all these crops, virus diseases cause significant losses and require attention with respect to monitoring viruses and managing disease problems. Understanding the infection cycle, virus-host interactions, transmission, epidemiology, and strain composition of viruses affecting major Idaho crops facilitates development of more profitable and sustainable management practices for crop protection and production.

### What has been done

Hypersensitive resistance (HR) to Potato virus Y (PVY) in potato (*Solanum tuberosum*) is conferred by strain-specific N genes. Two such genes have been identified in potato so far, Ntbr conferring HR to PVYO, and Nctbr conferring HR to PVYC. A third, putative gene Nztbr was proposed to confer HR against a distinct strain PVYZ. However, due to the scarcity of the PVYZ isolates of PVY, no formal proof of the monogenic nature of this new gene, Nztbr, was available until now. We reported on a genetic study of the Nztbr inheritance in three crosses between cultivars Maris Bard (Ny:Nz) and King Edward (ny:nz), and Maris Bard (Ny:Nz) and Russet Norkotah (ny:nz). A fully-sequenced PVYZ isolate, L26, was used to screen the parents and progeny for a virus-induced HR phenotype in foliage. Based on the phenotypic analysis of 203 progeny, segregation of HR phenotype in the PVYZ-infected plants was found to be 1:1, indicating a monogenic, dominant nature of the Nztbr gene. Since the PVYZ strain includes PVYNTN isolates associated with tuber necrotic ringspot disease (PTNRD) in susceptible potato cultivars, the Nztbr gene represents a valuable source of HR against PTNRD-inducing PVY isolates. This is the first demonstration that Nztbr is a single, dominant N gene in potato conferring resistance to the PVYZ-NTN strain.

### Results

Graduate students were trained in various virus research, published peer-reviewed papers, and presented results at professional meetings and to growers at conferences and trade shows.

## 4. Associated Knowledge Areas

| KA Code | Knowledge Area  |
|---------|---|
| 203     | Plant Biological Efficiency and Abiotic Stresses Affecting Plants |
| 205     | Plant Management Systems  |
| 212     | Diseases and Nematodes Affecting Plants                           |
| 216     | Integrated Pest Management Systems                                |

## V(H). Planned Program (External Factors)

### External factors which affected outcomes

- Other ()

### Brief Explanation

## V(I). Planned Program (Evaluation Studies)

### Evaluation Results

Post-harvest application of phosphorous acid to potatoes loading into storage for late blight management was a novel concept initiated by University of Idaho over 13 years ago. This year the recommendation for this application was made to growers plagued with tuber late blight and testimonials indicated a majority of the growing operations in the affected

area used phosphorous acid going into storage. Major processors were also recommending it to all their growers in those areas. A management solution initiated and developed by the University of Idaho was instrumental in minimizing the impact of late blight on the stored crop.

**Key Items of Evaluation**