V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Global Food Security and Hunger

☑ 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
201	Plant Genome, Genetics, and Genetic Mechanisms	8%		8%	
202	Plant Genetic Resources	8%		8%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	6%		6%	
204	Plant Product Quality and Utility (Preharvest)	6%		6%	
205	Plant Management Systems	8%		8%	
211	Insects, Mites, and Other Arthropods Affecting Plants	7%		7%	
212	Pathogens and Nematodes Affecting Plants	7%		7%	
213	Weeds Affecting Plants	6%		6%	
215	Biological Control of Pests Affecting Plants	5%		5%	
216	Integrated Pest Management Systems	6%		6%	
301	Reproductive Performance of Animals	7%		7%	
302	Nutrient Utilization in Animals	8%		8%	
303	Genetic Improvement of Animals	3%		3%	
304	Animal Genome	1%		1%	
305	Animal Physiological Processes	5%		5%	
306	Environmental Stress in Animals	1%		1%	
307	Animal Management Systems	7%		7%	
308	Improved Animal Products (Before Harvest)	1%		1%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Extension	Research

Year: 2012	1862	1890	1862	1890
Plan	3.0	0.0	6.6	0.0
Actual Paid Professional	0.0	0.0	0.0	0.0
Actual Volunteer	1000.0	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**
887369	0	2574264	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
887369	0	2574264	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Adequate vascular development supports embryonic survival and subsequent fetal growth. Vascular endothelial growth factor (VEGF) is the most potent inducer of angiogenesis, and factors regulating VEGF may ultimately affect vascularization. Activation of CXCR4 by CXCL12 increases VEGF synthesis and secretion, which in turn stimulates CXCL12 and CXCR4 production. This synergistic regulation may drive placental vascularization. The objective of this study was to determine if mRNA for CXCL12, CXCR4 and select angiogenic factors and their receptors are differentially expressed in caruncle and fetal extraembryonic membrane tissues on days 20, 25 and 30 of pregnancy, with d10 of the estrous cycle as a control. Real time PCR was used to assess relative mRNA levels. The increase of angiogenic factors in fetal placenta during implantation and placentation highlights the concept that the fetus regulates its vascularization in synergy with the maternal placenta. The relationship between VEGF and CXCL12/CXCR4 underscores the potential role for this chemokine system in placentation. These results provide strong support for enhanced signaling between chemokines and angiogenic factors within the fetal-maternal interface. We interpret these results to mean the CXCL12/CXCR4 pathway is activated during implantation and placentation in sheep and is likely playing a role in the communication between trophoblast cells and the maternal endometrium, specifically driving vascularization. Knowledge gained through this project will provide a more complete understanding of the mechanisms involved in growth and vascularization of the placenta.

This research demonstrated that delaying a bovine viral diarrhea vaccination and initial growth implant for 28 days tended to decrease calf performance during the first 56 days on feed in the feedlot. Therefore, delaying a bovine viral diarrhea vaccination and initial growth implant did not improve efficacy of the vaccination and implant program in stressed calves receiving antibiotic therapy. This research provides insight towards providing nutrition to target improved animal immunity by identifying those amino acids that are limiting in newly weaned beef calves, thereby providing the opportunity to reduce calf morbidity. If this

effort reduces calf morbidity by only 2% annually, savings to the United States beef industry is estimated to be $12 million/year (based on 600 million/year morbidity loss).

Research projects conducted at the Veterinary Entomology Research Laboratory have continued to center on fly pests of livestock, particularly cattle. Two insecticide resistance studies concerning house flies were completed in 2012, data from which are being used to prepare manuscripts for publication this year in peer-reviewed journals maintained by the Entomological Society of America (ESA). A house fly strain suspected to be resistant to the active ingredients found in neonicotinoid-based fly baits were colonized and evaluated with three of these compounds to determine their resistance levels. To separate any resistance effects due to behavior, such as aversion, these insecticides were applied to house flies using a topical method. The results of this study suggest that resistance to neonicotinoids is at least in part due, to metabolic mechanisms and not due to behavioral aversion. This study was the first to use topical applications of insecticidal active ingredients, which are normally ingested and activated via insect digestion (gut toxins). The results of this study were presented at the annual meeting of the ESA in Knoxville, TN, in November 2012 as, "Evaluating House Fly (Diptera: Muscidae) Insecticide Resistance to Selected Nicotinoids Using Topical Application." A second study to evaluate house fly bait insecticide resistance was conducted both in the field and the laboratory to determine attraction and mortality effects of industry standards, as well as an experimental compound. The results of this study demonstrated that a highly resistant house fly strain exhibited behavioral aversion to certain products, which may also play a role in the loss of efficacy observed for house fly insecticidal baits in the field. Our colonization of the filth fly (house flies, stable flies, and horn flies) biological control organisms, Spalangia spp. and Muscidifurax spp. have allowed us to recently begin to evaluate the insecticidal tolerance of these insects and whether or not they can acquire resistance to insecticides as their filth fly counterparts do. In addition, we have started studies to determine the attractant host cues used by these organisms, which determine their attack rates; cues that may help us understand and increase their efficacy in the field and in insectaries alike.

Our studies have identified lower gene copy number in glyphosate resistant Palmer amaranth populations form New Mexico compared with populations from Georgia. The difference between the gene-copy numbers of these populations could be due to cropping system related abiotic factors. The primarily results of our fitness studies, which will be completed in 2013, also indicate that in pecan orchards the use of competitive vegetations covers will enhance the management of glyphosate resistant Palmer amaranth populations.

We believe that the results from organic farming study will increase our understanding of the ecology of weeds and plant pathogens under various treatments and field conditions. Furthermore, this study will improve our current knowledge of seasonal (short-term) and long-term variability of soil microbial biomass and their co-relation to various pest control treatments in organic agriculture. Effective short- (seasonal) and long-term (seedbank dynamics) weed management strategies that are environmentally and economically sound, and will be evaluated in this study, will enhance the profitability of organic agriculture by reducing the labor and fertilizer cost, at the same time will increase the sustainability of organic systems through soil, water and fertilizer conservations.

The insectary plant mixture has been shown to perform well under New Mexico conditions, producing a continuity of bloom for much of the growing season. The effect of the insectary treatments on the main groups of beneficial insects has been somewhat variable, although parasitic Hymenoptera have shown the most consistently positive response. Nevertheless, in our trials, the plantings had no significant effect on the level of parasitism of squash bug eggs, and factors other than the availability of hosts and floral resources may be limiting the effectiveness of the squash bug egg parasitoids (e.g. the proximity of suitable overwintering sites); studies are now underway to address the latter hypothesis. Insectary plantings are probably most likely to have a demonstrable impact on pests such as aphids that are attacked by a diverse range of natural enemies known to benefit from access to floral resources. Effects

on pests such as squash bug, which are chemically defended and attacked by fewer generalist predators, are harder to demonstrate. Nevertheless, insectary plantings are a useful component of overall IPM strategies for small, diversified farms with a range of crops and pests, such as are found in much of New Mexico. A 2012 survey of the state's small-scale growers showed that 65% of respondents have now adopted this technique.

Research results expanded knowledge in several areas including characterization of emerging pathogens in the Southwest (Phytopthora capsici, Verticillium dahliae, beet curly top virus, and other), efficacy of engineered disease resistance genes for nematodes, Phytophthora, and Verticillium. Together, these results expand the knowledge base of significant diseases affecting crops in NM and provide information on efficacy of potential remediation strategies including deployment of natural and engineered resistance genes. In particular, studies on and development of new resistance genes for significant pathogens of chile are expected to lead to practical solutions that will benefit NM producers by reducing losses to these pathogens in the future.

Maturing work in DNA fingerprinting of nematodes is expected to find application in several areas. The improved protocol we have developed is a substantial improvement over past methods that enables reliable DNA fingerprint based ID of single nematodes in 48 hours or less. This method is expected to be useful for nematode ID in areas ranging from ecological studies to product quality assurance and trade regulation.

Our work on the Heteroptera provides information on the biology and ecology of our species that fills gaps in our understanding of these understudied taxa of insects. It also allows for better identification of species of economic importance. Our checklist of the stink bugs provides the first modern look at the distribution of this group, containing many pest and beneficial species, for New Mexico. Our recent work on the morphology of segmentation of the abdomen of Corimelaena incognita has broad implications for the morphology and evolution of segmentation in the Heteroptera. Little is known about the blister beetles that are present in the state and the relative importance of the various species as threats to animal health even though hundreds of thousands of dollars are lost with the death and care of livestock injured by these insects. Our work will provide information on the important species to animal health. Our work on the beet leafhopper will impact management timing and strategies for control of this insect and reduction in curly top virus incidence. Efficient management of crop pests can result in a reduction in unnecessary control costs and potentially increase crop yields. This can translate into a significant increase in productivity and profit to New Mexico's growers. Also, fewer insecticide applications can result in reduced exposure of the chemicals to the environment. Our flea beetle data on chile and weed hosts will provide a better picture of the species present and their timing in order to better manage this early season pest.

Urban landscapes and crop production land in arid New Mexico are dependent on irrigation water supplied by compacted earthen canals and laterals either continuously or intermittently throughout the nine month irrigation season. Equisetum hyemale has been an increasing problem on the canals, using water intended for irrigation and obstructing water flow in irrigation canals. The research will result in new management tools for suppressing Equisetum populations on canals. However, in recent drought years, Equisetum populations have been suppressed by feather fingergrass on many canal banks; these populations have been managed by spraying with low rates of glyphosate. Preliminary data suggests that New Mexico populations of feather fingergrass vary in their response to glyphosate leading to concerns that these populations are evolving resistance to this herbicide. Growers and others rely heavily on glyphosate for their weed management. Identification of weeds that are not controlled by this herbicide will reduce ineffective use of this product and will also reduce the selection pressure that results in either selection for weed species that are not controlled by glyphosate or to species that have evolved resistance to glyphosate. The research on effectiveness of herbicides used in chile pepper will result in better recommendations to growers who are interested in using these products for weed management in this non-competitive crop. Without effective weed management tools, advances in mechanical harvesting will

not be realized because weeds will continue to hinder the ability of the harvesters to remove the chile fruit in the field. The work to develop modeling approaches for predicting the presence or counts of root-knot nematodes based on nutsedge counts will result in additional tools for growers to identify problem areas in their fields before the pest complex becomes dominant. Finally, clear and correct identification of the nutsedge species complex present in New Mexico fields is critical to defining the weed problems faced by growers.

Our research on curly top virus focuses on the ecology, epidemiology and management of the disease caused by the virus in chile. We looked at curtoviruses in mixed infections and the effects of host plants on those interactions. We took the first steps to characterize the leafhopper/virus interactions, including studying the bacterial endosymbionts of the leafhoppers. Understanding more about the ecology, genetics, transmission, and weed hosts of beet curly top virus in New Mexico will aid in developing management options for chile growers. Our predictive model for curly top in southern New Mexico has given growers information on the disease so that they can make informed choices on which management methods they will need to use to handle the disease pressure. The information on virus-tolerant plants provides growers with several pepper types that can be grown without significant disease losses.

Our research on fungal endophytes of locoweed has made progress toward characterization of endophytes from locoweeds throughout the western US. We concluded studies characterizing the proteome profiles of several of the fungal endophyte species. We also concluded work on the localization of the endophyte in Oxytropis plants using different types of microscopy. A better understanding of the role that the fungal endophytes of locoweed play in locoism, the genetics of the fungi, and the factors that influence toxin production will lead to new options to mitigate the disease locoism and its impact. The information generated thus far changed knowledge significantly, in that nothing has been known about the mechanism by which the fungi produce the toxin. In addition, we now understand much more about the ecology and biology of the fungi.

The ET internet site is nearly complete. Farmers will be able to access this site and track irrigation water use. They will be able to follow the water use for their crop and determine when to irrigate next. This internet site will help the farmer to use the right amount of water at the right time. As farmers properly manage water applications other input costs will be minimized.

Developing a simple spreadsheet tool that will evaluate irrigation pump performance, will help irrigation farmers track energy use and efficiency and help identify any problems that are developing. This tool will identify a problem before thousands of dollars are lost to inefficient pumping.

Developing a low cost, easy to construct water control gate will help irrigation districts and farmers manage water more efficiently. This device will be safer than stop-log structures and individual irrigation districts or farmers will be able to construct this gate with common fabrication tools that they have available.

Canal control algorithms will help irrigation districts determine how much water to divert down canals to meet the water demands of individual farms. Water use will be matched to the needs of the water users with little or no waste.

Declining well outputs and restrictions from ground water districts are compelling area farmers to conserve water. Low water using alternate crops are getting attention of the farmers. During field days, a number of farmers have expressed their interest in the alternate crops I am working with. A few have visited my trials and discussed with me about my findings. An area farmer, who grew safflower in an extremely dry year, is encouraged by the yield levels and wants to try it again. Development of winter safflower will be promising for the area producers. More research is needed to evaluate integrated cropping systems, alternate crops, stubble and tillage management, reducing crop damages by wind (sand

blasting), and innovative water management practices.

We have demonstrated that HUAPs are an effective way of predicting growth stages of chile and can be a useful model for growers, especially when applying PGRs. Field managers from Mizkan Americas, Inc. (formerly Border Foods) have adopted and currently track heat units as a prediction and management tool for their chile growers. We continue to use it in ongoing research projects requiring PGR applications.

Recommendations for rotational/cover crop species with specific roles, characteristics, and modes of use are in development. In this way, growers will have access to information regarding weed and pathogen suppression, and crop growth enhancement characteristics of each rotational, bioactive (biofumigant) crop. This can help to minimize the costs and reduce the environmental harm of traditional chemical fumigants.

The forage industry plays a vital role in New Mexico's agricultural economy. The magnitude of the role of forages in New Mexico and throughout the United States has been changing over the past few decades and changes are likely to continue in view of heightened awareness of the need for better environmental stewardship and food security, the demands of a growing livestock industry, and the need to develop alternative energy sources. Based on published research reported in this performance evaluation, if 5% of New Mexico's alfalfa growers select the highest yielding alfalfa variety over the lowest yielding variety within a region, the return would be at least $2.5M annually, which is consistent to 2011, and almost twice that of previous years. For producers growing sorghum forages in rainfed conditions, photoperiod sensitive cultivars will yield 1.5x that of forage sorghum and sorghum forages planted in May or early June will have approximately twice the yield of sorghum forages planted in late June or July depending on late season precipitation. Taller growing perennial warm-season grasses that are native to New Mexico have similar biofuel quality characteristics to switchgrass when harvested post-frost.

Open-pollinated, male-sterile, maintainer, and pollinator breeding lines were screened for disease resistance, bulb yield, bulb quality, maturity date, and bulb color. Promising breeding and hybrid lines and released cultivars were compared to commercial cultivars and experimental lines using variety trials. The New Mexico onion industry is economically significant and is highly competitive. The industry has a recent history of expansion, and the potential exists for further expansion. Further development and release of high-yielding, high-quality, well-adapted, bolting-resistant, disease-resistant, short-, intermediate-, and long-day onion open-pollinated and hybrid cultivars with varying maturities and scale colors, and improved bulb quality will support industry growth in New Mexico. Genetic improvement in bolting resistance, disease resistance, and bulb quality also will facilitate further expansion and add significantly to New Mexico's economic development. Identification of verifiable sources of Iris yellow spot virus tolerance and/or resistance would lead to the development of tolerant/resistant cultivars and reduced disease impact on onion yield throughout the western United States.

With the strawberry research and jujube research conducted at the NMSU Alcalde Center, plus presentations at the ASHS meeting, New Mexico Organic Farming Conference, and workshops, numerous home gardeners planted jujubes in their yards and several commercial growers started to plant jujubes and strawberries on their farms.

There is great interest in high tunnels for production of horticultural crops. By enhancing the ability of local growers to have product more of the year, they may be able to pursue additional markets, including school lunches and year-round farmers' markets. The hoop house projects at Alcalde and Las Cruces, NM, have been the subject of numerous tours to visitors, scientists, school groups, and legislators.

Commercial seed production of the drought tolerant alfalfa cultivar, NuMex Bill Melton, is underway. This will ensure that farmers in the southwestern U.S. can benefit from its yield stability in both well-watered and water-limited environments. In previous research, this project identified specific alfalfa chromosome regions (i.e., QTL) that influenced shoot and root biomass production during drought stress.

We recently used DNA marker assisted selection (MAS) techniques to transfer some of these QTL into elite cultivar backgrounds. One DNA MAS study suggested that the ERECTA gene may play a key role in affecting alfalfa forage productivity and water-use efficiency in drought-prone environments. In a separate field study, evaluation of multiple MAS-derived populations over two years indicated that some QTL improved alfalfa cultivar productivity by 6% to 19% under well-watered and drought-stressed conditions. The high performance of some germplasm developed through this project suggests that it may be suitable for commercial release, pending additional testing in multiple environments. Given that annual increases of 1% are the norm for yield improvement in many crops, but much less so in alfalfa, the potential of MAS to improve alfalfa forage productivity and drought resilience appears to be very promising. Water is a critical agricultural resource and effective use and reuse requires an understanding of crop requirements, climate and soil/medium characteristics. Novel irrigation scheduling protocols were developed for container-grown conifer seedlings which will improve irrigation efficiency and decrease greenhouse runoff. Long-term treatment of wastewater via a land application system has been evaluated. Both the vegetation and soil response were monitored and prescriptions for the slow-rate land application of wastewater to desert ecosystems developed. This is the first time this system has been documented in an arid environment. Prescriptions for improved seedling survival and growth were developed for Pinus ponderosa forestation programs in Argentina. Prescriptions for managing irrigation scheduling of containerized conifer seedlings for reforestation were developed. Land application of partially treated wastewater can reduce contamination of surface waterways, while providing alternative crops for small landowners. Impact of 5 years of saline wastewater application to desert soils was determined.

The greenhouse and nursery industry is in need of alternative potting media components to circumvent the increasing costs of traditional peat moss and pine bark. Pecan wood prunings are readily available in southwestern U.S. pecan orchards. A study is in progress to investigate the potential for chipped pecan wood to substitute for peat moss and pine bark in potting substrates at two commercial greenhouse and nursery firms. Preliminary results indicate that as little as 25% volumetric substitution of peat moss and pine bark by various particle sizes of wood chips reduces the growth of three potted ornamental plant species. The negative effect of pecan wood chips on the growth of several potted ornamental crops indicates that there is a need to modify cultural practices to allow partial replacement of peat moss or pine bark by pecan wood chips in commercial greenhouse and nursery potting media.

The New Mexico Recombinant Inbred Lines (NMRILs) were used to characterize the physiological races of Phytophthora capsici isolates from Brazil. Phytophthora blight, caused by Phytophthora capsici,is one of the most destructive diseases in New Mexico and worldwide that affects Capsicum pepper. In addition, the screening method used at Embrapa Vegetables in Brazil to detect resistance to P. capsici in Capsicum was compared with the screening method used at New Mexico State University. Both screening methods produced similar and consistent results when a range of P. capsici isolates were used. It was concluded that either method can successfully differentiate resistant and susceptible individuals. When 20 P. capsici isolates from Brazil were characterized for virulence using a subset of 26 New Mexico Recombinant Inbred Lines (NMRILs) of Capsicum annuum. Within the P. capsici populations from Brazil, eight new physiological races for the root rot disease syndrome were identified. A total of nine isolates were pathogenic only on the susceptible control 'Camelot.' The ability to identifyphysiological races of P. capsici occurring in Brazil allows for a better understanding about race-specific resistance leading to improved approaches in breeding for durable resistant cultivars. This information is very important in chile pepper breeding programs for developing resistant cultivars, and will aid New Mexico in being vigilant for the possibility of new races being introduced from South America.

Extension

A tremendous emphasis has been placed on emergency management preparedness programs through the dedicated work of trained Extension agents and specialists this past year. These global food security efforts have emerged from a growing and strong resource commitment of the New Mexico

Cooperative Extension Service over the past five to eight years. Agents and specialists have focused their work on seven areas: county emergency management planning; insect diagnostic detection; pesticide applicator trainings; master gardener first detector programs; youth entomology projects; livestock ALIRT programs; and collaborations with various local and regional agencies.

County emergency management planning programs largely fall on the agendas of county gents working with local producers and county emergency personal developing agro-terrorism emergency disaster and food related emergency plans. They continue to work with government officials, medical personnel, and local elected officials to incorporate emergency disaster planning into daily government routines. Agents provide trainings and three planning phases to help build buy-in with local citizenry. Phase one is the introduction to why disaster planning is an economical sound decision. Phase two is the trial and error phase where plans evolve and commitment tends to grow. Phase three brings permanency to the plan(s) and is initiated while adjusting the issues resulting from phase two trial and error. As a result of counties initiating emergency disaster plans, they report being able to apply for funding to complete their customized and localized plans. Last year, the extensive occurrence of several New Mexico wild fires and the need to put plans into action brought the need for disaster planning home rather dramatically. In preparing for food related incidences, agents provided animal, plant and food incidents training to county officials. This six hour FEMA training provided area producers, restaurant owners, public and private food service entities, fire department volunteers, local police, and dispatch personnel with invaluable training as reported in post-session evaluations. Participants generally reported a 98% knowledge increase.

Agents spearheaded work with the local livestock producer organization and county emergency manager to form a County Agriculture Emergency Planning Committee. The need to develop this plan usually stems from the fact that the agriculture industry in the county is a major contributor to the economy of the county; accounting for at least a third of the annual total gross receipt taxes. The negative impact of an outbreak of disease, or impact of a natural or man-made incident (severe weather, wildfire, flood, a Hazmat incident), could result in economic losses on an enormous scale. The agents meet with producers and the planning committee at least four times throughout the year. The 'plan', which usually takes about a year to develop, is thoroughly edited. The plan includes a list for the Emergency Managers and County Commissioners who are identified as primary and secondary producer contacts across the county. These folks have agreed to serve as geographically located information sources if an emergency occurs in their area of the county. A phone tree is developed as well as a county map of roads and off roads, gates, and obstacles along with a county resource map of equipment availability in different areas of the county. This is a living document that will need to be updated annually. The agent also facilitated a meeting between the area producers and commissioners to address major concerns about county roadwork and assistance during times of emergency to both residents and livestock. In this example forty-eight producers and thirteen county government professionals participated.

Insect diagnostic detection is anotheraspect of NM CES global food security programming. This area of work is led by Extension specialists and is largely driven by county offices receiving requests for information on particular pest destruction. This information is extensively catalogued and tracked which in turn generates reports for the NM Department of Agriculture and USDA, providing state records when identifications are confirmed. How many damage reports are logged each year depends on how many people need to learn what pests they have and what to do about them quickly. Popular press books, particularly of insects, are often inadequate for 'do-it-yourself' people who are unclear about what 'organic controls' are or how to apply them successfully. Requests to assist clientele depend on many factors. NM CES agents and specialists have found they all have roles to play in making themselves available, being approachable, having a willingness to assist, delivering requested information in a timely fashion, and having a reputation for accuracy. Pesticide applicator trainings last year numbered over 30 presentations statewide including county emergency management planning; insect diagnostic detection; pesticide applicator trainings; master gardener first detector programs; youth entomology projects; livestock alert programs; and collaborations with various local and regional agencies. Of the 1853 individuals attending

these presentations, 114 were trainees with the remainder already licensed; of the ornamentals and turf trainees, all indicated an appreciation for highlighting and emphasizing the study tips posted by NM Department of Agriculture (a training partner). A hybrid program emphasizing the principles of Integrated Pest Management (from the NMDA study guide), basic entomology and a series of examples from the Category 1A (Agriculture Plant) manual was created for trainees who needed their private applicator licenses. Over 680 of the licensees attended workshops geared for 'Ornamentals and Turf--- a mixture of public and commercial licensees in Category 3A. Roughly 1051 attended workshops with more varied pest and host subject matter as would be expected for farmers or ranchers, who are primarily Private Applicators. Currently, Private Applicators need to verify completion of 5 Continuing Education Units (CEUs) in 5 years to be eligible for license renewal. There's no way to tell if this group of attendees needed all 5 (or fewer) CEUs before the end of the year or if they were taking a particular workshop because of subject matter provided or just convenience. In an effort to address the variety of audiences, updates were made on the 'entomology roundup' presentations for licensees, adding or deleting information depending on the general interests of the audience, that included ornamental and turf farmers, fruit or field crop farmers, vegetation managers (requiring bio-controls for certain weeds and Integrated Pest Management) and ranchers (who must guard against grasshoppers and assorted other arthropods that attack range plants, people, pets and livestock).

Assuming Category 3A trainees receive, on average, a salary of $25,000 annually and licensees receive $32,000 annually, and allowing for seniority as well as experience; these two groups could be responsible for $24.5M in New Mexico's food service economy. Incomes from farms and ranches in New Mexico vary widely for many reasons, but assuming an average of $60,000 profit for each Private Applicator licensee, this group could be responsible for over $63,000,000 in the state's agricultural production economy.

Licensing does not require an individual to purchase and use restricted pesticides; the license gives individuals the flexibility to do so. Licensees are exposed to a variety of pertinent topics during recertification workshops (not sales pitches). They are made aware of their potential linkages to Cooperative Extension Service personnel at county and state offices, and they have the opportunities to meet these personnel and discuss particular problems.

Unlicensed applicators more than likely will not make the effort nor pay the expense to attend workshops if they were not required to keep their applicator license. Trade magazines do not provide the same quality information, the level of detail, or potential follow-up with presenters as delivered at Extension workshops. Organic producers, by law, must consider all pesticides as 'restricted', but organic producers are not required to have Pesticide Applicator licenses in New Mexico. Attendance at the annual organic farmers' conference is optional. Judging from questions asked on phone or in-office contacts, or when identifications are made, some have very limited experience with crop or livestock production and even poorer understanding of which pesticides are acceptable, which are not, and why (for organic production in New Mexico).

Master Gardeners (MGs) are committed to learning the basics on a variety of topics. Some MGs are designated as first detectors when it comes to entomology. Unfortunately, in entomology, the basics often seem alien to many. Even the common examples of insect pests and beneficials are numerous. Since entomology classes may last only 3 hours (on average), the tour of common insects through programs on vegetables, fruits and nuts, beneficials, ornamentals and turf can be intense. Emphasis is given to vegetable/fruit and nut pests since turf isn't as popular, due to drought. Beneficials and tree pests are the most popular entomology topics for NM Master Gardeners. Comments on evaluations are qualitatively helpful in judging the connection with the audience and their experience with the plants and pests under consideration.

Twelve entomology MG programs were conducted in nine counties last year, including one 'First

Detector' and two 'general garden/theme' presentations for special events. All presentations are made with specimen displays and, while some of these specimens are truly exotic, they do represent the variety of arthropods found in the world and easily show audiences some of the features mentioned in lectures. At the annual MG conference, some trainees had the opportunity to collect arthropods from an ornamental garden and see these living specimens through a dissecting scope. This added a new level of understanding and arthropod appreciation.

Youth entomology projects and programs are carried out in NM 4-H. There is an extensive collection of study materials for 4-H projects and competitions, which are held annually. They include identification quizzes, and a 50 multiple choice and 50 true/false question exam on pesticide use and safety. Display specimens are used for judging as well as for educational programs in schools. Last year 1017 participants were involved in some facet of entomology projects and programs. Sixteen adults, leading various 4-H clubs from around the state, were advised of entomology project learning materials and given copies to use with youth.

Collaborations with various local and regional agencies and focuses on the efficient use of public resources continue to prove beneficial for citizens. Collaborative partners and other agencies that benefited from work completed last year included US Department of Agriculture (APHIS and ARS), US Forest Service, Bureau of Land Management, NRCS, NM State Forestry, Texas State Forestry, Texas AgriLife Extension Service, NMSU 4-H, NMSU FFA, county and city parks and recreation departments, school districts, pest control businesses and applicators, farmers, ranchers, gardeners, and homeowners. Programs were also created and delivered for Southwest Turfgrass Association, Texas Pest Control Association, Think Trees, NM Vegetation Management Association, Pecan Growers Workshop and Conference, Chile Conference, Onion Field Day, NM Master Gardeners' State Conference, Roswell Independent School District (Retired Teachers' Organization for Super Day for Super Students), NM State Parks (Bosque State Park), Bosque Farms Elementary School, NMSUEntomology, Plant Pathology and Weed Science (Diagnosing Plant Disorders class) and Mercer School.

The diversity of NM CES global food security programs across the state include program presentations and organizational efforts with

· FEMA Foreign Animal Disease Exercise and Joint exercise with the FBI on Agricultural Emergency Preparedness;
· Meetings with USDA National surveillance Unit about Syndromic Surveillance and transitioning into the Enhanced Passive Surveillance Program;
· NM Syndromic Surveillance and ALIRT (Arizona Livestock Incident Response Team) programs; NM-ALIRT Conference; and
· NM-ALIRT and Syndromic Surveillance - FBI International Symposium on Agro-terrorism.

The NM-ALIRT and Syndromic Surveillance program (modeled after a similar program in Arizona) was developed in NM. This is a state-wide network of practicing veterinarians who have been equipped and trained to respond to large or suspicious livestock losses that occur in New Mexico. This program is designed to provide a first line of defense against disease or terrorism incidents that may threaten the livestock industry of New Mexico. Participating veterinarians also report monthly on disease syndromes that will allow for earlier detection of disease trends or outbreaks. As this program evolves, it is expanding into a more regional approach to emergency preparedness which now includes veterinary practitioners in Arizona and Texas in the reporting process and the addition of a web-based reporting surveillance component. This program is being evaluated by the USDA National Surveillance Unit for expansion into a national livestock health surveillance system and has been presented at several national meetings as a model for other states to follow. This program now includes classes on Agri-bioterrorism, taught at NM State University to FBI agents from all over the United States.

2. Brief description of the target audience

The target audience includes: ranchers, feedlot operators, dairy producers. small/medium/large-scale agricultural operations, business, associations, cooperatives, consulting firms and collectives that might or might not be defined as a farm under the USDA economic return criteria, but are land owners, managers, consultants, or students who wish to improve agricultural production and efficiency. Other audience participants include Extension agents, other agricultural specialists, pesticide applicators, Master Gardeners and garden clubs, youth (4H, Future Farmers of America and other groups) and the general public.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year:	2012
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	5	5	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- The specific output measures will vary according to the specific project being monitored. The development of research procedures and technology, training of students, publishing research papers, and disseminating research results via educational workshops, conferences, and

Extension media are important outputs for the various projects falling under this planned program.

Year	Actual
2012	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	# of trained professionals
2	# of improved animal varieties
3	# of research publications
4	# of methods, technology, and animal varieties adopted by public and private sectors
5	# Extension publicatons

Outcome #1

1. Outcome Measures

of trained professionals

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
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
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

301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
304	Animal Genome
305	Animal Physiological Processes
306	Environmental Stress in Animals
307	Animal Management Systems

Outcome #2

1. Outcome Measures

# of improved animal varieties

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals

Outcome #3

1. Outcome Measures

# of research publications

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	134

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
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
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
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
304	Animal Genome

305	Animal Physiological Processes
306	Environmental Stress in Animals
307	Animal Management Systems

Outcome #4

1. Outcome Measures

# of methods, technology, and animal varieties adopted by public and private sectors

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
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

301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
305	Animal Physiological Processes
306	Environmental Stress in Animals
307	Animal Management Systems
308	Improved Animal Products (Before Harvest)

Outcome #5

1. Outcome Measures

Extension publicatons

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	16

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Producers and homeowners require current information regarding growing, rearing, or protecting plants and animals.

What has been done
Extension publications have provided information to producers and consumers.

Results
Producers and consumers have access to current recommendations regarding growing/rearing plants or animals.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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
307	Animal Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

New Mexico continues in severe drought, which affects agronomic, animal and range research.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The majority of adult program evaluations carried out by New Mexico Extension agents and specialists are pre-post and post-program knowledge gain instruments. The majority of youth (primarily 4-H club) program evaluations are demonstrations of knowledge gained and applied in teaching others, competitive events, and climbing 'youth career ladders'. Rarely, if at any time, does an agent or specialist report that participant knowledge attained/gained was less than satisfactory. One can only assume that knowledge gain survey questions are fairly worded, and that audience participation was not mandatory. The only exception to this is with Master Gardener and Integrated Pest Management qualification exams. But again, participation is initially by application and the desire to learn and apply what is learned.

Key Items of Evaluation

What is interesting to note is that most Extension faculty now use goal setting, program objectives, and evaluation instruments in their program plans (as opposed to 10 years ago, when there was a great degree of resistance). The next step in program evaluation is to assist Extension agents and specialists to develop precision evaluation instruments. On-going training, such as the Western Extension Cohort (Evaluation) Training (WECT), needs to be organizationally supported and participation needs to be encouraged by all Extension faculty.

Also, the American Evaluation Association has an Extension group section and should

become a legitimate and heavily encouraged professional Extension association. The Association does more than any other organization to encourage evaluation 'best practices.'