FY 2004

Annual Report
-of-
University of Illinois Extension
-and-
Illinois Agricultural Experiment Station
-to-
Cooperative State Research, Education and Extension Service CSREES-USDA

University of Illinois Extension - Office of Extension and Outreach
-and-
Illinois Agricultural Experiment Station - Office of Research

College of Agricultural, Consumer and Environmental Sciences
University of Illinois at Urbana-Champaign

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Acknowledgments and Preface

This report has been developed to fulfill the requirements of the Agricultural Research, Extension and Education Reform Act of 1998 (AREERA) which amended the Smith-Lever Act, the Hatch Act and the National Agricultural Research, Extension and Teaching Act of 1997, and animal health and disease funds. AREERA focuses on funding through Smith-Lever 3(b) & 3(c), Hatch, McIntire-Stennis, and Evans-Allen. This report is the fifth annual report under Illinois' current plan of work with CSREES-USDA. This plan of work was amended in 2004 at CSREES's request to extend it through 2005 and 2006.

Consistent with the CSREES Annual Report Guidelines this annual report addresses some but not necessarily all of the issues in the plan of work.

Interpretations of AREERA have strictly limited those activities which can be claimed as jointly-funded Extension and Research activities as well as what can be claimed as multi-state Extension activities. As a result of these interpretations, this report fails to disclose the extent to which integrated and multi-state activities now represent the way the College does business. The College has decades-old ties with sister institutions and personnel based in other states. Over the past decade, which has witnessed a reorganization of the College and U of I Extension, a guiding principle has been to integrate Research and Extension so that the citizens of Illinois can be better served.

For the content of this report, the reporting team has drawn heavily on the work of the College's Department of Information and Technology and Communication Services' (ITCS) Public Affairs Section under the leadership of Gary Beaumont.

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CSREES Management Goals

APPENDIX A

A. Programs

Note on Key Themes reported by Goal: Illinois has chosen to report on some key themes that were not specifically named in the state's original Plan of Work. This is done because of the interest that the federal partner has expressed by listing all of the themes found in the respective plans of the states and territories.

Overview

The College of Agricultural, Consumer and Environmental Sciences enhances the quality of life for people and communities through teaching, research and outreach programs focused on human activity, food, fiber, and natural resource systems. The College's future rests mainly on two criteria: global preeminence in scholarship and local relevance to the needs of Illinois citizens. The land-grant mission envisioned opportunities to apply the knowledge of many disciplines to problems where people live and work. In ACES, that means extending discovery and learning across the domains of food and wellness, natural resources, bio-based products and processes, and individuals, families, and communities.

University of Illinois Extension reaches more than 2 ½ million people annually in Illinois with educational outreach programs in agriculture and natural resources; nutrition, family, and consumer sciences; 4-H youth development; and community and economic development. The statewide Extension system employs approximately 300 professional field staff, assisted by over 26,000 volunteers in all 102 counties in the state. Extension web sites receive more than three million page views each month, accessed by users from nearly every country in the world.

Strengths/Initiatives: The key strength of ACES is the capability to combine high-impact integrative research and education with cutting-edge scholarship across disciplines that are defined by our domains, serving needs of global and local audiences.

Among the many major initiatives, a few are particularly noteworthy:

- South Farm Modernization – creating the integrative field-scale laboratory of the future.
- Council on Food and Agricultural Research (C-FAR) – fostering stakeholder engagement in translational research.
- University of Illinois of I Extension – supporting the integrity of and increasing entrepreneurship in the system that serves as the University's face to all of the citizens of Illinois.

- ➤ Food and Nutrition Institute – building the platform for expanding opportunities in an area of established excellence.

Others are well along the path to success:

- ➤ The Institute for Genomic Biology is up and running, with spectacular new facilities under construction. ACES faculty members are well represented among the IGB leaders.
- ➤ The innovative Family Resiliency Program, led by ACES faculty, will soon have its new home in Doris Kelley Christopher Hall.

Vision and Direction: Even in fiscally challenging times, the College engaged internal and external stakeholders to chart its course. Task forces built on leadership conclaves and strategy conferences were able to examine the identity and culture of ACES. The College is crafting a strategic intent of global preeminence and local relevance through Teaching, Research and Extension in domains related to food and wellness, nature and resources, bio-based products and processes, and individuals, families and communities, while defining measurable performance criteria.

Budgets

University of Illinois Extension was affected in three areas of the FY 2005 state appropriations process. From the University's base budget reduction, Extension lost $207,331, resulting in 3.22 FTE fewer academic positions. The general support line for Extension in the Illinois Department of Agriculture was successively reduced from $3,209,600 in FY 2003 to $1,966,300 in FY 2004 to $1,782,100 in FY 2005. Primarily in place to support youth educators in local units, reduction of this line item resulted in a net loss of 32 originally budgeted positions, separate from the base reduction. Regional center-based educators were reduced in force from 89 to 86 in FY 2004, down from 104 FTE in FY 2002. County board match is the state's obligation to match locally committed funds. Resulting from the loss of state funds, Extension closed one center in Cook County.

The appropriation for the Illinois Council on Food and Agricultural Research (C-FAR), funded through the Illinois Department of Agriculture, fell to $3.5 million in FY 2005, after successive reductions from $15.0 million appropriated in FY 2002. The cuts curtailed internal grants for the participating universities, allowed for only a limited managed research portfolio, and sharply reduced capacity to engage in research projects of specific interest to stakeholders in Illinois.

Service to Stakeholders

Partnership value: Partner relationships are highly valued in ACES. Private and public organizations regularly seek assistance from ACES faculty and draw on unique expertise in entities such as the National Soybean Research Laboratory. Policy makers have called upon the College for input on issues such as federal farm and agricultural research policy, food security/safety, animal industry development, and global climate change. Numerous other examples indicate that stakeholders value direct relationships with the College, both on-campus and off-campus. Reach is extended with tools like *Farmdoc*, an acclaimed online source for research-based outreach, the *Urban Programs Resource Network*, among the University's most dynamic and highly accessed web sites, and the Midwest Dairy Consortium, which leverages teaching and outreach capabilities in several Midwestern states. In some areas, the dwindling faculty research base threatens the ability to keep pace with demands for outreach programs.

University of Illinois Extension: Extension provides educational programs throughout the state, in local units, in regional centers, and from campus specialists. Loss of center educators and faculty specialists threaten our capability to meet needs in core program areas and weaken stakeholder connections. Local support and associated county board match from the state is critical to local units. Extension is gradually increasing the proportion of resources targeted to the Northeast region.

Research and Extension coordination: The critical links between Research and Extension are the campus-based subject matter specialists and the center educators located throughout the state. Partial restoration of Extension faculty positions was included in the University's budget request for FY 2005, but the request did not survive the state budget process. However, the Chancellor committed $100,000 to begin rebuilding Extension faculty capacity.

C-FAR: Funding for C-FAR remains highly vulnerable in the state budget environment. The C-FAR appropriation has declined by nearly three-fourths since FY 2002. Not only does this limit the near-term ability of our faculty and research professionals to investigate problems of interest to stakeholders in Illinois, but it also affects decisions on faculty hiring and research orientation.

The South Farms is the largest component of the statewide system of food and agricultural research and education centers. Research and education centers in various locations suffer from deferred maintenance, old

equipment, and shortages of land for modern experimentation. Revolving and recurring operating resources are inadequate to properly sustain the research and education centers, including the South Farms. Knowledge and information produced is valuable for opportunities such as those in the "green" industry, alternative agriculture, urban landscapes, bioprocessing, and animal industry development.

Opportunities to Address

The College will invest to achieve its intent to be globally preeminent and locally relevant in domains that are consistent with our mission, have a fundamental base of excellence in advanced areas of discovery, contribute to our educational enterprise, and create value for our stakeholders.

Food and Wellness:

Food systems: The College of ACES has redoubled efforts to leverage strengths in food value chains and consumer behavior where we can truly be a globally preeminent intellectual center.

Food, nutrition, & health: Interdisciplinary opportunities to investigate disease prevention, obesity, food bioactivity, and global nutrition are manifest on this campus. Interdisciplinary collaboration is clearly evident in nutritional sciences, the World Initiative on Soy in Human Health, work in functional foods, and chemo-prevention of cancer and other diseases. The effort to establish the Food and Nutrition Institute will pay substantial dividends to the University.

Food security: Institutionalized as a campus initiative, the food security initiative is creating novel approaches to complex systematic problems. This area is of keen interest to public and private partners, who are forging new relationships with the College and the University.

Bio-based Products and Processes:

Biotechnology: Commitment to molecular biology remains a top priority, including investment in genomics and its functional derivatives. The Institute for Genomic Biology will enhance dimensions from animal and plant genomics and bioinformatics to metabolism, comparative physiology and nutrition, and whole organism biology, and the socioeconomic implications of biotechnology. Unique opportunities exist to translate new knowledge from molecular biology with field scale studies of whole organisms and biophysical systems on the new South Farms.

Bio-based initiatives: The College is well positioned to lead on issues related to the management and use of bio-based resources to benefit society and the environment. Significant research efforts exist in ACES and among Midwest collaborators, related to air, water, renewable energy, bio-based resources, and bio-refining. The College has the potential to bring together a nationally prominent critical mass around sustainable agricultural, food, and energy systems.

Nature and Resources:

Integrated landscapes: Continuous rather than bounded systems, integrated landscapes focus on issues ranging from systems biology and biocomplexity to precision technology and management. Global issues pertaining to urban-rural interface are critical, due to changing demographics, urbanization, land use, environmental impacts of agriculture and human activity, economies of scale and scope in the food and agricultural sector, and emerging opportunities for "green" industries (horticulture to turf grass), companion animals, and restoration ecology and wildlife. Given the ideal laboratory of the South Farms and transfer of the arboretum to ACES, exciting concepts for green spaces and multiple uses can become features of the integrated landscape.

Scientific literacy and communications: Raising the level of scientific understanding, increasing awareness of the role of science in society, and translating scientific knowledge for adaptation and application is a significant opportunity for a next-generation land-grant institution. ACES and Extension have unique capabilities to move in this direction. A high-visibility global outreach program on biotechnology already raises the University's profile in substantive policy forums.

Individuals, Families and Communities:

Human development and family resiliency: The mission of the College of ACES explicitly emphasizes a commitment to quality of life for people. The commitment to family resiliency is supported by the campus initiative and major donations for Christopher Hall and the endowed chair in family resiliency, building a platform for unparalleled scholarship.

Leadership: Leadership studies are being institutionalized in tandem with our communications, agricultural education, and agribusiness management programs. Programs in Extension provide the outreach basis for individual and community leadership development. The College will provide intellectual and structural underpinnings to partner with the campus to

develop the leadership curricula and programs that will serve students across campus.

eXtension: Internet and related technologies portend enormous opportunities to expand the reach and impact of outreach and Extension activities in the future. University of Illinois Extension participates in national planning for innovation in educational delivery methodology.

CSREES GOAL 1 - An Agricultural System that is Highly Competitive in the Global Economy

Indications of the Scope of Research and Extension Programs under Goal 1 - See Appendix A.

As in previous years, about two-thirds (66 percent) of the College's research portfolio is invested in Goal 1 efforts with just over 60 percent of scientist and support staff efforts invested under this goal. Just over 18 percent of Extension's efforts were directed to Goal 1 and included more than 350,000 face-to-face teaching contacts by paid Extension employees.

Key Theme – Agricultural Competitiveness

Target-Site Mutations Conferring Resistance to ALS-Inhibiting Herbicides

a. Progress - Herbicides continue to be the primary means of managing weeds in the United States. Among the most widely used herbicides are those that target acetolactate synthase (ALS). Due to their very low use rates and low mammalian toxicities, these herbicides also are among our most environmentally benign. Unfortunately, numerous weed populations have evolved resistance to these herbicides. Although resistance usually is a result of a point mutation in the ALS gene, the exact mutation has been identified for relatively few resistant biotypes. The goal of this project is to add to our catalog of ALS mutations in weed biotypes.

During the past year, research focused on common ragweed. Over 20 populations of this weed were obtained from several states in the Midwest, and several of these populations were suspected to be resistant to ALS inhibitors. Numerous plants were analyzed from each population and, for those that were confirmed resistant, the mutation in the ALS gene is being identified. Thus far, the majority of the resistant plants analyzed have the same ALS mutation that was previously identified in common ragweed. However, several plants have a different ALS mutation that was not previously reported in common ragweed.

In addition to the common ragweed research, water hemp and smooth pigweed biotypes resistant to ALS inhibitors were investigated. In water hemp biotypes, mutations in the ALS gene not previously reported from this species were identified. For the smooth

pigweed biotype, the resistance-conferring mutation was the same as one previously reported in this weed species.

b. Impact - The development of herbicide resistance in weed populations threatens the continued effectiveness of herbicides, and thus threatens the ability of U.S. crop producers to remain competitive in the global market. Cataloging of resistance-conferring mutations in the ALS gene aids crop production professionals in rapid confirmation of new resistant populations. In turn, this enables farmers to make informed decisions on the most appropriate herbicides to manage their weed populations.

c. Source of Funding – Hatch, State, Industry Funds

d. Scope of Impact – National

Key Theme – Agricultural Profitability

The Illinois Predictive Equation for Alfalfa Quality (PEAQ) Program

a. Producing high quality alfalfa is essential in the forage-feeding program for profitable dairy/livestock production in the state of Illinois. In addition, alfalfa is gaining in popularity as a cash crop among Illinois producers. Over 450,000 acres of alfalfa is produced and harvested annually throughout the state yielding approximately 1.8 million tons of hay equivalent with a value of $180 million.

Alfalfa plant maturity at the time of harvest is the single most important factor impacting on the forage quality and quantity. Previous university research has demonstrated a direct correlation between the morphological development of the alfalfa plant and the forage yield and nutrient quality. Alfalfa quality decreases as the plant matures from the vegetative stage to full flower. At the same time, the pounds of plant material harvested per acre increase as the plants mature. This situation demonstrates the need for producers to identify the optimum date to harvest alfalfa in order to optimize both quality and quantity.

Many producers have harvested alfalfa based merely on the calendar date versus the plant growth stage. This often results in lower quality forages that increase purchased feed costs needed to balance the ration or yield a lower dollar value commodity for the alfalfa grower. Proper timing of the first harvest for alfalfa is the number

one factor that determines quality and sets the stage for quality and yield in the remainder of the growing season. Second and successive cuttings should then be harvested every 26 to 30 days throughout the growing period. The purpose of this *Predictive Equation for Alfalfa Quality (PEAQ) Project* was two-fold:

1. Provide information and awareness to alfalfa producers to enhance their ability to produce higher quality forages through timely harvest.

2. Establish an alfalfa quality monitoring system that demonstrates the techniques and benefits of monitoring alfalfa growth in the field in order to determine the optimum date for first harvest.

The PEAQ program, now in its seventh consecutive year, has grown each year in the number of data collectors and fields sampled. During the past seven years, a total of thirty-nine individuals have been involved in monitoring alfalfa growth and collecting field data. The Illinois PEAQ coordinating team has also collaborated with the land grant universities in Iowa, Minnesota and Wisconsin to share results and data collection techniques. This collaboration has enhanced the quality of results and information distributed to producers throughout Illinois and the Midwest.

The PEAQ project has produced excellent results by providing reliable information and increasing producer awareness of the need to monitor alfalfa quality standing in the field. Relative Feed Value (RFV) is an industry-accepted measure that evaluates the plant fiber fractions, which dictate the digestibility and feed intake potential of the forage. To achieve the recommended goal of RFV from 150 to160 points for harvested alfalfa, producers are advised to remove the first cutting when the in-field prediction is 170 RFV.

b. Impact – To measure the impact producers and agri-business personnel have been surveyed. The average number of acres in alfalfa production among the producer respondents was 91 acres. The survey revealed the following:

1. **80%** of the producers and **100%** of industry personnel were familiar with the PEAQ program.
2. **83%** of the producers and **100%** of industry personnel said they use the PEAQ data to help them or their clients to produce high quality alfalfa.

3. **74%** of the producers and **83%** industry said the PEAQ program greatly improved their understanding of the effect plant maturity has on feed value.
4. **68%** of the producers and **83%** of the industry personnel said the PEAQ program greatly improved their hay quality by proper harvest timing.
5. **71%** of the producers indicated that they now always harvest first cutting based on the recommended "bud stage" of growth.
6. **82%** of the producers indicated that they now always harvest subsequent cuttings every 26-30 days, as recommended by the PEAQ program.
7. **96%** of the producers said their overall harvested alfalfa quality has improved by as much as 30 RFV points.
8. **100%** of all producers and **100%** of the industry personnel surveyed said University of Illinois Extension should continue the PEAQ alfalfa monitoring research program because of the awareness and improved management decisions made by producers.

Based on the survey average showing the improvement in the hay quality as evaluated on RFV and the number of acres harvested, the calculated **increase** in "net profit" per alfalfa acre is **$86.40** or **$25.9 million** over the 450,000 acres in Illinois. This demonstrates the impact on improving the profitability of alfalfa production credited to the positive knowledge, attitude and management changes made by the producers resulting from the Predictive Equation for Alfalfa Quality program.

c. Source of Funding – Federal, State

d. Scope of Impact – Illinois, Iowa, Minnesota, Wisconsin

Improved Grazing Systems for Beef Cattle Production

a. Progress - We have demonstrated that year-round grazing of beef cattle is very economical. Annual cow costs are about $120 per year using current land rental charges. This research involves management-intensive grazing of cool season grasses in the spring, summer and early fall and strip grazing corn stalks with turnips and oats in the winter. In this system there is more economic return than the traditional corn-soybean rotation.

b. Impact - This research demonstrated an alternative corn-cattle rotation that is more economical than traditional corn-soybean rotations.

c. Source of Funding – Hatch, State, Sale of Products Funds

d. Scope of Impact – National

Key Theme – Animal Genomics

Physiological Mechanisms Involved in Regulation of the Immune System

a. Progress - Sickness in animals resulting from infection with microbial pathogens leads to a perturbation in immune homeostasis that is characterized by fever, inactivity, and reduced appetite. This response to immune challenge is mediated by the induction of proinflammatory cytokines, such as tumor necrosis factor alpha (TNF alpha) and interleukin-1 (IL-1). These proinflammatory cytokines are the major reason that immunologically challenged animals fail to eat.

We hypothesized that activation of receptors for proinflammatory cytokines affect the somatotropic axis, as they do for the insulin receptor, by reducing sensitivity of IGF-I receptors in muscle myoblast cells. Myoblasts are critical for the growth of lean muscle mass. We have now provided evidence that TNF acts on muscle cells to induce a state of IGF-I receptor resistance. We established that TNF inhibited IGF-I-stimulated protein synthesis in primary porcine myoblasts. Similar results were observed in C2C12 murine myoblasts, where as little as 10 pg/ml TNF significantly inhibited protein synthesis induced by IGF-I. TNF also impaired the ability of IGF-I to induce expression of a key myogenic transcription factor, myogenin. The inhibition by TNF of IGF-I-induced protein synthesis and expression of myogenin was not due to direct killing of myoblasts by TNF. Although IGF-I induced an approximately 19-fold induction in tyrosine phosphorylation of the b chains of its receptor, TNF did not inhibit this autophosphorylation. Instead, TNF significantly reduced by approximately 50% IGF-I-stimulated tyrosine phosphorylation of two of the major downstream receptor docking molecules, insulin receptor substrate (IRS)-1 and IRS-2.

These results established that as little as 100 picogram/ml of TNF acts on both porcine and murine myoblasts to impair tyrosine

phosphorylation of both IRS-1 and IRS-2, but not the receptor itself. These data are consistent with the notion that very low physiological concentrations of TNF interfere with both protein synthesis and muscle cell development by inducing a state of IGF-I receptor resistance. These data establish that proinflammatory cytokines from an activated immune system impair the ability of IGF-I to promote protein synthesis in porcine and murine muscle cells.

b. Impact - It is likely that the reduction in growth and productivity that occurs in diseased animals is the result of cytokine and hormone receptor cross talk, resulting in a reduction in responsiveness of target tissues to IGF-I stimulation (IGF-I receptor resistance).

c. Scope of Impact – IA, IL, KS, MO, ND, NE, OH

d. Source of Funding – Hatch, State, Public Health Service Funds

Characterization and Mapping of Novel Cattle Genes and Divergent Orthologs

a. Progress - Using a starting set of 12,620 cattle 5' ESTs derived from placenta cDNA, 1,536 clones with ESTs having no significant database alignment (BLASTN E-value >e-5) were rearrayed and sequenced from the 3' end. Full-clone sequences were obtained by 5'/3' EST overlap, alignment to publicly available cattle EST sequences, and primer walking. In total, 373 of these full-clone sequences remained putatively novel after BLASTN. BLASTX interrogation of the putatively novel sequences identified distant homologies (E-value < e-10) in 23 sequences. This initial sequence set included five divergent orthologs, eight divergent paralogs, three sequences related to housekeeping genes in primitive eukaryotes, four apparent retrotransposon-derived sequences, and three additional identifiable paralogs [pregnancy associated glycoproteins (PAGs)] that contained multiple premature stop codons, representing probable sterile transcripts.

The 350 putative novel genes that did not have significant BLASTX alignments were conceptually translated in the three forward frames, and the longest complete and partial open-reading frames (ORFs) were extracted for further bioinformatic analysis. Radiation hybrid (RH) mapping was carried out to place the working set sequences on the cattle-human comparative map, and orthologous/paralogous assignments were confirmed. Expression data for the working set sequences was generated by performing a microarray experiment

using placental RNA and, in combination with collected data from previous expression studies on 17 other cattle tissues, the sequences were found to be expressed in 1) predominantly placenta, 2) predominantly other tissue(s), or 3) constitutive expression patterns. Global substitution analysis to detect positive/negative selection was performed on the multiply aligned sequences in the divergent ortholog/paralog groupings.

The results indicated that the majority of sequences were under negative selection, but one paralogous family, the prolactin-related proteins, showed significant evidence of positive selection.

b. Impact - The novel genes and divergent orthologs identified in this research provide a unique resource for examining the molecular basis of traits that may be directly related to the ruminant adaptation.

c. Source of Funding – NRI Competitive Grant Funds

d. Scope of Impact – National

Livestock Genome Sequencing Initiative

a. Progress - As a step toward the goal of adding the cattle genome to those available for multi-species comparative genome analysis, 40,224 cattle BAC clones were end-sequenced, yielding 60,547 sequences (BESs) after trimming with an average read length of 515 bp. Cattle BACs were anchored to the human and mouse genome sequences by BLASTN search, revealing 29.4% and 10.1% significant hits (E < e-5), respectively. Greater than 60% of all cattle BES hits in both the human and mouse genomes are located within known genes. In order to confirm in silico predictions of orthology and their relative position on cattle chromosomes, 84 cattle BESs with similarity to sequences on HSA11 were mapped using a cattle-hamster radiation hybrid (RH) panel. Resulting RH maps of BTA15 and BTA29 cover ~85% of HSA11 sequence, revealing a complex patchwork shuffling of segments not explained by a simple translocation followed by internal rearrangements.

Overlay of the mouse conserved syntenies onto HSA11 revealed that segmental boundaries appear to be conserved in all three species. The BAC clone-based comparative map provides a foundation for the evolutionary analysis of mammalian karyotypes and for sequencing of the cattle genome.

b. Impact - The results will contribute directly to a sequence-ready map of the cattle genome and will provide the cattle genomics community with an enormously powerful resource for identification of genes of economic importance to the dairy and beef industries.

c. Source of Funding - CSREES Grant, USDA Grant Funds

d. Scope of Impact - National

Production of 25,000 Cattle ESTs and Development of a High Resolution Radiation Hybrid Map

a. Progress - A second-generation 5000 rad radiation hybrid (RH) map of the cattle genome was constructed primarily using cattle ESTs that were targeted to gaps in the existing cattle-human comparative map as well as to sparsely populated map intervals. A total of 826 targeted markers were added, bringing the number of markers mapped on the RH5000 panel to 1,913. Of these, 1,564 are genes or ESTs, of which 1,463 have significant BLASTN hits (E<-5) against the human genome sequence (NCBI build 33) and 101 are novel genes and divergent homologs. The remaining 349 markers are microsatellites that anchor the RH map to the linkage map.

The map length is 11,901 cR5000 and is comprised of 86 linkage groups. A cattle-human comparative map was then created using human genome sequence coordinates for the paired orthologs in order to define the boundaries of conserved chromosome segments. One hundred and ninety-six conserved segments (defined by two or more genes) were identified between the cattle and human genomes, of which 31 are newly discovered and 34 were extended singletons on the first generation map. The average length of the conserved segments is 9.58 Mbp.

The new map represents an improvement of more than 43 percent comparative coverage as compared with the first generation map.

b. Impact - The new, more detailed cattle-human comparative map will provide a resource for the analysis of mammalian chromosome evolution and will facilitate the identification of candidate genes for economically important traits.

Moreover, the second generation RH map will provide an invaluable resource for the assembly of the cattle genome sequence.

c. Source of Funding – NRI Competitive Grant Funds

d. Scope of Impact - National

A DNA Microarray to Quantify Nutritional Effects on Gene Expression in Peripartal Dairy Cows

a. Progress – Holstein cows (n = 71) in their second or greater lactation were fed diets providing different amounts of nutrients during the far-off (FO) dry period (the first five weeks of the eight-week dry period) and close-up (CU) dry period (the last three weeks of the dry period before calving).

During the FO period, cows received a low-energy, high-fiber diet to meet but not exceed energy requirements, a higher-energy diet fed for ad libitum intake to exceed energy requirements, or the same higher-energy diet restricted to provide only 80% of calculated energy requirements. During the CU period, cows received one diet but were fed either for ad libitum intake or restricted to libitum intake to provide only 80% of requirements. All cows received the same lactation diet after calving.

Liver biopsies were obtained at -30, -14, +1, +14, and +28 days relative to calving to study how nutritional treatments affected liver metabolism of fat, which could be important for development of the metabolic disorders ketosis and fatty liver. Results showed that excessive energy intake during the dry period promotes changes in liver tissue that would lead to fat accumulation in the liver after calving. Liver biopsies from five Holstein cows fed the low-energy, high fiber diet during the FO dry period and the higher-energy diet ad lbitum during the CU period were obtained at -65, -30, -14, 1, 14, 28, and 49 days relative to parturition. We used a DNA microarray that allowed the simultaneous measurement of expression of 7,872 genes in the liver. The expression of messenger RNA (mRNA) for several critical genes of fatty acid oxidation (FACL1, SLC25A20, ACADVL, CPT1A), glucose synthesis (PC, LDHA), response to immune system activation (SAA1), and oxidative damage (GPX3) peaked by day one, then declined gradually. Expression of genes coding for key transport proteins (TF, ALB, IGFBP3) or with roles in immune (CD59, CD5L, CCL5) and oxidative stress responses (MSRA, AOX1, ACAD8, CAT) was lowest on day one, then increased by days 14 to 28. Genes with peak expression on day 14 included some of lipid (ACOX1, SLC27A2, SC4MOL, ACAT2) and

carbohydrate (PDK4, DLD, SUCLG2) metabolism, stress responses (SOD1, SEPP1), and apoptosis (CASP6).

Results, discovered with a highly replicated design involving 68 microarrays, demonstrate that expression of genes in cow liver is modified in response to nutrition and time relative to calving.

b. Impact – Our data are resulting in increasing interest in higher-fiber, lower-energy diets for feeding dry cows, with the benefit of decreased health problems around calving.

Continued exploration of effects of dry period diet on gene expression patterns will likely yield important insights on how these programs should be best designed, as well as important new data on the underlying biology.

c. Source of Funding – NRI Competitive Grant, State, Sale of Products Funds

d. Scope of Impact – National

Key Theme – Animal Health

Enteric Diseases of Swine and Cattle: Prevention, Control and Food Safety

a. Progress - Based on our studies showing gangliosides, particularly N-glycolylGM3, are required by sialic acid-dependent strains of porcine rotavirus for enterocyte infectivity, we are actively pursuing synthesis of multivalent, neoglycoconjugate carbomimetics using the native sialyllactose oligo-saccharide moieties of porcine intestinal GM3. We recently synthesized a sialyllactosyl-phosphatidylethanolamine (SLPE) neoglycolipid which displays a potent ability to inhibit both virus binding and infectivity in vitro. We are currently conducting experiments evaluating the in vivo efficacy of this new carbomimetic.

In field trials this inhibitor blocked infection, virus shedding and diarrhea using a twice a day dosage administered to newborn pigs at the time of virus inoculation. We are currently investigating, in collaborative studies with Dr. Sharon Donovan, Department of Food Science and Human Nutrition, the synergistic effect of SLPE and specific porcine milk oligosaccharides as well as soybean derived

flavonoids, which we have found to exhibit anti-rotavirus activity that is acting distinctly from virus attachment and entry.

Previously we described an in vitro cell suspension assay that measures adhesion of sporozoites to host cells (MDBK and Caco-2 cells). This assay involves the incubation of individualized sporozoites and host cells in suspension with end-over-end rotation at 37C. Binding of the sporozoites to host cells is readily observed and quantified by phase contrast microscopy. This assay was used to screen a variety of glycoconjugates for their ability to inhibit parasite binding to host cells. Of the glycoconjugates tested, mucins markedly inhibited binding of sporozoites to host cells. Plasma membrane vesicles (PMV) and fractioned cell membranes, generated from MDBK cells, significantly inhibited binding as well. We have purified and partially characterized this membrane inhibitory activity isolated from MDBK cells, plasma membrane vesicles and bovine intestinal mucosa.

The results of these experiments are confidential and will be reported in an upcoming publication. We will provide the details of these results in later progress reports once the information is in print. Additionally, we are finishing preliminary experiments aimed at identifying specific sporozoite genes expressed as a consequence of the early stages of host cell invasion or exposure to the host cell membrane component mentioned above. Finally, we have determined the cryptosporidium oocysts are effectively retarded from overland transport by vegetative filter strips (VFS) and that the mechanism of this retardation is specific adhesion to the clay particles of the soil that occurs as a consequence of reduced flow over a vegetated surface as compared to bare soil.

b. Impact - Group A rotaviruses are among the most important agents associated with severe diarrhea. Receptor therapeutic approaches aimed at blocking virus attachment combined with nutritional therapy capable of blocking virus replication is likely to be a more field applicable, producer acceptable, and deliverable strategy to combat rotavirus in both the majority of people and agricultural animals affected by the disease than traditional vaccine approaches.

c. Source of Funding – State, Multi-State Funds

d. Scope of Impact - AZ, IA, IL, KS, MI, MN, NE, OH, SD, WA

Control of Animal Parasites in Sustainable Agricultural Systems

a. Progress - Our laboratory researches *Neospora caninum*, a protozoal pathogen that is transmitted between cattle and dogs, and is a cause of bovine abortion. W-102 funds are used to finance preliminary studies, underfunded studies, and aspects of neosporosis research for which we have been unable to obtain funding from other sources.

We investigated some of the factors that affect production of *Neospora caninum* oocysts in dogs. Only small numbers of oocysts have typically been produced by experimentally-infected dogs. This has caused some investigators to question if dogs may be inefficient definitive hosts that are unimportant in transmission of neosporosis to cattle. We hypothesized that one reason for low experimental production of oocysts is that dogs have been fed tissues from artificially-infected mice instead of tissues from cattle (which are natural intermediate hosts of *N. caninum*). In this study, nine dogs were fed tissues from *N. caninum*-infected calves, and oocyst production was compared with six dogs that were fed infected mouse carcasses. The mean number of oocysts produced by dogs that ingested infected calf tissues was 30-fold greater ($P = 0.03$) than the number of oocysts shed by dogs that ingested infected mice. Organisms closely resembling *Neospora caninum* have been differentiated based upon comparison of the base sequence of the Internal Transcribed Spacer-1 region (ITS-1). We performed a refined molecular characterization of the ITS-1 region of *N. caninum*, which revealed a source of common errors in the literature. Subtle ITS-1 differences should not weigh prominently as a criterion to describe a new species.

b. Impact - Increased production of Neospora oocysts by dogs strengthens evidence that dogs are important in the transmission of this parasite to cattle.

A refined method of genetic characterization of *N. caninum* revealed a source of common errors in the literature, and indicates that subtle ITS-1 differences should not weigh prominently as a criterion to differentiate between parasite species.

c. Source of Funding - State, Multi-State Funds

d. Scope of Impact - AZ, CA-D, CA-R, GA, IL, KS, LA, MN, MO, MS, NYC, TX, VA

Avian Respiratory Diseases: Pathogenesis, Surveillance, Diagnosis and Control

a. Progress - Genomic analysis of field strains of fowlpox virus reveals integration of reticuloendotheliosis virus (REV) in fowlpox virus genome. These viruses tend to persist in the poultry environment. The vaccine strains of fowlpox virus contain remnants of REV long terminal repeat (LTR) sequences. Since REV is widespread in the poultry population, the presence of REV LTR sequences in the genome of vaccine strains of fowlpox virus have the potential to generate a fowlpox virus containing REV provirus. In this regard, immunization of birds with a fowlpox virus vaccine in which either all REV sequences have been deleted or only REV envelope gene is incorporated would avoid chances of emergence of a fowlpox virus which contains REV provirus.

Since REV envelope gene has been associated with protection against REV, use of a fowlpox virus vaccine containing only REV envelope gene would provide protection against both fowlpox and REV. With a view to further evaluate the protective ability of two genetically modified fowlpox viruses as vaccines against fowlpox, chickens were immunized either with genetically modified fowlpox virus lacking any REV sequences or with genetically engineered fowlpox virus containing REV envelope gene. To determine the protective ability of these vaccines, two weeks after immunization, the birds were challenged either with field strain of fowlpox virus, MN97 or PA97. All immunized birds developed localized lesions at the site of inoculation, which regressed between three-to-four weeks. Both vaccines provided protection against challenge with either of the two field strains of fowlpox virus.

b. Impact - Persistent fowlpox virus in the poultry environment can be a source of infection for the susceptible birds. Immunization of birds with a fowlpox virus vaccine in which either all REV sequences have been deleted or only REV envelope gene is incorporated would provide protection against field strains of fowlpox virus.

Further, application of such fowlpox virus vaccines would avoid chances of emergence of a fowlpox virus which contains REV provirus.

c. Source of Funding –Multi-State Research Funds

d. Scope of Impact - AL, AR, CTS, IA, IL, IN, MN, OH, UT

Molecular Evolution, Immunology and Vaccine Failure in PRRS Virus

a. Progress - The goal of this project is to determine whether vaccination against PRRSV fails due to 1) failure of the virus to induce high levels of cellular and neutralizing immunity, and 2) the ability of the virus to shift genetically away from the vaccine strain.

We have collected data to indicate that the primary mechanism of vaccine failure in PRRSV appears to be the former. Specifically, experimental pigs that, once exposed to PRRSV, mount strong cellular immune responses suffer dramatically reduced reproductive losses. This appears to be independent of genetic changes in the virus. In two experimental replicates, we have demonstrated that immunized pigs have a bimodal cellular immune response: approximately 70% of pigs fail to mount a strong response, while 30% of pigs do mount a strong response. Pigs that mount a strong response have approximately one to two more live pigs per litter than pigs that do not mount a strong response. This translates into an approximate economic return of $43 per sow per farrowing cycle. The final stage of this project involves evaluation of a vaccination strategy that increases cellular immunity in commercial herds. Preliminary results are extremely encouraging. Vaccination followed by boosting with killed vaccine bolsters the cellular immune response of experimental pigs considerably. We are currently awaiting reproductive performance data from these pigs in order to assess the economic benefits of this strategy.

b. Impact - This project will determine whether vaccination against porcine reproductive and respiratory syndrome virus fails due to failure of host immunity, or mutation of the virus. It will provide information critical for the design of rational management strategies for PRRS that incorporate vaccines.

c. Source of Funding – USDA Animal Health and Disease Funds

d. Scope of Impact - National

Minimizing the Effects of PRRS Virus Infection in Nursery Pigs with Antioxidants

a. Progress - The objective of this study was to determine if feeding a vitamin E-rich diet would benefit nursery pigs infected with porcine reproductive and respiratory syndrome virus (PRRSV).

Sixty-four pigs were subjected to one of four treatment combinations (2 x 2 factorial) of dietary vitamin E (11 mg/kg or 550 mg/kg) and PRRSV (intranasal inoculation with DMEM or VR-2385 isolate P-129). Pigs were fed experimental diets during a 3-week period before inoculation as well as during a 12-day period after inoculation. Growth performance was determined throughout the study and lipid peroxidation in liver, glutathione peroxidase (GPX) activity in serum, circulating white blood cells and interleukin-1 beta (IL-1) and interferon-gamma (IFN) were determined in samples collected from pigs killed four or 12 days post inoculation. Two-way ANOVA of ADFI and ADG detected a main effect of PRRSV, but neither the main effect of diet nor the diet x PRRSV interaction were significant. PRRSV induced a marked decrease in both ADFI and ADG irrespective of dietary vitamin E concentration. Neither diet nor PRRSV affected feed efficiency. Two-way ANOVA of liver lipid peroxidation and serum GPX activity 12 days post inoculation revealed a significant main effect of diet, but neither the main effect of PRRSV nor the diet x PRRSV interaction were significant. Lipid peroxidation in liver and GPX activity in serum were lower in pigs fed 550 mg/kg vitamin E than those fed 11 mg/kg, suggesting that the diet high in vitamin E bolstered pigs antioxidant defenses. White blood cell counts, IFN, and IL-1 were elevated four and 12 days post-inoculation in PRRSV-infected pigs, but neither diet nor the diet x PRRSV interaction were significant.

Collectively, these results indicate that increasing antioxidant defenses by feeding high levels of vitamin E did not ameliorate the effects of PRRSV on depressed growth, leukopenia, and elevated serum IL-1 and IFN. Thus, feeding nursery pigs a diet high in vitamin E may not be useful for mitigating the acute morbidity effects of PRRSV infection.

b. Impact - Respiratory infections increase inflammatory cytokines and markedly depress growth in animals. Antioxidant vitamins have been shown to inhibit production of certain cytokines in pigs and promote recovery from influenza infection in rodents. However, the results of this study indicate that feeding nursery pigs a diet high in vitamin E may not be useful for mitigating the acute morbidity effects of PRRSV infection.

c. Source of Funding – Public Health Service, USDA Animal Health and Disease Funds

d. Scope of Impact - National

Functional Food Ingredient Effects on Canine Nutrition and Health

a. Progress - The accuracy of laboratory starch analyses to predict in vivo starch digestibility was investigated. Forty-two rats were adapted to diets containing corn, potato, or amylomaize starches for two weeks prior to euthanasia and harvesting of intestinal contents. Starch concentrations of the digesta were measured at specific segments along the small intestine in order to determine starch disappearance or digestibility. These values were compared to two different published chemical assays designed to predict rate and extent of starch digestibility. Results from our study indicate that both the digestion rate and extent of partially digested starches (termed resistant starches) are overestimated by in vitro methodology compared to in vivo values. However, in vivo digestion of completely digestible starch (corn starch) was well predicted by the chemical assays. In a different study, the health-promoting effects of two prebiotics, oligofructose and inulin, were tested using seven ileally cannulated dogs fed diets containing 0, 0.3, 0.6, or 0.9% of these compounds. Nutrient digestibility, stool quality, and fecal concentrations of fermentative end-products were measured. Both inulin and oligofructose decreased total tract nutrient digestibility of dry matter, organic matter, and crude protein, and fecal output was increased. Small intestinal digestibility and stool quality were not affected by prebiotic supplementation. Fecal concentrations of ammonia and short-chain fatty acids were increased in dogs consuming either prebiotic. Oligofructose, but not inulin, increased fecal concentrations of amines, while both compounds decreased fecal concentrations of phenols.

These data suggest that, at low levels of supplementation, inulin and oligofructose somewhat impact colonic fermentation and depress total tract nutrient digestibility without reducing the proportion of nutrients available to the host animal.

b. Impact - Data from the starch digestibility study will serve as a guide to direct future development of in vitro models that can more accurately predict starch digestibility or indigestibility. This information will be vital to formulation of foods and diets for dogs, cats, or even humans who suffer from poor glucose tolerance or diabetes.

Data from the prebiotic study demonstrate that inulin and oligofructose positively impact some indicators of gastrointestinal

tract health without negatively affecting nutrient availability or stool quality. This information will be of great interest to pet food manufacturers in formulating diets that will help support and maintain the health of companion animals throughout the life cycle.

c. Source of Funding – Hatch, State, Industry Grant Funds

d. Scope of Impact - National

Key Theme – Animal Production Efficiency

Standardized Performance Analysis (SPA): Making the Illinois Beef Industry More Competitive through Business Enterprise Records

a. Beef cattle producers throughout Illinois and the country are focusing attention upon sustainability and least-cost production in an ever increasingly competitive and volatile business. The Illinois Standardized Performance Analysis Program (SPA) was implemented in 1994 due to dire economic conditions in the beef industry at the time. It was important that changes were made soon or Illinois beef producers may have no longer been viable in the changing agricultural business structure. From 1994 to 1995, the number of Illinois farms with beef cows dropped from 20,000 to 18,000 which was the largest percentage decline of nearly any state (National Agriculture Statistical Service, 1996). In spite of those declines, the beef industry in Illinois was still estimated to account for over five billion dollars of the total agricultural economy.

The Cow/Calf Standardized Performance Analysis (SPA) program was developed to analyze the economic stability of an operation. SPA is a business record system that allows producers to analyze beef production and economic records in a standardized format. An annual summary is published that allows producers to compare their operations against state and regional averages and allows university personnel to identify problem areas for future Research and Extension education.

Each year, an annual summary is published that provides information about Illinois beef enterprises that has never before been available. The financial and economic information provides an in-depth look at not only an individual's management, but also provides a statewide database that ultimately is the key to the project objectives. This standardized summary is used by

individual producers to compare their operations against state and regional averages and by university personnel to identify future areas for research and Extension education.

This project worked with a wide range of beef industry participants. Geographically speaking, this project included beef producers from every region of Illinois as well as collaborations with university personnel and producers in five other Midwestern states, and to a lesser extent, nationally. Herds included ranged from part-time cattlemen with as few as six cows to farm managers and absentee owners with input into operations greater than 500 cows.

b. Impact – Results of the Illinois Cow-Calf SPA program show that producers who had five years of SPA data reduced their annual cow costs by an average of $175 per cow. This resulted in a savings of over $20,000 per producer per year for the average sized herd enrolled. With over 100 producers who have completed a full SPA analysis, this program has directly resulted in an annual savings of greater than two million dollars for Illinois beef producers.

While the primary beneficiaries of this effort are Illinois beef producers and other Midwestern cattlemen who operate in a similar production environment, improving the economic viability of these producers also indirectly benefits numerous allied industries and local communities.

c. Source of Funding – Federal, State

d. Scope of Impact – Illinois and other Midwestern states

Illinois Horse Breeders Short Course

a. The national average conception rate for all mares bred is only about 55%. This is in part due to horse breeders lacking knowledge of equine reproductive physiology and management. To help remedy this situation, a two-day in-depth workshop has been offered annually over the past four years. Targeting breeders, mare owners, stud farm managers, and veterinarians the course offers hands-on experiences, wet labs and lectures covering mare reproductive physiology, semen evaluation and shipping, stallion management, foaling, ultrasonography, and herd health.

b. Impact – Eighty-nine horse breeders and veterinarians representing approximately 10,000 mares attended the Illinois Horse Breeders Short Course during the past four years.

Based on evaluations (with a 78 percent response rate) 94.3% of all respondents either agreed or strongly agreed to each of the following assessments regarding the impacts of the course:

1. I gained valuable information about breeding management of mares.
2. I gained valuable information about breeding management of stallions.
3. I gained valuable information about collection, preparation and transport of stallion semen.
4. I will apply what I learned in the course to my horse breeding operation.
5. I expect that the information and techniques learned from the course will help me to improve conception rates in my horse breeding operation.

Twenty eight attendees (40% of respondents) gave a quantitative answer to the question: "How much improvement in conception rate for your horse breeding operation do you expect due to information and techniques learned at the Horse Breeders Short Course?"

4% expected up to 5% improvement,
32% expected an improvement of 5-10%,
29% expected an improvement of 15-30%, and
35% expected 30-50% improvement in conception rates.

c. Source of Funding – Federal, State

d. Scope of Impact - Illinois

Swine Nutrition and Bacterial Populations in the Gut

a. Progress - We have completed, compiled and summarized data from several experiments which tested the impact of a mannan oligosaccharide product on growth performance of newly weaned pigs. The results show an average improvement in growth rate of about four percent when the product is added to the diet. The response is robust, occurring over a wide range of conditions. The only factor shown to alter it significantly is growth rate of the control pigs; pigs that grow more slowly have a bigger response to

the product. We are finishing a series of preliminary experiments designed to determine the mode of action of the product, with no clear answer to date. We made a significant investment of effort and resources to establish an important facility for performing experiments on a commercial farm, and we have completed three experiments with newly- weaned pigs in that facility.

The results have shown no improvement in growth performance from adding either lactic acid or lactose to the diet. In laboratory tests, we found these ingredients to have limited effects on the environment and bacterial populations in the digestive tract. An experiment to define the impacts of spray-dried plasma on the digestive tract of young pigs is underway. Our research on amino acid requirements of lactating sows suggests that lysine is first-limiting and threonine second-limiting in a typical corn-soy diet, at least in short-term experiments using plasma urea nitrogen as the response criterion. We plan to test this observation in full-lactation studies, using litter growth rate as the primary response criterion.

b. Impact - Our summary of the data on the efficacy of the mannan oligosaccharide product has already caused many pork producers and feed manufacturers around the world to use this technology, and the impact will spread with anticipated publication in a refereed journal.

Our observations that lactic acid does not improve growth performance under conditions typical of a U.S. pork production business, and that its effects on conditions in the digestive tract are limited, will influence attitudes toward the use of organic acids in pig diets and direct attention to other technologies. These observations will help the industry draw a distinction between U.S. conditions and European conditions; in the latter, diets are usually simpler and performance is often improved by organic acids.

Results of our on-going research on the effects of mannan oligosaccharide, lactose and spray-dried plasma in the digestive tract will help the industry understand how to best use these products, and perhaps guide development of succeeding generations of products.

Our present and planned research on amino acid requirements of lactating sows will guide the industry to more effective utilization of soybean meal and crystalline amino acids and perhaps to improved productivity.

c. Source of Funding – Hatch, State, Sale of Products Funds

d. Scope of Impact - National

Germ Cell and Embryo Development and Manipulation for the Improvement of Livestock

a. Progress - Our goal is to maximize swine milk production and piglet growth and development through transgenic technology. We previously created transgenic swine containing either bovine alpha lactalbumin (alpha-LA) or human IGF-I by pronuclear injection. Alpha-LA over-expression increased milk lactose content. Milk yield was greater until day nine of lactation and piglets suckling alpha-LA transgenic sows had significantly greater weight at weaning compared to controls. IGF-I transgenic pigs produced milk with 10-fold greater IGF-I content in the first 48 hours, and 60% higher milk IGF-I thereafter. Growth of piglets suckling IGF-I transgenic sows was not different than control, however, higher jejunal villus height was observed in piglets suckling transgenic sows.

The goal of the current study was to develop a new line of transgenic pigs by mating alpha-LA transgenic sows to the IGF-I transgenic founder. We hypothesized that animals transgenic for both genes would display increased milk volume and IGF-I content. Piglets were screened and gilts positive for both alpha-LA /IGF-I, alpha-LA alone, IGF-I alone and negative for both transgenes were bred to a Yorkshire boar. Milk yield and piglet growth were assessed throughout lactation. Milk production of alpha-LA (6.56 kg) and alpha-LA /IGF-I (6.51 kg) was higher ($P<0.05$) on day seven of lactation than IGF-I (5.3 kg) or control (5.1 kg) sows. Body weight at weaning tended to be higher in the piglets suckling from sows positive for both transgenes, but the difference was not statistically significant.

Analysis of milk composition and growth factor content is ongoing. The lines of transgenic swine created in our laboratories using mammary over-expression of alpha-LA, IGF-I or both may provide means to improve pig production and piglet health. The overall transgenic pig results suggest that alpha-LA maybe limiting for lactose synthesis, and lactose may be limiting for milk production. Results suggest that over-expressing alpha-LA will provide an avenue to increase milk production. This may be useful in beef and dairy cattle as well as sheep, goats and pigs. The production of the

alpha-LA transgenic swine have and will continue to allow analysis of the effects of over expression of alpha-LA on milk composition, milk yield and lactose synthase activity.

b. Impact - We have shown that milk production and piglet growth can be significantly increased by the introduction of a single gene, which is involved in milk synthesis. The production of alpha-LA swine may allow for improvement of piglet growth and health in swine production systems. These observations may have profound effects on milk and meat production.

c. Source of Funding – State, Multi-State Research Funds

d. Scope of Impact - AR, CA-D, CO, CTS, IA, IL, LA, MD, OR, UT, WA, WI

Beef Carcass Merit as Affected by Age, Breed, Feeding Program, and Marbling EPD

a. Progress - Early-weaned Simmental steers (n = 192) of known genetics were individually fed in a four-year study to determine performance and carcass factors explaining variation in carcass value and profitability. Steers were weaned at 88 days and fed a high concentrate diet ($108.99/T) for 84.5 days prior to allotment. Steers consumed a 90% concentrate diet ($98.93/T), consisting primarily of whole shelled corn and corn silage, for 249.7 days and harvested at 423.3 days of age. Five-year price data were collected for feedstuffs, dressed beef, and grid premiums and discounts. Average dressed beef price was $110.67/45.4 kg. Premiums ($/45.4 kg) were given for Prime ($5.62), Premium Choice ($1.50), yield grades (YG) 1 ($2.46), 2A ($1.31) and 2B ($1.11). Discounts ($/45.4 kg) were given for Standard (-$16.85), Select (-$8.90), YG 3A (-$0.12), 3B (-$0.19), 4 (-$14.16) and 5 (-$19.56), and hot carcass weight (HCW) extremes (409-431 kg, -$0.64; 432-454 kg -$11.39; > 454 kg, -$19.71). Input costs included annual cow costs ($327.77), veterinary/medical and labor ($35/hd), feed markup ($22/T), yardage ($0.25/hd/d) and interest (10%). Dependant variables were carcass value and profit per steer. Independent variables were yearling weight EPD, marbling EPD, daily DMI, ADG, feed efficiency, HCW, 12th rib fat, calculated YG and marbling score (MS). Carcass value was correlated ($P < 0.05$) with yearling weight and marbling EPD, DMI, ADG, feed efficiency, HCW and MS. Carcass weight, MS and YG accounted for over 79% of the variation in carcass value among steers, explaining 57, 12 and 10%, respectively. Profit was

correlated ($P < 0.05$) with DMI, ADG, feed efficiency, HCW and MS. Marbling score, DMI, ADG, YG and HCW accounted for over 77% of the variation in profit among steers, explaining 30, 14, 12, 12 and 9%, respectively. Carcass weight was the most critical factor contributing to carcass value while carcass quality was the leading factor affecting steer profitability.

b. Impact - The beef industry is moving toward marketing cattle based on the value of individual carcasses. Producers have the ability to select seed stock for a variety of traits that may impact carcass value. This study provides beef producers with a shopping list of traits and ranking of importance in making sire selections that impact profitability.

c. Source of Funding – Hatch, State, Sale of Products Funds

d. Scope of Impact – National

Metabolic Relationships in Supply of Nutrients for Lactating Cows

a. Progress - Two trials were conducted to evaluate effects of feeding supplemental fibrolytic enzymes or soluble sugars and malic acid on milk production. In Trial 1, 257 cows at four sites were fed a basal diet consisting of no more than 60 percent forage dry matter as corn silage and less than 40 percent alfalfa hay. Cows were assigned randomly within site, parity, and two stages of lactation to 1) control, 2) fibrolytic enzyme solution A (Finnfeeds, Helsinki, Finland), 3) fibrolytic enzyme solution B (Biovance Technologies, Inc., Omaha, NE) and 4) additive-containing soluble sugars and malic acid (Milk Specialties, Dundee, IL). There was a 14 day pretreatment and an 84 day treatment period. Enzyme solutions were sprayed on either the forage component or the TMR each day while mixing feed. Trial 2 was similar, except 122 cows at one site in the United Kingdom were fed diets containing forage that was 75 percent corn silage and 25 percent grass silage, and all cows began the trial between 25 and 31 days in milk. Mean milk productions for 233 cows that completed trial one were 32.9, 32.5, 32.4, and 32.9 kg/d for control, enzyme A, enzyme B, and soluble sugars and malic acid, respectively. Mean milk production for 116 cows that completed trial two were 28.2, 27.9, 28.8, and 28.4 kg/d, respectively.

In vitro analyses of the activities of enzyme solutions indicated that all major cellulose and hemicellulose degrading activities were present; however, the pH optima (approximately pH = 4 to 5) were more acidic, and the temperature optimum (approximately 50 degrees C) was greater than normal pH and temperature in the rumen.

b. Impact - If fibrolytic activity in the rumen is a major mechanism of action of supplemental fibrolytic enzymes, it appears that considerable activity of these preparations was lost due to conditions in the rumen. Feeding supplemental fibrolytic enzymes or malic acid with soluble sugars had no effect on milk production under the conditions used in these trials.

c. Source of Funding – State, Multi-State, Sale of Products Funds

d. Scope of Impact - AL, IA, IL, IN, MI, MN, NC, NE, OH, OK, TN

Molecular Mechanisms Regulating Skeletal Muscle Growth and Differentiation

a. Progress - Efforts have been initiated to investigate the events that occur in the developing animal, particularly at the cellular level, that control the number, development, and metabolism of muscle cells in the adult. We are investigating how various growth factors influence the development of muscle in livestock species. In addition to looking at genetic and cellular events, we also are obtaining carcass data from the animals at the end of standard production cycles to examine the effects of alteration in muscle growth patterns on carcass and meat quality.

We have observed that modifications in muscle growth rates can have effects on meat quality.

b. Impact - Development of methods to improve the rate and efficiency of muscle growth in livestock species will be essential to allow animal agriculture systems to meet projected increases in both population and demand, and to allow domestic production to remain globally competitive.

This research has shown that muscle growth can be enhanced and that specific genetic and cellular events are correlated with these changes in growth patterns. Meat from animals with enhanced muscle growth rates can vary in quality but that numerous

techniques can be employed that will allow the meat to be very acceptable to the consumer.

c. Source of Funding – State, Multi-State, Sale of Products Funds

d. Scope of Impact - AZ, CA-D, HI, IA, ID, IL, IN, KS, MI, MN, NC, NE, OH, OR, SD, UT, WA, WI

Economic Optimization of Wean-to-Finish Production and the Quality of Illinois Pork

a. Progress - This is an integrated research program that encompassed two main areas: 1) The economic optimization of wean-to-finish pork production systems; and 2) Integrated approaches to improving pork quality.

Twenty-seven experiments have been carried out to establish the effects of facility design and animal management strategies for wean-to-finish production units on pig performance criteria (e.g., average daily gain, feed intake, morbidity and mortality, and variation in performance) and meat quality (e.g., color, water holding capacity, eating quality). As proposed, the strategy for completing the project has involved both an on-farm research program and an economic analysis of the results using a computer simulation model. Semi-annual meetings of an industry advisory committee have been used to set priorities for the research program. This group has continued to function beyond this specific research project, focusing on facility design and management issues impacting the future competitiveness of Illinois swine production.

Studies have been completed on four commercial pig units involving more than 23,000 pigs. In addition, results have been reported to pig producers and industry consultants through a series of seminars and producer development meetings organized throughout the state. Reports also have been published in both the scientific literature and the popular press.

b. Impact - This research project involved a total of 27 experiments (with over 23,000 pigs) that were carried out on four different commercial Wean-to-Finish systems.

Important outcomes and impacts for the Illinois swine industry include:

1. Swine producers are applying these research findings to make critical management decisions regarding the management of Wean-to-Finish systems.

2. Specific areas impacted include the use of double-stocking buildings, housing pigs in large group sizes (i.e., 100 pigs/pen), optimizing floor-and feeder-space allowances, minimizing body weight variation, improving post-weaning performance through feeding and management and optimizing pig removal strategies at market.

3. The formation of a group of collaborators, including producers, associated industry personnel, and researchers, bringing together research expertise with the facilities and extensive experience and expertise of the commercial team.

4. This group has continued to function beyond this specific research project, focusing on facility design and management issues impacting the future competitiveness of Illinois swine production.

c. Source of Funding – Hatch, Industry, State, Sale of Products Funds

d. Scope of Impact – National

Key Theme – Aquaculture

Microbial Ecology of the Salmon Gastrointestinal Tract: A Molecular Approach

a. Progress - Characterization of the bacterial diversity and community structure of Atlantic salmon and rainbow trout gastrointestinal communities has previously relied on classical culture-based microbiology techniques. The use of molecular techniques to compare the bacterial diversity has several distinct advantages over culture-based approaches. Therefore, the bacterial community structures in the gastrointestinal tracts of these food fish were analyzed by denaturing gradient gel electrophoresis (DGGE) and compared with constructed 16s rDNA libraries. DGGE amplicon patterns were analyzed using Dice coefficient and relatedness trees were constructed using the unweighted pair group method with average linkages (UPGAMA) algorithm. The diversity of the Atlantic salmon and rainbow trout GI tract microbiota was characterized for fish fed a standard diet, Atlantic salmon fed a diet including one high in fat, one with an addition of the antibiotic,

tetracycline, and one with the addition of the nutritional supplement, taurine. In addition, the gastrointestinal tract bacterial microflora of Atlantic salmon raised in seawater was characterized and compared to fish reared in freshwater. Distinct relatedness tree clusters indicate that the bacterial community structure of the gastrointestinal tracts of independently reared rainbow trout and Atlantic salmon fed the same diets differ markedly. However, when raised together, Atlantic salmon have amplicon patterns similar to both Atlantic salmon and rainbow trout reared independently. Rainbow trout reared with Atlantic salmon took on a distinct gastrointestinal bacterial population that was different than both the rainbow trout and Atlantic salmon raised separately.

Analysis of unweighted trees suggested that there was no evidence of a shift in bacterial populations when salmon were fed Tetracycline and a limited shift in the bacterial microorganisms present in high fat fed salmon samples in comparison to control dieted samples. However, fish fed a 2.5% taurine diet resulted in less diverse bacterial populations and therefore, differed remarkably from the control and the 0.5% taurine-fed samples. Although there is an effect from feeding fish higher concentration levels of taurine, there is not much known about the mechanism that drives this process and should be followed up in future studies. Assay of the bacterial community structure of Atlantic salmon acclimated to seawater for one or seven days was compared to salmon reared in freshwater. Atlantic salmon reared in seawater samples exhibited a bacterial community structure more related to the freshwater samples than were expected. Yet, the last branching of the tree was predominantly seawater samples and so the similarities observed among these gastrointestinal tract bacterial microorganisms might be due to the short duration of seawater residency. Predominant microorganisms found in the gastrointestinal tracts of Atlantic salmon were *Shewanella putrefaciens* and *Carnobacterium*. The rainbow trout gastrointestinal bacterial populations included the genus *Clostridium*, *Comamonas*, *Bacillus*, *Staphylococcus*, *Streptococcus*, and *Enterococcus*.

b. Impact - Aquaculture is an emerging new economic endeavor, however, it is far from a pathogen-controlled environment, a situation which has created many opponents. Bacterial pathogens account for most of the economic loss of food fish worldwide. The high demand for seafood has caused an increase in the number of aquaculture centers around the world. Previous studies regarding fish

and the fish farming industry have been limited. Furthermore, many of these papers have been based on "classic" microbiology techniques, which have many limitations, i.e., cannot culture all microorganisms present in the population. Molecular techniques provide useful tools for determining normal microflora of fish gastrointestinal tracts that house multiple infectious and symbiotic bacterial populations.

Our studies confirmed previous findings and found a few novel bacteria that have not been reported in fish studies before. Food fish animals reside in aquatic environments. There is no separation between the water they live in or drink, the food they eat, and the feces/waste they swim in. Therefore, anything present in this aqueous environment passes through the fish system, potentially allowing unwanted species to colonize in areas such as the gastrointestinal tracts of these cold-blooded hosts. Thus, our determining and understanding the symbiotic and resident gastrointestinal microbiota present is the first step to understanding the concern of the health and well-being of the animals.

c. Source of Funding – NRI Competitive Grant, State Funds

d. Scope of Impact – National

Key Theme – Biofuels

Characterization of Clostridium BA101 Hyper-Butanol Producing Mutant

a. Progress - An integrated system for fermentation and recovery of butanol employing gas stripping has been successfully developed. This system is being used with substrates derived from corn processing in order to improve the economics of biologically-produced butanol production.

b. Impact - The development of an integrated system for butanol production and removal by gas stripping significantly improved the economic potential for biologically-produced butanol from agricultural-based substrates. Scale up testing is currently underway at a large Midwestern corn wet milling operation.

c. Source of Funding – NRI Competitive Grant Funds

d. Scope of Impact – National

Value-Added Processing of Corn for Ethanol and Other Uses

a. Progress - The purpose of this work is to develop new technologies for corn dry grind ethanol production that recover high valued coproducts and reduce the cost of ethanol production. Structurally, the corn kernel has four main components: germ, fiber, starch, and protein. Of these four components, only starch can be readily converted into ethanol.

Currently, in a dry grind ethanol process corn kernel is not separated into its individual components and is processed as a whole for ethanol production. The non-starch components (germ, fiber and protein) are carried through the process and are recovered together at the end of the process as a product called distiller dried grains with solubles (DDGS). DDGS is mainly sold as ruminant animal food stuff and is priced based on its protein content. We are developing an enzymatic dry grind process that uses novel separation techniques and use of enzymes to recover germ, pericarp fiber and endosperm fiber separately at the front end of the process. Recovery of non-starch components at the front end of the process could increase the capacity of the plant and improve the protein content of DDGS produced. Effect of enzymatic dry grind process was evaluated on ethanol yields and DDGS composition. A dent corn hybrid was processed using the laboratory enzymatic dry grind process and compared with the conventional dry grind process. The rate of fermentation, final ethanol yields and DDGS protein content were compared. For the enzymatic milling process, ethanol yield increased by 27% compared to the conventional process.

Analysis of protein content in DDGS showed that the protein content of DDGS from the enzymatic process was approximately 58% compared to 28% protein content for the DDGS produced from the conventional process.

b. Impact - Recovery of valuable coproducts, increased ethanol yield and improved protein content of DDGS will improve the overall economics of ethanol production for the dry grind ethanol industry. Enzymatic process will also improve the sustainability of the ethanol industry.

c. Source of Funding – USDA Hatch Funds

d. Scope of Impact – National

Evaluation of Biomass-Derived Alternative Fuels for Off-Road Vehicles

a. Progress - Research was focused on evaluating biofuels and their effect on NOx exhaust emissions, which are regulated by the EPA. Work also continued on the development and application of a detailed three-dimensional model for simulating combustion of fat and vegetable oil derived fuels in a diesel engine.

A 7.3 liter V-8 turbocharged diesel engine was set up in the laboratory with combustion pressure, crank angle, fuel injection and NOx emission sensors to be able to monitor the in-cylinder combustion processes. One hundred firing cycles were captured and averaged with a data acquisition system that was developed for the biofuel evaluation. In addition to regular diesel fuel, four fuels comprising 100% soybean oil-based biodiesel (B100), a blend of 2% biodiesel with regular diesel (B2), 10% ethanol plus 1% additive with regular diesel (E10), and 5% ethanol with biodiesel (BE5), were tested in the V-8 engine and the data were analyzed to determine what the key variables were that affected NOx emissions.

An expected increase in NOx emissions of 12% was measured with B100 compared to regular diesel. An increase of 2.3% for B2 was much greater than expected from the small proportion of biodiesel. The E10 blend decreased NOx emissions by 2.7%, which was attributed to the higher latent heat of vaporization of ethanol thus lowering the localized temperatures in the combustion chamber at the time of injection and suppressing the production of NOx. The addition of 5% ethanol to biodiesel resulted in the same effect and yielded only a 2.6% increase in NOx emissions. Such a result warrants further investigation of ethanol-biodiesel blends. The study also indicated that the point of start of combustion in the crank rotation had the strongest correlation with NOx emissions, with an earlier start of combustion causing increased emissions. It was concluded that the use of a fuel composition sensor would permit the injection timing to be adjusted so as to reduce the NOx emissions to at least the levels obtained with regular diesel, while still achieving a substantial reduction in particulate emissions.

For the combustion modeling work, a special effort was made to define and be able to predict the chemical and physical properties of biodiesel fuel, taking into account the fatty acid composition of the source material for the fuel. Different sub-models were either modified or added to improve the accuracy of the overall model.

These sub-models simulated the fuel spray and break up, the ignition and subsequent combustion of the fuel and also the generation of NOx. Data provided by Iowa State University were used to calibrate and validate the model.

A preliminary analysis suggests that the fatty acid composition of the fuel has a substantial effect on NOx emissions. The value of using this model is that it will be possible to optimize the fatty acid composition of the biodiesel within genetic constraints so as to minimize engine exhaust emissions. Further refinement and verification of the model is required to achieve acceptable accuracies.

b. Impact - Engine test results suggest that adding 2% biodiesel to regular diesel could cause higher levels of NOx emissions than expected from the relatively small proportion of biodiesel, the impact of which could be significant because of the large proportion of biodiesel fuel being commercially marketed in the U.S. as a 2% blend.

Injection timing in a turbocharged diesel engine plays a major role in NOx production with a retarded timing reducing emissions, indicating that fuel composition sensing and electronic fuel injection control can be used effectively in reducing NOx emissions from biodiesel.

The addition of ethanol to either regular diesel or biodiesel causes a significant reduction in NOx emissions and in the latter case helps to offset the expected increase.

A preliminary investigation shows that small changes to the fatty acid composition of biodiesel can have a large effect on NOx emissions.

c. Source of Funding – Hatch, State Funds

d. Scope of Impact – National

Key Theme – Biotechnology

Soybean Gene Expression and Regulation

a. Progress - The objectives of this research are to understand the regulation of gene expression in soybean as revealed by examination

of unusual mutations in genes that affect pigmentation of the seed coat. One of these genes shows a form of gene silencing, another affects both pigmentation and cell wall structure, and others contain mutable alleles that may be due to transposable elements.

Progress includes isolation of a flavonoid 3' hydroxylase gene in soybeans and proof that it is encoded by the T locus that specifies trichome coloration in soybeans and also influences seed pigmentaion. We have also developed quantitative RT-PCR for the CHS gene family in soybeans and used it to determine the differential expression of the CHS genes in mutations of the I locus.

b. Impact - This research will benefit the biotechnology industry and soybean producers and consumers by providing basic information on gene regulation in soybeans, specifically of the flavonoid pathway and gene silencing. This information will be applicable to designing better vectors for genetic transformation that will overcome the problem of gene silencing in transgenic plants. A better understanding of molecular genetics of the flavonoid pathway may enhance our understanding of plant disease resistance or the modification of flavonoid products in the seed for improved nutritional and health value.

c. Source of Funding – Hatch, State, National Science Foundation Funds

d. Scope of Impact - National

Soybean Research Illinois – Soybean Disease Biotechnology Center

a. Progress - Microarray has been employed to examine the genetic response of soybean plants to specific pathogens. We are currently analyzing soybean response to virus-transmitting aphids by comparing resistant to susceptible plants. RNAs from the infected plant material have been collected and hybridized to the arrays.

The SCN resistance-breaking research resulted in the initial development of a rapid DNA-based marker system for tracking SCN populations virulent on PI437654. The Wide Hybridization research to cross soybean with perennial ancestors (*G. tomentella* and *G. argyrea*) that are resistant to soybean rust, bean pod mottle virus, and SCN has resulted in production of in vitro plantlets. Over 100 different perennial *Glycine* accessions have been planted for

additional resistance screening. Copies of virus genomes that will be used to produce virus-based vectors for soybean transformation have been synthesized, and a cloned copy of one of the virus genomes has been modified to allow it to accept foreign gene sequences.

We also have shown that at least one of the viruses under investigation infects germline cells, which adds support to the concept of using modified seed-borne viruses as gene-delivery systems. Expansion of utility patents has offered the potential for increases in marketability and profitability of agricultural research. If the risk of research and development is reduced and if returns are increased by diversification of research projects, then diversification may drive the research approach in agriculture if inventions are not subject to obsolescence. Technologies embedded in seed and plant varieties are more susceptible to obsolescence than other technologies, and returns for technologies are highly correlated with their economic life in the market. Patented inventions appear to have an ability to counteract obsolescence in the market, thus, promotion of the utility patent and improvements in prosecution for utility patents tend to help appropriate true values of seed and plant utility patents.

The NSRL uses the Internet (www.vipsoybeans.org; www.stratsoy.uiuc.edu; www.nsrl.uiuc.edu) to effectively and rapidly disseminate research findings to the soybean industry, especially soybean growers. The VIPS and StratSoy sites are comprehensive tools including information spanning the soybean market channel, and the NSRL site includes presentations, publications, and news about research generated by the Center and other research programs.

b. Impact - Microarray technology will enable the development of new defense-related markers to rapidly identify soybean varieties with resistance to specific pathogens. The development of a rapid, reliable test to assess the virulence profile of an SCN population would allow rotation of resistant soybeans in such a way that virulent SCN populations would not accumulate, and valuable SCN resistant soybean germplasm would be preserved.

Using wide hybridization technology, the influx of *G. argyrea* genes into U.S. soybeans will significantly expand the range of genetic diversity available to soybean breeders including superior resistance alleles for SCN, rust and BPMV.

The gene therapy system has the potential to streamline introduction of genes into soybean lines without the constraints of currently employed transformation procedures.

Studies on intellectual property protection suggest that policy makers must invest more time and effort to improving the system granting and implementing intellectual property protection for soybean-related inventions in the market. Further, these results encourage seed companies to reassess their contractual schemes so that terms and conditions in their contract would induce their contracted farmers to voluntarily deter from saving seed. Lastly, it is expected that we might see more efforts by seed companies to improve the efficiency of patent enforcement mechanisms in the United States. Research presentations, program overviews, and news events that emphasize the Centers advancements are available online for rapid dissemination.

c. Source of Funding – USDA Special Grant Funds

d. Scope of Impact - State

The Illinois-Missouri Biotechnology Alliance

a. Progress - IMBA researchers are making significant advances towards creating corn varieties with improved tolerance to important environmental factors such as drought. This research has just been published in the journal *Plant Cell*. Other IMBA research has determined that corn fiber can be fermented into butanol, a valuable chemical stock. The reaction conditions for this process have been defined, and a patent application is being prepared.

A new IMBA study assessed the incentive structures needed to create efficient contracts for farmers who produce genetically enhanced seed for commercial seed companies. IMBA also supports work on understanding and communicating the benefits of bioengineered foods. A calculator that allows consumers to select soy foods with optimum levels of functional ingredients has been created (www.nat.uiuc.edu/soy).

IMBA researchers identified peptides that bind to infective structures of the fungus, *Phytophthora sojae*, which causes a destructive disease of soybean. These peptides impair growth and function of the infective structures, thereby protecting plants from

disease. The researchers are submitting a patent application to protect the intellectual property associated with the peptides.

IMBA assisted scientists to improve methods to use a bacterium to transfer DNA into cultured corn tissues. This is an essential step in gene transfer and is difficult with plants such as corn. Initial experiments are underway to transfer genes, not to cultured corn tissue, but to intact plants. If successful, this would be a quantum leap in the technology to improve corn via biotechnology.

IMBA has allowed a scientist to produce soybean lines that express an antigenic protein that could be used to develop a vaccine against porcine reproductive and respiratory syndrome. This is an economically important disease that attacks an estimated 60-70% of the pigs in the U.S. The vaccine has the potential to control this devastating disease.

With support from IMBA, investigators are developing methods to understand how consumer responses to biotechnology are shaped in this country and to create effective communication strategies to inform consumers. Work was undertaken to better understand consumer reactions in key European countries that import corn and soybean from the United States.

IMBA has underwritten the most comprehensive analysis ever done on intellectual property protection as it relates to crop varieties. This includes an in-depth study of a Supreme Court decision on utility patents, and a thorough study of all U.S. plant variety protection certificates and their impacts on innovation and investments in plant improvement. The most important conclusion from these studies is that utility patents, and not certificates of plant variety protection, are likely to be most significant for future innovation in agricultural biotechnology.

IMBA also began funding investigations focused on the ethical concerns about the application of biotechnology to agriculture. These studies seek to understand the ethical, aesthetic, and cultural values that inform debates about agricultural biotechnology. Four major papers have been published, and the investigator has been involved in eight recent symposia and seminars.

IMBA helped establish and continues to support *AgBioForum*, a unique, web-based, peer-reviewed journal that educates a broad audience on issues of central importance. *AgBioForum* articles are

widely reproduced in the classroom, by the media, and as references in academic journals. Total readership has surpassed 175,000. In 2003, *AgBioForum* articles concentrated on several issues related to soybean biotechnology, and other articles ranged from labeling issues to marketing strategies to agronomic sustainability of biotechnology crops. For additional information on the Illinois-Missouri Biotechnology Alliance please consult our website at www.imba.missouri.edu.

b. Impact - The Illinois-Missouri Biotechnology Alliance (IMBA) is a joint program of the University of Illinois and the University of Missouri and is funded by a Congressional Special Grant administered by the United States Department of Agriculture (USDA). The purpose of IMBA is to fund biotechnology research that is an integral part of a Research and Development (R&D) program directed at expanding the volume of profitable businesses in the United States (U.S.) food and agricultural sector. Initially, the IMBA program was limited in scope to corn and soybeans. However, the scope of IMBA interest now encompasses all concepts of these industries including production, processing, marketing, utilization, inputs and support services, as well as economic, social, environmental, and natural resource concerns. The geographical focus of IMBA is Illinois and Missouri along with other Midwestern states having similar crops, soils, climate, and socio-economic conditions.

c. Source of Funding – CSREES Special Grant Funds

d. Scope of Impact – IL, MO

Key Theme – Emerging Infectious Diseases

West Nile Virus in Illinois

a. Progress - We are: 1) working with mosquito abatement districts, forest preserves, local public health departments, and the Illinois Department of Public Health to identify key vector mosquitoes of West Nile Virus (WNV) and determine their infection rates, 2) tracking bird exposure to WNV to determine how the virus spreads and the key host species, 3) looking at mammals and other animals to determine additional hosts and the ecological effects of the disease, and 4) determining the critical environmental and ecological factors that govern transmission of arboviruses, in order to predict risk to key animal groups.

We assayed over 9,500 samples in 2003 using reverse-transcriptase PCR to give accurate results of samples. The years 2002 and 2003 yielded very different results. In 2002, in Illinois there were 884 human cases and 66 human deaths from WNV; in 2003, there were 50 human cases and one human death from WNV. There were 1,147 cases of WNV in horses in 2002, versus 66 horses in 2003. WNV was found in 528 mosquito samples and 513 dead birds in 100 counties in 2002, versus 388 mosquito samples and 222 dead birds in 76 counties in 2003. Seropositive results in birds significantly increased, from an average of 5.4% positive bird blood samples in 2002 to 11.7% positive in 2003. Remaining work will assess roles of migratory birds and duration of resistance to WNV, as well as its long-term impact on populations of different bird species.

b. Impact - This project is providing the necessary foundation for better management of West Nile Virus in Illinois. We compared seasonal population dynamics of key mosquito species (*Cx. pipiens*, *Cx. restuans*, *Cx. salinarius*, *Culex quinquefasiciatus*, and *Aedes albopictus*) by collecting adult mosquitoes at selected sites within the state. At those sites, we also collected blood samples from various bird species in the same general area.

The results of this proposal will enhance the understanding of the expanding distribution of WNV in Illinois, as well as provide an ecological focus for vector abatement and risk assessment.

c. Source of Funding – CSREES Special Grant Funds

d. Scope of Impact - State

Key Theme – Home Lawn and Gardening

4-Seasons Teleconference Series

a. Homeowners garden for several reasons, including enhanced beauty of property, food production, therapeutic effect, recreation, enhanced value of property, controlling chemical use in their own personal environment, exercise, saving money, and energy conservation.

Gardening is the number one hobby in the United States and a major source of exercise for many Illinois residents.

To help meet the needs of gardeners, U of I Extension has offered a total of 12 different sessions by distance education each year for the

past two years. The total attendance for all 24 sessions combined was 7,113. A follow-up mail survey was conducted with 231 folks who registered for one or more of the sessions offered.

b. Impact – Depending on the topic, between one in five to two out of every three will have followed up on a recommended practice. This means at least 1,422 and more likely more than 4,700 have adopted at least one recommended practice.

More than 96 percent would recommend the sessions to others.

More than 80 percent would share the information learned with others and on average would share the information learned with at least five people. Applying this to the attendance of 7,100, information from the sessions will have been shared with up to 28,400 non-participants.

Almost 90 percent or more than 6,200 would be more satisfied with their gardening efforts

Two-thirds (more than 4,700) credit the sessions with gardening to having a higher level of physical activity (exercise).

c. Source of Funds – Federal, State, Local

d. Scope of Impact - Illinois

Key Theme – GIS/GPS

Fuzzy Controls for Mechatronized Off-Road Equipment

a. Progress - This research has addressed several basic issues in agricultural equipment automation, especially the study of in-field sensing and control technologies for agricultural equipment. Efforts have focused on developing a mobile "on-machinery" agricultural operation automation information management research platform and "on-line" equipment health monitoring and fault diagnosis technologies. A low-cost navigation system based on an integrated low-cost GPS and low-cost motion sensors has been successfully developed. Field test results validated that this low-cost system (less than $600 of off-shelf components) could achieve a dynamic navigation accuracy of less than 0.4 meters, the same accuracy range as on-market products of $3,000 - $5,000.

Another major accomplishment was the development of a hydraulic pump fault diagnosis system, which can provide sensitive and robust fault diagnosis based on either the outlet pressure or the vibration signals of the pump.

The impact of this research is very significant because it will furnish agricultural producers advanced technologies needed for practicing precision farming using low-cost equipment, and also allow them to monitor their equipment health condition and schedule services to remove the faults before they can affect operation.

b. Impact - This research intends to develop automation technology for agricultural equipment. Agricultural equipment automation technology becomes more and more important for supporting the rapid development in agricultural machinery and precision agriculture technology and providing technical solutions for solving the aging and/or inexperienced machinery operator problems in the agricultural work force. Therefore, this research has both technical significance and societal importance.

c. Source of Funding – Hatch, State, Industry Funds

d. Scope of Impact – National

Key Theme – Organic Agriculture

Cropping Intensity and Organic Amendments in Transitional Farming Systems: Effects on Soil Fertility, Weeds, Diseases, and Insects

a. Progress - This multi-disciplinary research and outreach effort involves participants from the Illinois Natural History Survey, University of Illinois, and University of Wisconsin. Over six acres on the University of Illinois Cruse Farm (Champaign) have been set aside for this multi-year project. The organic transitions project is designed to 1) compare influence of transition schemes that differ in management intensity and organic amendments on weeds, soil fertility, soil invertebrates, and the relationship between fertility, plant health and insect/disease pressure, and 2) to develop relevant, accessible outreach and educational products for organic producers.

Management intensity treatments include 1) intensive vegetable production with frequent tillage, 2) less intensive cash grain production, and 3) unharvested grass-legume sod. Soil-building

amendments will be cover crops or sod alone, added manure, or added compost. An advisory board of organic producers has been established to refine objectives, lend expertise in farming systems management, provide input on the relevance of experimental approaches and treatments, and evaluate the results of experiments. The project's goal is to establish an organic systems program--a partnership of organic producers, researchers, and Extension Educators--that improves performance of organic systems and enhances the ability of farmers to meet the growing demand for organic products.

Prior to the official start of the grant, funds from ILLU-875-342 and other sources were used to establish cover crops at the research site (fall 2002), initiate crop rotations (May 2003), and collect baseline field data to increase the start-up value of the project. First-season field data included initial soil fertility parameters, weed seed bank, productivity of summer crops (tomatoes, soybeans), insect pests, soil pathogens, and insect predator (carabid beetle) incidence and activity.

b. Impact - This multi-disciplinary research and outreach team is already serving as an active resource for improving the two-way flow of information between Illinois organic growers and agricultural scientists.

It is also a focal point for involving other scientists and other disciplines in organic systems research.

c. Source of Funding – CSREES Grant Funds

d. Scope of Impact – IL, WI

Sustainability of Organic Systems in Illinois

a. Progress - The sustainability of organic agricultural systems needs to be understood and promoted by the University research programs. Over the past year we have been associated with the Windsor Organic Research Trial (WORT), designed to explore impacts of several strategies for converting from conventional to organic systems.

Several rotational intensities of cropping systems have been installed to track changes in soil properties and pest conditions during this transition. We have also been involved with the Sustainable

Agriculture Research and Education Program, particularly in helping get research and management information into the hands of practitioners. Web sites have also been used to transfer this information. An Organic Agriculture Task Force has been organized and is developing further research activities that are appropriate for this project.

b. Impact - As economic and environmental pressures mount on the current row crop system that dominates much of the upper Midwest, alternatives for the productive, sustainable use of this land are needed. Current examples of successful farmers (including organic operators), detailed analysis of their operations, along with on-farm research, provide means for defining a diverse and robust Illinois landscape of the future.

c. Source of Funding – Hatch, State Funds

d. Scope of Impact - State

Key Theme – Ornamental/Green Agriculture

20 Minutes in the Life and Death of a Tree

a. Conventional wisdom would suggest that when a tree is transplanted, the tree should be planted at the same depth as it was originally. That is that the top of the root ball should be reasonably level with the surrounding soil. Such "conventional wisdom" can easily result in storm or wind damage decades later.

"Twenty Minutes in the Life And Death of a Tree" is an all-day workshop intended to teach homeowners, professional arborists, municipal foresters, landscapers, and nursery owners the proper method for planting a tree.

This workshop includes an overview on how the root system of a tree grows and responds to planting. Planting methods for both balled and burlapped and containerized trees are demonstrated, showing how to plant the tree at the correct depth. The root systems of older trees are examined to show how improper planting can lead to severe root problems, such as girdling roots.

b. Impact – A mail survey was sent to 74 people who had attended one of the workshops a year after their attendance. There was a 58 percent response rate.

100 percent responded "Strongly Agree" or "Agree" to:

The workshop:
- Exceeded my expections
- Provided useful information
- Provided useful demonstrations
- Increased my knowledge of proper planting techniques

93 percent (39) indicated they had a chance to use the information provided in the workshop. Of these:
- 95 percent used information from the workshop to advise others in proper planting techniques.
- 95 percent had used the information themselves in tree planting

Highlights of written comments:

The workshop showed numerous examples of resulting root structure from improperly planted trees. We learned how to properly prepare the planting site and the importance of not planting too deep.

Probably the best workshop I've ever attended. Very informative and presented in an easily understood format.

Improper planting is epidemic. Repeat this workshop in as many places as possible to put an end to improper planting.

Very entertaining, fun, visual, and resourceful. I think anyone who owns a shovel should be required to attend.

Horticulture Crop Water Requirement

a. Progress - An improved, simple linear model to predict water retention and aeration has been developed for bidisperse container and other shallow-drained soils for use in greenhouses, nurseries, roof top gardens, football or other athletic fields, and golf greens and tees. It applies to bidisperse soil mixtures where one component particle size is several magnitudes smaller than the other and thereby fits between the pore spaces of the larger particle (for example, silty clay loam (small) and very coarse-textured sand (large)). Inputs are bulk porosity and bulk proportions of both fractions and output is total, water retention, and aeration porosity of the mixture.

b. Impact - A previous soil physical amendment model by the Investigator formed the basis for the development of the soil mixtures recommended for worldwide use in U.S. Golf Association Greens Section Greens. It is expected that this model will improve the reliability of blending and testing soils for golf greens and other shallow-drained soils. Billions of container-grown plants are grown annually in the U.S. alone. Soils in these shallow-drained soils tend to be poorly aerated due to excess water retention. This model will improve the blending and testing of soils for containers, thereby potentially reducing crop loss due to the effects of poor soil aeration.

c. Source of Funding – Hatch, State Funds

d. Scope of Impact - National

Sudden Oak Death – Preventing a Regional Problem from Becoming a National Problem

a. In spring 2004, potentially infected ornamental plants were shipped throughout much of the United States The plants came from a few nurseries that inadvertently shipped containerized rhododendron, camellia and other plants that may be infected with *Phytophthora ramorum*, cause of Sudden Oak Death and other diseases. Since *P. ramorum* is a quarantine pathogen, inspections were conducted and infected plants recovered and destroyed at over 160 sites in 21 states. However, because many plants were sold prior to inspections, this project aims to reach out to homeowners so that they will report suspicious plants in their home landscapes.

A training teleconference to educate first responders to the potential threat of *Phytophthora ramorum* (a.k.a. Sudden Oak Death) was conducted on October 26th. The training involved 115 sites from 40 states with a total of 731 participants. The program was funded by the U.S. Forest Service and involved the collaboration of USDA-CSREES IPM Centers and the National Plant Diagnostic Network, the Animal and Plant Health Inspection Service (APHIS), and the National Plant Health Board.

b. Impact – Illinois developed the evaluation and collected the data through a web interface:
https://webs.aces.uiuc.edu/athome/suddenoakdeath/overallResults.asp

45% (406) of the participants completed evaluations

57% reported working for a governmental agency or organization and 34 percent reported being Master Gardeners.

99% of those responding felt the teleconference increased their knowledge of Sudden Oak Death

Almost 97% felt the teleconference helped increase their ability to identify Sudden Oak Death

More than 62% felt they had a better understanding of IPM strategies and options to control Sudden Oak Death.

c. Source of Funding – Federal, State, Local

d. Scope of Impact - National

Surveying the Illinois Green Industry to Assess its Value, Attributes and Needs

a. Progress - The identification of critical problems and constraints to business success and market expansion was an important and articulated goal of the green industry survey. The green industry survey conducted earlier in the project identified both the rapidly changing business environment facing green industry businesses and a need for current information on the changing business environment as critical problems to business success. This problem was addressed in several ways. First, project staff created several different models for future statewide surveys that build on the completed survey. Second, project staff met with green industry leaders throughout the state to discuss needs for future surveys. Third, survey proposals were designed. In addition, the distribution of the survey results throughout Illinois and to other interested parties continued.

b. Impact - Impacts include assisting with the development of a statewide green industry coalition and publicizing the role of the green industry in the Illinois economy.

c. Source of Funding – Hatch, State Funds

d. Scope of Impact – State

Key Theme – Plant Genomics

Comprehensive Resources and Datasets for Mapping Genes Controlling Maize

a. Progress - Increasing the value of corn grain by modifying composition is a long-term objective of corn breeders. However, there is often an associated reduction in grain yield when kernel composition is modified, which negatively impacts the economics of the value-added concept.

Molecular marker assisted selection of small chromosomal segments or specific alleles of candidate genes for kernel composition and grain yield has been proposed to address this problem. However, much of the research on kernel composition and grain yield was performed at different times and in different locations. The Research is utilizing several fully developed molecular marker mapping populations for which molecular markers were genotyped, phenotypic data were collected for certain traits, and marker-trait associations were determined or are under analysis. We continue to move molecular marker trait data sets on several per se and testcross populations for kernel composition traits, plant morphology traits, and disease resistance traits into specific Excel spreadsheets. We continue to develop an Access database with the Excel spreadsheets, so that the data can be easily put into the Access database, and also extracted for additional statistical analysis with statistical programs such as SAS or PLABQTL.

We grew more populations this year in the field and collected phenotypic data to more precisely define associations, enable specific comparisons across populations, and assess candidate gene ESTs for association with QTL. We grew for a second year the full Mo17xB73 IBM resource population that is part of the NSF Plant Genome funded Missouri Maize Project. This population, designed specifically to serve as the common resource population for integrating corn genetic, QTL, and microarray data for the corn genetics and breeding community, is serving as a core population within our database. We accessed the molecular marker mapping genotypic information for this population and were able to perform QTL analyses for tassel architecture and kernel composition traits with this population. We routinely use a new computer server as a central resource for consolidation and summarization of our data.

b. Impact - Our purpose is to increase the value of corn grain through genetic means. Our approach is to integrate, summarize, and make available information collected on chromosomal regions and candidate genes controlling kernel composition, disease resistance, plant morphology, tassel architecture, and grain yield. Use of molecular marker assisted selection should hasten the development of value added traits in corn grain while maintaining acceptable yield levels.

c. Source of Funding – Hatch, State, National Science Foundation Funds

d. Scope of Impact - National

Genetic Mapping and Introgression of Yield Genes into Soybean from Glycine Soja

a. Progress - The goals of this research are to improve soybean yield and to widen its genetic variability. These goals were accomplished by mapping genes from *Glycine soja* that control yield and agronomic traits and by testing the effectiveness of a novel population structure for mapping genes from a wild species.

This mapping was done in five backcross populations that were developed using a U.S. variety as a recurrent parent and a *G. soja* line as a donor parent. Experimental lines in the populations were evaluated with genetic markers and for yield and other agronomic traits in four field environments. Using a high stringency for accepting significance, we identified four genetic regions containing genes that putatively control yield. All four of these regions were also associated with plant height and two were associated with maturity. The allele for greater yield originated from the soybean parent for all four of the mapped yield genes. When the significance threshold was relaxed, four putative yield genes were identified with the *G. soja* alleles associated with increased yield.

Three of these regions were tested in confirmation populations during the summer of 2001. The confirmation populations were developed by crossing plants from the original backcross populations with another U.S. variety. During field tests in Chile during the winter of 2000-2001 and in Illinois and Nebraska during 2001, one of the three putative yield alleles from *G. soja* was significantly associated with an increase in yield and was not associated with other agronomic traits. The population segregating

for alleles of this significant gene was retested in 2002 and this region was again associated with a significant increase in yield. However, two populations of near isogenic lines that were segregating for alleles of this significant gene were tested during the summer of 2003, and the *G. soja* allele was not associated with greater yield. The fourth *G. soja* gene associated with increased yield was backcrossed into another U.S. experimental line and a backcross population was developed. The *G. soja* allele from this fourth region was associated with a significant increase in yield across three Illinois environments during the summer of 2003. The region where this *G. soja* allele maps, however, is also associated with resistance to soybean cyst nematode. Further work is needed to determine whether this yield increase is due to a direct effect from this gene or the result of SCN resistance.

b. Impact - The goal of this research is to improve soybean by identifying useful genes from *Glycine soja*, the wild ancestor of soybean. Soybean populations were developed that have genes from *G. soja* incorporated into them. These populations were evaluated with DNA markers and in field tests for seed yield and other agronomic traits. Many of the lines in the field tests yielded well and have good agronomic appearance. Four genes from *G. soja* were initially mapped that were associated with significantly greater yield. One of these genes was significantly associated with greater yield in a second confirmation population, but was later found not to be significant in a third population.

   Further work is needed to determine the true effect of this gene. The fourth gene was retested in a backcross population and found to increase yield. The region where this gene maps contains a gene that increases resistance to soybean cyst nematode (SCN). Further work is needed to determine if the yield increase is the result of resistance to this disease, or because of a direct effect on yield. The finding of new, yield improving genes from *G. soja* may help pave the way to improving the productivity of the soybean crop, thus increasing the efficiency of soybean production.

c. Source of Funding – State, Industry, NRI Competitive Grant Funding

d. Scope of Impact - National

Plant Cell Cultures as Biochemical and Genetic Tools

a. Progress - The mechanism of resistance to the herbicide, glyphosate, is poorly understood. We are using tissue culture as a tool to investigate development of glyphosate resistance. We previously selected glyphosate resistant suspension cultures of several plant species that became resistant due to amplification of the glyphosate target enzyme, 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS). Amplification of the EPSPS gene results in increased EPSPS mRNA and in turn enzyme activity which causes the resistance.

Recently we carried out selection with newly initiated cultures of carrot and *Datura innoxia* and found that the resistance was not due to gene amplification. In some cases the EPSPS enzyme activity was increased and in some cases not, but glyphosate resistant EPSPS activity was not found. When selection was carried out with older cultures of the same species, gene amplification again became the mechanism causing resistance in most cases. These results show that plant cell cultures can change over time to become gene amplification permissive. The differences seen between young and older cultures are similar to those found between mammalian normal and cancer cells where normal cells have mechanisms that prevent gene amplification while cancer cells have lost these controls.

b. Impact - Tissue cultured plant cells undergo changes during time in culture that leads to mutations (somaclonal variation) seen in plants regenerated from the cultures. Our findings indicate that changes in certain critical controls over the ability to withstand the DNA breakage needed for gene amplification can also occur. These results are important to understanding the development of resistance to the herbicide, glyphosate, in plants.

c. Source of Funding – Hatch, State, Other Non-Federal Funds

d. Scope of Impact - National

Key Theme – Plant Health

Preparing for Soybean Rust

a. Soybean rust is a potentially devastating disease that could drastically reduce soybean yields and increase production costs in the continental United States. Since its arrival in South America

nearly three years ago, agronomists have watched the disease steadily creep northward.

The University of Illinois Extension IPM Team has worked with government and industry for the past year and a half to develop a state plan to monitor fields for, verify the presence of and educate clientele on this foliar disease of soybean:

1. Extension personal in all Units in the state have been trained to process soybean rust samples through our Distance Digital Diagnostic (DDD) system. Additionally, training materials were posted to the site and specific protocols were developed and posted by June 2004. Additional training materials have been distributed statewide for Extension and industry personnel.

2. A soybean rust videoconference was held in 11 of 12 North-central states with 533 attending. The largest number of participants were agribusiness and crop consultants (more than 50 percent) followed by public servants and producers.

b. Impact – Illinois provided leadership for the evaluation of the conference. Seventy-seven percent of the participants (421) completed evaluations of the conference.
For complete results see:
http://web.aces.uiuc.edu/athome/soybeanrust/overallResults.asp

More than 99 percent of the participants reported increased knowledge of soybean rust

96 percent reported increased ability to identify soybean rust and increased understanding of IPM strategies and options in controlling soybean rust.

c. Source of Funding – Federal, State, Local

d. Scope of Impact – North Central States

Soybean Breeding and Genetics

a. Progress - The objective of the project is to improve soybean through plant breeding and genetics research. This work is being done because soybean farmers need improved varieties with greater disease resistance and improved yield.

A new germplasm line, LN97-15076, was released from the program during 2003. This is a high yielding, maturity group IV line. For genetics research, the program completed a study of methods used to obtain a high level of sudden death syndrome (SDS) foliar symptoms in the field on a consistent basis. In a large, multi-year study, we identified two inoculation methods that increased the level of SDS symptoms in field tests. These methods include planting the soybean seed with sorghum or popcorn seed that is infected with the fungus that causes SDS, or placing the infected seed directly below the soybean seed. We also found that the more irrigation treatments that we apply to the field, the more SDS symptoms we will observe. Overall, we found that by using our best inoculation methods together with irrigating the field, we can consistently obtain SDS symptoms in the field.

We made progress in increasing our understanding of the effect of two soybean cyst nematode (SCN) resistance genes from PI 88788. These genes are rhg1 and a second gene on linkage group (LG) J. Using populations of near isogenic lines, which segregate for only a small portion of the genome, we found that lines homozygous for the resistance allele at rhg1 had a female index that was 123 less than lines homozygous for the susceptibility allele. The difference between these homozygous groups was 13 for the LG J gene. In some environments with a high SCN pressure, the rhg1 resistance allele was associated with greater yield and a reduction in SCN reproduction.

b. Impact - The goal of this research is to improve soybean through breeding and genetics. During the past year, progress was made in a number of areas:

A new maturity group IV germplasm line was released from the program that has high yield. This line was released to private and public soybean breeders for use as a parent in their programs.

We identified methods that show promise as a way to increase the level of sudden death syndrome (SDS) disease in the field. This could greatly help soybean researchers increase their efficiency in screening for SDS resistance because in most SDS trials, little disease is observed and ratings cannot be taken from plants.

We obtained better information on the effect of two soybean cyst nematode (SCN) resistance genes mapped from PI 88788, the most commonly used source of SCN resistance. One gene was found to

have a very large effect on SCN reproduction in the greenhouse, whereas the second was found to have a minor effect. The gene with the large effect on greenhouse SCN reproduction was found to be associated with a significant yield increase and a reduction in SCN reproduction in field sites with a high SCN pressure. This information will help breeders better understand the effects of these genes and improve their methods of breeding for SCN resistance.

c. Source of Funding – Hatch, State, Industry Funds

d. Scope of Impact – National

Biotic Interchange of Habitat Utilization by Insects in Agricultural and Surrounding Landscapes

a. Progress - During this project, the results of several projects in two major areas were highlighted: The movement and dispersal of vectors (aphids, leafhoppers, whiteflies, thrips, and chrysomelid beetles) of plant viruses and the bioecology of a poorly understood group of flies, stiletto flies (Diptera: Therevidae). The movement studies of virus vectors took place in Costa Rica and Israel, the former concentrating on biotic interchange between forested (natural) and pasture (managed) habitats.

Using directional flight intercept (Malaise) traps, the biodiversity of chrysomelids was generally greater in the forested habitat, but far fewer specimens of were captured from either family of Cicadellidae (leafhoppers) or Chrysomelidae in the forest than in the pasture. The pasture habitat was richer in leafhoppers than the forest. The second major virus vector study took place in the semiarid Arava Valley of Israel and reported on the effects of natural water catchments on the populations and dispersal dynamics of leafhoppers, aphids, whiteflies, and thrips. The study sites were within close proximity of high input agriculture, but each had different water capture potentials, which influenced the presence and abundance of flora (grasses, annual flowers, and Acacia trees).

Potential vectors did not behave uniformly: Aphids and whiteflies were more abundant at sites with less water, while leafhoppers and thrips were more abundant at sites with more water, with differences among sites most pronounced following abundant winter rains. Most flight activity was recorded in the spring (March-May) each year, with aphids and thrips peaking slightly earlier than leafhoppers and whiteflies. Two trapping methods were employed in this study,

yellow pan traps (attractive) and Malaise traps (passive flight intercept). Yellow pans were more effective for thrips than Malaise traps, less effective for leafhoppers and whiteflies, and equally effective for aphids.

The capstone of our research, which also incorporated information from the studies of other workers on movement and dispersal of aphids was captured in a book chapter which is expected to be published in 2004. The second group of organisms studied was the stiletto fly family, Therevidae. These flies are often found in arid to semiarid habitats, and immatures (larvae) are predaceous natural enemies of soil dwelling arthropods in loose, often sandy soils. The larvae can be sifted from the soil substrate and the greatest proportion of those in a study from the Guadalupe-Nipomo Dunes area of southern California were found under vegetation in sand with minimal exposure to sunlight and wind. The distributional patterns of three species collected as larvae revealed differences in habitat utilization. The larger habitat occupied by *Acrosathe pacifica* (Cole) encompassed that of *Thereva hirticeps* (Loew), but neither species completely overlapped the habitat of *Thereva bakeri* (Cole). All three species were associated only with certain habitats and appeared to occur in predictable patterns.

b. Impact - The behavior of potential vectors of plant diseases is an important factor contributing to the epidemiology or spread of insect-borne plant diseases. Knowledge of the abundance and flight timing of potential vectors of plant diseases can influence planting date, crops and crop cultivars planted, and other measures that may be able to slow or avoid plant virus epidemics. Key also to determining the movement of biota is a knowledge of the taxonomy, phenology, larval and adult habitat, and distribution, i.e., what species are being caught, when are they caught, and where they are found. These data are beginning to be accumulated for the fly family Therevidae, whose larvae are voracious predators in loose, friable soils. Their presence is thought to be an indicator of ecosystem health in often fragile arid or semiarid environments. Studies of the larval ecology of these flies, which have been recorded in habitats ranging from coastal strand to stabilized backdune areas to sandy agricultural fields, are helping to establish associations of therevid species with specific habitats.

c. Source of Funding – Hatch, State, National Science Foundation, Industry Funds

d. Scope of Impact - National

To Develop and Implement Effective Tactics for Management of Phytophthora Blight of Vegetables

a. Progress - The research on management of Phytophthora blight (*Phytophthora capsici*) of vegetables emphasized integrated approaches of combining seed treatment, fungicide spray, plant resistance, and calcium application. Seed treatment with mefenoxam (Apron XL) reduced pre-and post-emergence damping-off of seedlings significantly in pumpkin and watermelon. Also, seed treatment with mefenoxam plus spray application of fungicides dimethomorph (Acrobat 50WP), Ranman 400SC (a new fungicide), or A1162 (a new fungicide) reduced foliage blight and fruit rot significantly in pumpkin and watermelon.

The rates of vine and fruit infection with *P. capsici* in pumpkin and watermelon plots that received seed treatment plus soil or foliar calcium application and red-light treatment plus spray application of fungicides were significantly lower than control plots. Red-light treatment of seedlings alone delayed the occurrence of plant infection with *P. capsici* on pepper, pumpkin, tomato, and watermelon. However, toward the end of the season, red-light treated plants exhibited symptoms of Phytophthora blight. Percentage of infected plants with *P. capsici* in bell pepper plots sprayed with Ranman 400SC was significantly lower than that of control plots. Also, the bell pepper cultivars Emerald Isle, Paladin, and Reinger identified as resistant to Phytophthora blight in the greenhouse performed well in the field trial. In comparison, more than 50% of the plants of the susceptible cultivars California Wonder and Arthur King became infected and died.

To establish effective crop rotation sequences for management of Phytophthora blight of vegetables, research was conducted to determine the host range of *P. capsici*. The pathogenicity of *P. capsici* was evaluated on 36 species of crops grown in rotation sequences with vegetables and nine species of weeds that commonly grow in cucurbit fields in Illinois. Twenty-two crop species and two weed species became infected with *P. capsici* and developed symptoms. Five crops, beet (*Beta vulgaris*), Swiss chard (*Beta vulgaris var. cicla*), lima bean (*Phaseolus lunatus*), turnip (*Brassica rapa*), and spinach (*Spinacea oleracea*), and one weed species, velvetleaf (*Abutilon theophrastii*), were determined to host *P. capsici*, the first report of Phytophthora infection on these species.

b. Impact - Illinois produces approximately 13,750/ha of cucurbit crops, eggplants, peppers, and tomatoes. Phytophthora blight causes yield losses of up to 100% in commercial fields of these crops. Losses to Phytophthora blight in Illinois (in pumpkin and pepper fields only) exceeds $10,000,000 in some years. Using effective methods (e.g., seed treatment, application of fungicides, and plant resistance), developed in this study, control of Phytophthora blight in vegetable fields resulted in substantial increase in production and area of cucurbits and peppers.

c. Source of Funding – CSREES Special Grant Funding

d. Scope of Impact - State

Integrated Management of Soybean Diseases

a. Progress - We completed the final year of a 4-year project researching the potential interaction between several post-emergence herbicides and sudden death syndrome (SDS).

The spraying of imazethapyr (Pursuit) and acifluorfen (Blazer Ultra) at growth stage V2 resulted in severe foliar injury, but did not affect the level of SDS. However, Rhizoctonia root rot continued to be a problem in plots treated with both herbicides. We continued evaluating several inoculation methods for SDS on soybean. The two most successful methods involved growing the fungus on sterile sorghum and applying the infested grain to the field in a 5 cm wide band approximately 4-6 cm below the seed at 218 kg/ha prior to planting. The second method was to apply the infested sorghum with a no-till drill at 450 kg/ha prior to planting. Both methods resulted in symptoms, but additional studies need to be done on the timing and amount of irrigation/rainfall to obtain consistent disease levels.

We also completed the second year of a study to evaluate the response of several new strains of Bradyrhizobia on soybean. In plots cropped to a corn/soybean rotation, there was no significant difference between the inoculated and control treatments for nodules/plant or yield. In plots cropped to at least 10 years of corn, there was a significant increase in nodule number/plant, but there was no significant difference in yield.

b. Impact - Sudden death syndrome continues to be a major disease of soybean in Illinois and control is achieved through the use of partly

resistant cultivars. The field inoculation technique has helped identify the most resistant cultivars as well as study possible interactions with other pathogens or herbicides. While Rhizoctonia root rot is clearly increased due to the application of post-emerge herbicides, it appears that sudden death syndrome is not affected. In addition, the application of new strains of Bradyrhizobia increased nodule number in plots with a history of no soybeans for many years, but they did not affect yield.

This research will help producers make management decisions about the value of chemical control of soybean classes, and seed inoculation.

c. Source of Funding – Hatch, State, Industry, Other Non-Federal Funds

d. Scope of Impact - State

Biology and Management of Selected Soilborne Pathogens of Field Crops

a. Progress - This project aims to improve management of soybean and alfalfa diseases. The focus is on the soybean diseases Phytophthora rot caused by *Phytophthora sojae* and brown stem rot caused by *Phialophora gregata*, and the alfalfa disease Aphanomyces root rot caused by *Aphanomyces euteiches*. Isolates of *P. sojae* were obtained from soybean fields in 24 counties.

We evaluated pathogenicity, virulence, race, and sensitivity to selected fungicidal compounds for *P. sojae* in laboratory, greenhouse, and field experiments. Over 30 different virulence phenotypes (races) of *P. sojae* were identified from soybean fields in Illinois. Soybean Rps genes 1c and 1k appear to be effective against most populations of *P. sojae* in Illinois. However, populations have been identified in several counties that overcome 1c and 1k. Various fungicidal seed treatment products are being tested for disease control of Phytophthora and other seedling diseases in field trials with mixed results. Soybean stems were collected from specified varieties in several field locations for studies of *P. gregata*. Two different genotypes of *P. gregata* are distributed inconsistently in Illinois, and they appear to have preference for different soybean germplasm with different Rbs genes. Isolates of *A. euteiches* were obtained from alfalfa fields in 19 counties. This pathogen was

detected from over 90% of the alfalfa fields tested in Illinois and both races one and two of this pathogen are widespread in the state.

b. Impact - Soybean and alfalfa are two major crops in Illinois, with combined total acreage of approximately 4.453 million ha. This project is focused on improving disease management practices for three important diseases of these crops, Phytophthora rot of soybean, Aphanomyces root rot of alfalfa, and brown stem rot of soybean.

Several management tactics are being explored to manage these pathogens. This research provides information concerning the races of *P. sojae* in Illinois as well as deployment of the resistance genes Rps1c and 1k, which remain effective in many but not all fields. The pathogenic diversity found in Illinois populations of *P. sojae* indicates that this pathogen is more diverse than previously thought and it will be a challenge to maintain resistance to this pathogen in Illinois.

Soybean fungicidal seed treatments have the potential to be another effective tool to manage the seedling stage of Phytophthora rot, and we are developing data based on field studies that producers can use to determine if seed treatments can provide significant benefits. The Aphanomyces root rot pathogen seriously affects establishment and growth of alfalfa and reduces alfalfa yields.

Our studies show that both races of this pathogen are widespread in Illinois, and alfalfa cultivars with resistance to both races will reduce the impact of this disease. Our work also indicates that diagnosis of brown stem rot is more challenging than is commonly thought, and management of brown stem rot will depend in part on selection of the proper resistance in soybean varieties.

c. Source of Funding – Hatch, State Funds

d. Scope of Impact – State

Key Theme – Plant Production Efficiency

Technical and Economical Efficiencies of Producing, Marketing and Managing Environmental Plants

a. Progress - Individual studies on 35 pesticide crop combinations were initiated in 2003. The studies were selected from the IR-4 high priority list that was developed at the Ornamentals Workshop in

Houston. The workshop results represent input from pesticide manufacturers, formulators, ornamental crop producers, and ARS and land grant university scientists. These projects included insecticides, herbicides and plant growth regulators. The pesticides studied represent new chemistries and compounds that have a lower use risk than currently labeled products. The projects will be completed in the spring of 2004.

Plant evaluation studies with herbaceous and woody plants were conducted. These plants were evaluated for their landscape performance in central Illinois. New woody plant cultivars were evaluated as to their winter hardiness. The studies in 2003 focused on 30 woody plant taxa and 656 herbaceous plant taxa. The principal investigator participated in the Fourth National Nursery Survey conducted by this regional project coordinated by the University of Tennessee and Texas A & M University. Results are anticipated in 2004. The principal investigator conducted a survey to determine the potential paying markets for compost.

Approximately 2,275 surveys were mailed to members of horticultural trade associations in Illinois. A 33.7% return rate was achieved and analyzed. A majority of the respondents have used compost and most were satisfied with the results. The primary reasons cited for using compost were related to soil tilth, building humus content of soil and increased plant growth. Respondents reported development of quality standards for compost would encourage use. The data collected in the IR-4 studies will be submitted by the IR-4 National Headquarters to support label expansions on ornamental crops. The expansion of the pesticide labels will provided growers and landscape professionals with better chemical pest management alternatives then those currently being used. The label expansions will provide growers with pesticides that have lower risk and more efficacy than pesticides currently on the market.

b. Impact - Results from the compost survey of the horticulture industry will be used to justify the development of state standards for compost.

The data from the IR-4 studies will result in additional pesticide labels providing needed tools for nursery crop growers, greenhouse crop producers and landscape managers. Data from the fourth national nursery survey will provide researchers, Extension personnel and industry participants with understanding and insight

regarding trends and structural changes impacting the competitive position of producers in various parts of the country.

c. Source of Funding – State, Multi-State Funds

d. Scope of Impact - AL, DE, FL, GA, IL, IN, KY, LA, MI, MS, NJ, NYC, OH, OR, PA, RI, TN

Assessing Crop Rotation Effects in Illinois

a. Progress - Support was provided to a study of the effect of rotational sequence and sequence order on the yields of corn (*Zea mays* L.), soybean [*Glycine max* (L.) Merrill.], and wheat (*Triticum aestivum* L.) rotated in either of two possible orders. The corn-soybean rotation was included for comparison, along with continuous corn and, at one location, continuous soybean.

The study is underway at three locations in Illinois. Averaged over six years at Monmouth (1997-2002), continuous soybean, soybean following wheat in the 3-year rotation (C-W-S), and soybean following corn in the W-C-S rotation yielded 27 percent less, 10 percent more, and one percent more, respectively, than soybean in a 2-year (C-S) rotation. Continuous corn, corn following wheat in S-W-C, and corn following soybean in W-S-C yielded 17 percent less, six percent more, and five percent more, respectively, than corn in the 2-year S-C rotation. No-till corn yielded two and five percent less than tilled corn when corn followed wheat and soybean, respectively, in the 3-year rotation. No-till, continuous soybean yielded 23 percent more than tilled, continuous soybean, and about four percent more than tilled soybean when soybean followed corn. Wheat yields following soybean were about 12 percent higher than those following corn, and tillage increased wheat yield following corn but not following soybean. Using yield data and current crop and input prices, the 3-year rotation at Monmouth produces returns very similar to those from the corn-soybean rotation. Higher corn and soybean yields in the 3-year rotation compensated for the lower income from wheat.

b. Impact - This research is continuing to build a foundation that will allow crop producers to assess relative economic returns to different cropping sequences and practices, particularly when including wheat in the rotation.

The wheat-corn-soybean rotation showed a profit potential about equal to that from the corn-soybean rotation at Monmouth, with an advantage in the corn-soybean-wheat sequence over the S-C-W due to higher soybean and wheat yields. This will be very useful information as producers try to diversify cropping systems in areas where the corn-soybean rotation occupies virtually all of the cropped area. If income from the 3-year cropping sequence is similar to that in the corn-soybean rotation, including wheat will help to buffer the agricultural system against soil loss and against income fluctuations.

c. Source of Funding – Hatch, State, Sale of Products Funds

d. Scope of Impact - State

Factors Related to Yield of Grain and Oilseed Crops in Illinois

a. Progress - Results of a four year (1999-2003) tillage study at six Illinois locations showed that, while deep tillage in the fall after harvest of the previous crop significantly reduced the resistance to soil penetration, it had no consistent effect on yield of the following corn (*Zea mays* L.) or soybean [*Glycine max* (L.) Merr] crop. Deep-tilling in alternate years or only once at the start of the study also failed to affect crop yields. Secondary (spring) tillage in a few instances improved the plant stand marginally, although effects on yield were minimal. Research on the effects of deeper tillage, higher fertilizer rates, and increased plant population on yields of continuous corn showed no effect of deep tillage, on yield at the higher fertilizer rates at Urbana, and a yield decrease from increasing the plant population at both Monmouth and Urbana.

A study initiated in 2003 at three locations showed that a new Bt corn hybrid effective against western corn rootworm produced yields and plant population responses similar to those of its non-Bt counterpart hybrid.

b. Impact - The consistent lack of response to deep tillage, across six different soils and weather conditions over four years, casts considerable doubt on the usefulness of this capital-intensive practice by crop producers. It is possible that smaller equipment used on research centers decreases response to practices that relieve compaction, but our data indicate that producers might want to leave check strips when using deep tillage in order to test returns to this practice. The lack of response to secondary tillage indicates that corn

and soybean can be produced effectively without soil disturbance in the spring.

c. Source of Funding – Hatch, State Funds

d. Scope of Impact - State

CSREES GOAL TWO – A Safe and Secure Food and Fiber System

Indications of the Scope of Research and Extension Programs under Goal 2 - See Appendix A.

While the number of food safety and quality projects dropped from 24 to 22 this year, the number of scientist years increased from 14 to 16. There was drop in the amount of technical and support staff effort from 39 to 30. The percentage of the College's research portfolio in this area dropped from 7.7 percent to 6.5 percent. Extension face-to-face teaching contacts continued to increase going from 280,000 in 2003 to 320,000 in 2004.

Key Theme – Food Accessibility and Affordability

Improvement of Thermal and Alternative Processes for Foods

a. Progress - The purpose of this work is to develop and verify methods for measurement and prediction of engineering and biochemical properties of foods as needed in process design and analysis. A second objective is to identify and describe transport mechanisms occurring in food processes.

Fouling of food processing equipment is a major problem in the food industry since many process streams contain compounds responsible for fouling. Of interest was the effect of fouling on efficiency of the corn processing industry, which depends on evaporator concentration of various process streams, such as corn steepwater, to allow handling and storage of co-products. Implications of process design on fouling rates of corn steepwater were being measured using an annular fouling probe. Improvement in efficiency of this process would have a dramatic impact on process economics as well as product quality.

Microfiltration membranes were used to filter corn steepwater to reroute large protein and carbohydrate molecules away from evaporators. To measure effects of membrane filtration, the fouling probe was used to measure relative rates of fouling of unfiltered steepwater and material permeating the membranes. It was found that micro-filtered steepwater had fouling rates seven times slower than those of unfiltered steepwater. Ongoing research is studying the effect of process temperature, pH, and acid during processing of thin stillage from dry grind corn processing.

Fouling of evaporator surfaces is a significant factor in efficient production of fuel ethanol. Maintenance of evaporators requires additional capital investment, labor, and energy consumption by the dry grind industry.

b. Impact - For a sustainable and competitive corn process industry, an understanding of how biological materials interact with food processes is needed. Many food processes require removal of water for safe storage and transport of the final product. Evaporators consume a large portion of energy and capital investment in many processes, such as dry grind corn processing. Research to date has measured the tendencies for process materials to reduce the efficiency of evaporation, which adds costs for production.

c. Source of Funding – Multistate, Non-Federal Research Funds

d. Scope of Impact – CA-D, DE, FL, GA, GU, IA, ID, IL, IN, MI, MO, NC, ND, NE, NJ, NYC, NYG, OH, OR, PA, SD, TX, WA, WI

Future Foods – Illinois

a. Progress - The objective of the outreach component of this project is to work towards creating sustainable solutions that will accelerate economic development in less developed countries, especially among populations affected by prolonged undernourishment, malnourishment, and devastating disease.

The team is currently implementing a pilot program in Botswana in collaboration with the National Food Technology Research Center and the America Soybean Association to improve the protein density of local foods. The country of Botswana reportedly has the highest incidence of HIV infection in the world, and HIV infection increases the protein and energy requirements compared to those of a healthy person.

Sorghum, which is the staple of Botswana, was fortified with soy flour. The soy fortified sorghum and textured soy protein were tested as meat substitutes or extenders, and both were well accepted by consumers. A series of workshops was offered for community leaders and consumers on the benefits of adding soy protein products to the local diet, and local food processors were educated on how to introduce soy fortified food products commercially with local procurement of ingredients.

The laboratory research component of this project focused on the roles of specific soy compounds on rotavirus (RV) and salmonella infection in infants using the neonatal piglet as a model, and on determining the concentration of lunasin, a cancer preventive peptide, in several commercially available soy protein products. Soy isoflavones inhibited RV infection and shortened the duration of severe diarrhea in piglets. Piglets fed formula with isoflavones recovered from RV diarrhea 3 days sooner than piglets fed formula without isoflavones. The consumption of soy fiber enhanced digestion and absorption in the intestine and reduced severity of Salmonella-induced illness in piglets, indicating that consumption of infant formulas containing soy fiber may be a cost effective way to reduce diarrhea in newborn infants. The cancer-preventive peptide lunasin was measured using immunoassay techniques developed to identify and quantify the presence of this compound in different products. Lunasin was present in higher concentrations in isolates and hydrolyzed soy protein than in soy flour and soy flakes.

b. Impact - Several Private Voluntary Organizations (PVOs) have already started using soy protein products in their international food assistance programs. The beneficial effect of soy isoflavones in reducing the severity and duration of rotavirus in infants and of soy fiber in reducing intestinal infections could open niche markets in the infant formula industry and also in the pork industry where piglets are susceptible to intestinal infections.

Furthermore, bioactive peptides, such as lunasin, have potential to be isolated and developed as nutraceutical ingredients.

c. Source of Funding – CSREES Special Grant Funds

d. Scope of Impact – State

Key Theme – Food Quality

Prevention of Fumonisin in Corn-Based Foods Using Genetic Resistance

a. Progress - This research is using generation means analysis and molecular markers to study resistance to Fusarium ear rot and fumonisin in grain. Four sources of resistance were evaluated for resistance to Fusarium ear rot and fumonisin concentration in grain in three locations in the summer of 2003. All evaluations included crosses and segregating generations of the resistant inbred crossed

with the susceptible commercially used inbred FR1064. Resistant inbred line GE440 was evaluated in North Carolina in two locations. That line had been previously evaluated in North Carolina and at Urbana, Illinois in 2002. Resistant inbred line TBA76125 was evaluated in Urbana. That inbred line had been evaluated in 2002 at both Urbana and Haubstadt, Indiana. Inbred line CG1, which is one of the better sources of resistance, was evaluated at Urbana and Haubstadt in 2003. We also evaluated resistant inbred line CQ201 at Urbana only.

With all experiments we have multiple generations in a generation means analysis study as well as 200-346 families of the backcross susceptible selfed generation that is a molecular marker population. Genotyping (molecular marker analysis and current evaluations) of GE440 is being done at North Carolina State. Genotyping of TBA76125 is being done by a cooperator in commercial seed company at no cost.

b. Impact - This research has identified resistance to Fusarium ear rot and fumonisin concentration in corn grain that will provide the basis for control of fumonisin in processed feeds and foods. These results are important because fumonisin is a relatively commonly occurring mycotoxin in corn grain in many areas where corn is grown including the central United States. Fumonisin has been definitively linked to a number of diseases of animals and also has been linked to human neural tube birth defect and human esophageal cancer in numerous places worldwide. Studies indicate that resistance in currently used commercially available corn hybrids is not very high, and is not at a suitable level for control of fumonisin contamination of grain.

c. Source of Funding – NRI Competitive Grant, State Funds

d. Scope of Impact – National

Physicochemical Studies of Soybean and Muscle Proteins for Developing Novel Food Products with Improved Shelf-Life and Nutritional Value

a. Progress - Novel results were obtained by Near Infrared Spectroscopy (FT-NIR, NIT), FT-IR, High-resolution C-13 Nuclear Magnetic Resonance (NMR), Electron Microscopy (TEM, SEM), Ion Exchange (IE) and High-Performance Liquid Chromatography (HPLC) of soybean composition and especially soybean proteins.

Determinations of amino acid composition profiles were carried out for both extracted soybean proteins and intact soybeans, and were then compared on a protein dry-basis percent. Such measurements were carried out for a wide range of soybean lines with the aim of improving the protein quality through selection and breeding of soybean lines that have higher protein quality in terms of the average amino acid composition of the soybeans. Recently, novel/high-quality FT-NIR calibrations were also developed for composition analysis of soy-based foods with high protein content and improved nutritional quality. Such calibrations were extended to isoflavone-containing foods such as soy crisps, soy burgers, dry-roasted soy nuts, soy tofu, liquid soy milk and soy milk powder that are important for both nutritional studies and human health improvements through adequately selected diets.

b. Impact - Recent studies of the health benefits of soybean proteins in human foods showed their potential for the prevention and treatment of cardiovascular diseases and also, tentatively, for cancer prevention.

This project examines the physiochemical interactions of soybean proteins with muscle proteins, the amino acid profiles and composition improvements of soybeans with the purpose of designing and developing novel health food products with improved soy protein quality, shelf-life, texture and taste, as well as of high nutritional quality. There is a niche market- estimated to be on the order of a billion US$- for such novel health food products with high nutritional qualities that can be utilized in diets designed for improving human health.

c. Source of Funding – Hatch, State, Industry Funds

d. Scope of Impact – National

Enhancing Beef-Effect on Palatability of Standard Choice Grades

a. Progress - The objective of this study was to evaluate the effects of enhancement prior to and after aging on quality characteristics of beef strip steaks from Select grade carcasses. The Longissimus was removed 24 hours postmortem from Select grade beef sides (20) to assess the effects of enhancement before or after aging on quality attributes of strip steaks. Strip loins were pumped to 108% of original weight to contain 0.4% phosphate, 0.3% salt, and 0.1%

natural flavoring for comparison with non-enhanced samples after aging up to 28 days at 4C.

Enhanced samples required less force to shear with no advantage for those aged past seven days. Controls had lower shear force values when aged to 28 days. As sensory tenderness scores increased, shear values decreased for all samples regardless of enhancement or aging time. Enhanced samples had higher pH values (0.3 pH units with no pH change over the aging periods). Purge loss for samples enhanced prior to aging only ranged from 0.7 to 4.0%; no differences occurred. Cooking loss did not differ due to enhancement or aging. Enhancement of Select beef strip steaks improved sensory characteristics regardless of when enhancement occurred. Tenderness and juiciness scores were consistently higher in samples enhanced prior to aging compared to samples enhanced after aging; the highest scores occurred for samples enhanced then aged for seven days. Enhanced samples were saltier than controls regardless of when they were enhanced or how long they were aged. Control samples had a more metallic off-flavor than did the enhanced samples; however all scores were low. L* (lightness), a* (redness), and b* (yellowness) values were higher for control samples compared to enhanced samples regardless of the aging period or time of enhancement. Controls had higher L* values prior to and after aging. Enhancement after aging resulted in higher L* values (lighter) compared to enhancement prior to aging, although this declined as the aging period increased past 14 days. A trend existed for a* value to increase over time, with control samples having overall higher a* values. The b* value was higher for controls than for samples enhanced either prior to or after aging, and gradually increased over time in all samples. Enhanced samples had lower hue angles (departure, in degrees, from the true red). Chroma (color intensity) of enhanced samples was lower than for control samples, indicating they had a less intense red color. Visual redness scores ranged from 5.6 for samples aged 14 days prior to enhancement to 9.9 for non-enhanced samples aged 14 days. Enhanced samples had lower red color scores regardless of the time of enhancement or the aging period. There were no differences in brown or green color scores between the enhanced samples and the control samples regardless of the aging period. Aerobic plate count (APC) was no more than one log (higher) for enhanced than for control steaks throughout the aging period. APC remained constant after 14 days for both enhanced and control samples. Using 10-6 CFU/cm2 as a cutoff point for spoilage, the APC never exceeded unacceptable levels, even after 28 days of aging.

b. Impact - These results are useful to the beef industry in terms of optimizing the enhancement and aging processes to manufacture products with higher quality characteristics using Select grade beef.

Decreased aging times increase profits to manufacturers in terms of energy savings and decreased product losses due to dehydration and microbiological spoilage. The combination of enhancement and aging to produce acceptable products from lower grading beef will potentially provide higher quality products to consumers at lower prices.

c. Source of Funding – Hatch, State Funds

d. Scope of Impact – National

Characterization and Analysis of Aroma (Odor) Components of Foods, Flavorings and Agricultural/Industrial Materials

a. Progress - Characteristic aroma components of rennet casein were determined by gas chromatography-olfactometry (GCO), aroma extract dilution analysis (AEDA) and sensory descriptive studies. Results of AEDA showed o-aminoacetophenone to be the most potent odorant among numerous short-chain volatile acids, phenolic compounds, lactones, and furanones. However, sensory descriptive analysis of model aroma systems revealed that the typical odor of rennet casein was principally due to hexanoic acid, indole, guaiacol and p-cresol.

In a similar study, aroma-active components of liquid cheddar whey were determined by GCO, AEDA, and sensory methods. Key aroma components of whey were identified as 2,3-butanedione, hexanal, 2-acetyl-1-pyrroline, methional, (E,E)-2,4-decadienal and (E,E)-2,4-nonadienal, as well as various short chain fatty acids. A standardized descriptive language with 21 descriptors was developed for skim milk powder and dried dairy ingredients, with some flavors common to all ingredients while some other flavors were specific to specific products. Natural (raw) and roasted Turkish hazelnuts (*Corylus avellana* L.) were discriminated (differentiated) based on volatile constituents and sensory attributes.

Major metabolic pathways and agents responsible for the typical flavor of cheddar cheese were reviewed with special emphasis on the analytical and sensory procedures used for the study of cheddar cheese flavor. We investigated the potential of Refractance Window

(RW) technology for dehydration of strawberry slices in terms of some important chemical and physical properties as compared to its freeze-dried (FD) counterpart. In particular, we evaluated the retention of flavor, color and ascorbic acid, rehydration capacity, moisture sorption behavior and glass transition temperature. Moisture-sorption isotherms and other physical data (e.g., glass transition and rehydration capacity data) indicated that RW produced a dehydrated sliced strawberry product having nearly identical moisture sorption behavior as its FD counterpart. However, RW product showed greater quality deterioration in terms of flavor and ascorbic acid losses as well as color degradation (browning).

b. Impact - Use of sensory-directed flavor analysis, such as gas chromatography-olfactometry, for identification of key aroma components will lead to an increased understanding of pathways involved in the formation and degradation of flavor (aroma) components of foods during manufacture and storage, which in turn will lead to production of higher quality products.

Knowledge of compounds involved in environmental off-odors (e.g., odors emitted from intensive animal production operations) will lead to development improved odor-control strategies and better methods for odor analysis (monitoring).

c. Source of Funding – Hatch, State Funds

d. Scope of Impact – National

Modifying Milk Fat Composition for Improved Manufacturing Qualities and Consumer Acceptability

a. Progress - Mammary tissue was collected by percutaneous biopsy at -14, +1, and +14 days relative to parturition from 2 multiparous Holstein cows fed according to current NRC recommendations throughout the dry period and the first 49 days postpartum. A microarray consisting of 7,872 cDNA inserts was constructed from a collection of clones selected from placenta and spleen cDNA libraries. Annotation was based on similarity searches using BLASTN and TBLASTX against the human and mouse UniGene databases. A total of 6,626 sequences (84%) have significant similarity to human or mouse genes and could be assigned as putative orthologs. Gene Ontology terms were annotated to the sequences and putative functions assigned. Cy3- and Cy5-labelled cDNA from tissue and a universal control sample (derived from a

mixture of cattle tissues not including liver or mammary tissue) were used for hybridization.

Three exogenous plant genes were used as spiking controls for data normalization. A parametric test using the cross-gene error model with log-transformed ratios in GeneSpring was used. Preliminary data analysis demonstrated clear increases over time in the expression (fold-change expressed as tissue/universal control) of genes with known or unknown functions associated with metabolism that accompanies copious milk synthesis. Large fold-changes in mRNA expression were detected between -14 and +14 days for stearoyl-CoA desaturase, xanthine dehydrogenase, fatty acid binding proteins-3 and -5, fatty acyl-CoA ligase-2, transport proteins (ABCG2, ABCA1, TAP1), GLUT1, IGFBP3, Lipin-1, SPP1, kinases (Janus, pyruvate dehydrogenase-4, myosin light-chain), PPAR-gamma, aminoacyl tRNA synthases, leucine aminopeptidase, and beta-1,4 galactosyl transferase. Expression of immunoglobulin lambda and kappa also were markedly upregulated by day 14 postpartum.

Results demonstrate the power of microarrays to study patterns of gene expression in the bovine mammary gland.

b. Impact - Microarray technology is expected to greatly increase our understanding of the biochemical changes with the onset of milk production in healthy and diseased states.

Future studies will allow us to examine the effects of different nutritional programs on genes affecting production of altered dairy products.

c. Source of Funding – Multistate, State, Sale of Products Funds

d. Scope of Impact – CA-D, IA, ID, IL, KY, MN, NYC, OH, SC, SD, UT, VA, WI

Key Theme – Food Resource Management

Membrane Technology in Food Processing

a. Progress - A process has been developed for producing higher-value products (corn oil and zein) in dry-grind ethanol plants using in-house materials only. The COPE (Corn Oil and Protein Extraction)

process allows traditional products (e.g., DDGS, CO2 and ethanol) to be marketed while also producing oil and zein.

Conceptually, there are four stages in the COPE process: (1) Extraction of ground corn with ethanol under optimum conditions for oil or zein, (2) Separation of the ethanol extract from the residual meal (by filtration or centrifugation), (3) Desolventizing the meal and using it for conventional ethanol production, and (4) Concentration of the corn oil and/or zein, depending on process requirements, and recovering the ethanol for recycle using low-energy processes (e.g., membrane technology).

Optimum conditions for zein extraction were 70% ethanol in water, extraction time of 30-40 minutes and temperature of 50C. The best yields (60% of the zein in corn) and highest zein content in the extracted solids (i.e., purity of the zein) were obtained at a solvent-to-solids ratio of 4-8 mL of 70% ethanol per gram of corn. Zein concentration in the extract was higher at lower ratios. Multiple extraction of the same corn with fresh ethanol resulted in a zein yield of 85% after four extractions, while multiple extractions of fresh corn with the same ethanol resulted in high (15 g/L) zein concentration in the extract. Column extractions were best at 50C and 70% ethanol; a solvent ratio of 1 mL/g resulted in high zein concentrations in the extract (17 g/L) but yields were low (20%). Several commercial polymeric ultrafiltration membranes were screened for their performance with aqueous ethanol solutions.

The method of conditioning the membranes had a major effect on solvent flux, membrane integrity and their pressure ratings. Gradual solvent exchange with successively higher concentrations increased in small doses appeared to work best with completely miscible solvents such as those studied here (ethanol-water mixtures). Rapid solvent exchange between water and high concentrations of alcohol disrupted the polymer matrix in many cases. Exposure to organic solvents significantly reduces the pressure rating of the membranes. Several membranes that provided acceptable rejection of ethanol-soluble proteins at low pressures (20 psi) lost its properties at higher pressures (60 psi) if conditioned incorrectly, and vice-versa. Zein purity in the ethanol extract is typically 40-60%. With membrane technology, a substantially purified zein containing 90% or more protein has been produced combining these technologies.

A considerable amount of experimental work was required to determine the best pore size, the membrane and operating

conditions. Additional work is needed to improve yield of zein and to get higher membrane flux.

b. Impact - An efficient and potentially low-cost process for production of zein from dry-ground corn has been developed using membrane technology. For a 30 million gallon per year ethanol plant, the additional revenue generated by zein is about $11 million per year, an increase of about 25%. This should reduce the net cost of ethanol from corn.

c. Source of Funds – Hatch, State Funds

d. Scope of Impact – National

Key Theme – Food Safety

Food Toxicology and Safety

a. Progress - We evaluated the effects of phytosterols, beta-sitosterol (BSS) and beta-sitosterolin (BSSG) on growth of estrogen-dependent breast cancer (MCF-7) both in vitro and in athymic nude mice implanted with MCF-7 cells. BSS and BSSG (1 nmol/L - 150 umol/L) were evaluated for their estrogenic and anti-estrogenic activities in MCF-7 cells using as an endpoint in vitro.

We demonstrated that BSS at concentrations above 10 umol/L induced MCF-7 cell proliferation in vitro. Growth of the MCF-7 cells was not affected by BSSG. The dietary effects of BSS and BSSG on the growth of MCF-7 cells were also evaluated using an ovariectomized athymic mouse model. Estradiol (E2) implants were placed into half of the animals, and MCF-7 cells were injected into the animals. When the average tumor surface area reached 34 mm2, animals were divided into treatment groups [negative control (NC), E2 control, BSS, BSSG, BSS + E2, and BSSG + E2). The animals in the NC and E2 control groups were fed AIN93G diet, and the animals in the BSS, BSSG, BSS + E2, and BSSG + E2 were fed AIN93G diet containing BSS (9.8 g/kg diet) or BSSG (0.2g/kg) for eleven weeks. The dietary intake of BSS and BSSG at the concentration used did not affect the growth of MCF-7 tumors. However, dietary intake of BSS and BSSG in the presence of E2 reduced the E2-induced MCF-7 tumor growth by 38.9% ($p < 0.0493$), 31.6% ($p < 0.0770$), and 42.13% ($p < 0.0259$), respectively. BSS dietary treatment significantly reduced E2-induced MCF-7 tumor growth compared to tumors in1:47 E2 control group. There

was no statistical difference in the reduction of MCF-7 tumor growth between BSSG and 1:47 E2, and no difference among phytosterols.

In summary BSS stimulates growth of MCF-7 cells in culture. However, in vivo BSS and BSSG did not increased preexisting MCF-7 tumor growth and reduced E2-induced MCF-7 tumor growth.

b. Impact - Phytosterols are present in our food and many dietary supplements. The potential for these compounds to alter estrogen-dependent tumor growth is an important issue to women with breast cancer.

c. Source of Funds – USDA, Hatch, Public Health Service Funds

d. Scope of Impact – National

Key Theme: Food Security

4-H "CAN" Make a Difference

a. For the sixth year, University of Illinois Extension's 4-H "CAN" Make a Difference anti-hunger initiative was presented the Statewide Food Drive of the Year Award for outstanding leadership on behalf of Illinois citizens in need.

The program has hundreds of corporate and organizational sponsors, including Illinois food manufacturers, agricultural commodity groups, state agencies, banks, businesses, and civic groups. A key to the program's success is the outstanding statewide leadership of a team of collegiate 4-H youth. The members of the coordinating team connect 4-H clubs with local food pantries, shelters and meal programs. University of Illinois Extension Educators are working to produce curriculum materials for youth groups that are concerned about local, state, national, and global food security issues. The project provides youth a firsthand look at hunger and helps them design strategies for action. The project should be unveiled this summer in concert with the kick-off of the annual 4-H CAN Make A Difference campaign.

b. Impact - Last year for the second year in a row, 4-H youth collected more than 1,000,000 pounds of food (500 tons).

-Youth contributed more than 1.5 million hours of volunteer service at local food banks, pantries, shelters and meal programs throughout the state.

c. Sources of Funds - Smith-Lever, State, Local, Private

d. Scope of Impact - Illinois

Key Theme: Foodborne Illness

Commercial Food Handlers Need to Wash Their Hands Too

a. According to the National Restaurant Association, the average food-borne illness outbreak costs a single business $75,000 including lost business, medical costs and litigation. As of 1999, Illinois requires certified food service sanitation managers to attend a minimum of five hours of training to retain their certification. Over the past five years, 3,233 food service staff have been re-certified through refresher courses taught by University of Illinois Extension Educators. These courses have done more than meet a minimum re-certification requirement; over 79 percent reported improving one or more food handling practices as a result of the training. Since many establishments have only three or four certified employees, one can assume that this training has impacted more than 900 establishments (assuming 3.5 trainees per establishment).

b. Impact – 2,554 food handlers improved one or more food handling practices.

- 924 food establishments now serve safer food.

c. Source of Funds – Federal, State

d. Scope of Impact – Illinois

CSREES GOAL 3 – A Healthy, Well-Nourished Population

Indications of the Scope of Research and Extension Programs under Goal 3 - See Appendix A.

Goal 3 research projects in the College numbered 24, a drop from last year. The number of scientist years increased from almost nine to 11. University of Illinois Extension paid staff reported more than 824,000 face-to-face teaching contacts related to Goal 3 with more than 20 percent of Extension's staff working in this goal area.

Key Theme – Human Health

Also see Camp Clover under Goal 5, Key Theme – Youth Development/4-H

Dining with Diabetes

a. Illinois has the sixth largest prevalence of diabetes in the U.S., with approximately 567,000 adults having been diagnosed with diabetes. It is estimated that an additional three million people in Illinois are at increased risk of undiagnosed diabetes because of the risk factors of age, obesity and sedentary lifestyles.

Since 2001 more than 2,100 people with diabetes and/or their caregivers have participated in the educational series "Dining with Diabetes". All U of I Extension Nutrition and Wellness Team Educators have been involved in the statewide implementation of this dynamic program. Not only have significant knowledge and behavior results been achieved, but coalitions have been forged with state and local agencies as well in order to improve the health and well-being of those with diabetes in Illinois.

Dining with Diabetes is a nutrition education program with cooking demonstrations for people with diabetes and their families. Extensively revised by Illinois Extension Educators over the past three years, the three sessions plus a six-month reunion meeting are designed to help participants better plan healthy food intake, thus leading to better control of blood glucose levels. Each session includes tips for managing diabetes, cooking demonstrations and taste testing of healthy recipes.

The goals of Dining with Diabetes include:

-Increasing knowledge of healthy food choices for the diabetic diet.

-Presenting healthy versions of familiar foods that are easy to prepare.

-Demonstrating cooking techniques that use new or more healthful ingredients.

-Encouraging behavior changes by providing tasting of healthy foods.

-Providing opportunities for participants to share and learn from one another.

b. Impact - Overall, mean post-test knowledge scores have improved from 67% to 84% correct. There was significant improvement in the participant's belief that they could overcome barriers to achieving a healthy diet. They also felt more strongly that there were benefits to their health if they maintained a healthy diet.

Impact on one lady as reported by Pam Jacobs, Unit Leader, Monroe County to Nutrition and Wellness Educator Carol Schlitt:

It was another great success story at the Dining with Diabetes reunion last night...one participant shared that this program made the difference for her! Since the April course, she laminated the recipe sheets to use them on a regular basis, has become very consciousness about portion control and began walking twice a day. She has lost 45 pounds, prescription medicine intake has been reduced and her asthma condition has improved. She is very enthusiastic about the improvement of her health and expressed appreciation for providing this course to move her in this position direction!

"Thanks again Carol, as always I appreciate your expertise and enthusiasm to teach programs that are making a wonderful impact in people's lives!

Comments from participants:

- *This class answered many of my questions on preparing diabetic meals.*
- *Portion size – I really watch my serving sizes.*
- *I was able to lose 22 pounds and bring my blood sugar down from 148 to 118."*
- *Began watching total carbs instead of just sugar.*
- *I am more aware of different oils and the best types for*

heart health. I know I can have a little sugar in meals – if controlled. I found this class very, very helpful.

c. Source of Funds - Smith-Lever, State, Local.

d. Scope of Impact - Illinois

Illinois Senior Wellness Initiative

a. The overall goal of this project is to educate, inspire and empower rural seniors to improve their health and that of their community. This is a grass roots program where teams of rural seniors participate in an experientially based holistic wellness conference and then receive a mini grant of $500 to transfer their knowledge into a local community wellness project or event. Additional goals include:

1. Meet new friends.
2. Experience joy, fun and excitement.
3. Obtain cutting-edge, credible health and wellness information for yourself and others in your community.
4. Become acquainted with exhibitors, speakers and staff.
5. Understand the importance of nature, laughter and health in daily well-being.
6. Learn about leadership and activities planning.
7. Increase knowledge of funding sources to support local wellness programs/events.
8. Develop a realistic action plan to implement a wellness activity or event in one's community.

This project is funded by State of Illinois, Attorney General's Office (Vitamin Anti-Trust Settlement Grant) and U of I Extension.

b. Impact – Select examples of wellness programs developed by participating communities:

"Calhoun County Wellness" Team

- Health Fair: Featuring gourmet health foods, massages, a chiropractor, American Cancer Society and much more! They met their goal of 100 attendees.
- Twelve-week fitness program incorporating yoga, cardio and weights that meets twice/week. They have 19-25 participants per week.

- The fitness program has been so successful they are considering adding a Tai Chi program.

Monticello "Sage Hens Plus One" Team

They developed a community walking program to promote physical activity. The program, called "Trekkin' with Lewis and Clark" encouraged people to accumulate miles toward the goal of accomplishing the 8,000 mile trail three times (24,000 miles).

Participants kept track of their miles and received prizes. About 130 people participated and they exceeded their goal and accumulated 27,540 miles!

Cuba "Spoon River Roustabouts" Team

- They developed entertainment programs, nutrition programs and foot care.

- They are investigating offering a foot care clinic, a memory building clinic and beginning a walking program.

- They also purchased stretch bands and are offering a cooking class focusing on cooking for one or two people.

Additional Evidence of Impact:

- Conference attendees rated the 2003 Senior Wellness conference very high with a mean score of 9.62 out of a possible 10 (on a 10-point scale where 1= very dissatisfied and 10=very satisfied)

- The nine participating communities have implemented a total of 23 new wellness programs and events in the last year.

- Across the nine communities, over 600 total individuals have participated in the wellness programs and events.

  What senior wellness team members say about the program:

- The conference was very fun and interesting! I liked the variety of topics and the enthusiasm of the presenters and participants.

- The educational sessions were interactive and held my interest well.

- The sessions I attended had professionally motivated presenters who had good listening skills and helpful attitudes.

- You can't improve upon perfection. Everything was perfect.

c. Source of Funding – Federal, State

d. Scope of Impact - Illinois

How Natural Environments Enhance Human Functioning: Identifying the Mechanism

a. Progress - This project involves two lines of research examining the mechanism by which exposure to "green" views and settings enhances human functioning. In both lines of research, the findings have provided strong support for the proposed mechanism.

In 2001, three journal articles describing these findings were prepared, submitted, and published. In 2002, an additional article was published in a Special Issue of the Journal of Environmental Psychology, and an invited book chapter describing the methodology used in this work was published in the New Handbook of Environmental Psychology. In 2003, an invited review article summarizing one series of findings was published in the Journal or Arboriculture, and two additional journal articles describing the most recent findings were prepared for submission. One was invited for a special issue in the American Journal of Public Health, and another is in preparation for Science.

b. Impact - The most recent data strongly suggest:

(a) a 20-minute exposure to urban nature is enough to reduce ADHD symptoms, and

(b) the effect of nature on ADHD symptoms holds for children from 5-18 years old, regardless of community size, region of the U.S., or case characteristics. The findings suggest a simple, inexpensive, side-effect-free new tool for managing a disorder afflicting roughly 1 in 20 children in the U.S. today.

c. Source of Funds – Hatch, State Funds

d. Scope of Impact – National

Mycotoxins in Cereal Grains

a. Progress - To prove a causal relationship between the vascular changes and elevated serum concentrations of sphinganine and sphingosine, we examined the in vitro effects of sphinganine, sphingosine, and sphingosine-1-phosphate (S-1-P) on relaxation and contraction of porcine thoracic aorta and pulmonary artery vascular rings.

Our findings indicate that fumonisin-induced systemic arterial hypotension is mediated by increased serum sphinganine and sphingosine concentrations, and suggest that pulmonary artery hypertension is mediated by increased serum sphingosine-1-phospate (S-1-P). The disparate response of thoracic aorta and pulmonary artery to sphinganine, sphingosine, and S-1-P probably reflects relative influences of L-type calcium channels and alpha-1 receptors in different vascular beds.

Similar results were found in vascular rings obtained from Sinclair minipigs fed 10-30 ppm fumonisin B1 for 6 months. To determine the roles of sphingosine and sphinganine in producing cell injury the cytotoxic effects of exogenous sphinganine and sphingosine were evaluated in rat embryonic cardiomyocytes (H9C2[2-1]) and hepatocellular carcinoma cells (HepG2) using the MTT assay. Sphinganine was a more potent cytotoxic agent than sphingosine for both H9C2[2-1] and HepG2 cells. These findings suggest a possible role for both sphinganine and sphingosine in fumonisin B1 induced cardiotoxicity and cell death.

b. Impact - Cardiovascular disease is a major cause of death in adults. Since fumonisins are commonly found in corn, it is important to determine the mechanism of fumonisin induced cardiotoxicity in order to protect human health.

The information obtained will be available for use in risk assessment of fumonisins for human health.

c. Source of Funds – State, Multi-State Research Funds

d. Scope of Impact - GA, IA, IL, IN, KS, MI, MN, MO, ND, NE, PA, WI

Enhancement of Food Lipids for Human Health

a. Progress - Arabidopsis plants were genetically manipulated to alter expression of different isoforms of Acyl Carrier Protein. Several lines of plants have been generated. One set of plants we studied was designed to reduce expression of the major ACP isoform in leaf (ACP-4). There was a dramatic reduction in ACP-4 and reduction of leaf lipid content (22-60%) based on fresh leaf weight. Additionally, there were varying degrees of bleaching of the plants and reduced photosynthetic efficiency. Also, fatty acid composition was affected. Results suggested that ACP-4 plays a major role in the synthesis of fatty acids for chloroplast membrane development. Also, lipid changes have revealed key information about the flow of fatty acids in the metabolic pathways. We have additional Arabidopsis plants generated from manipulation (decrease expression) of two other isoforms of ACP (ACP-1 and ACP-2), with direction of the changes specifically to the seed. Lipid content was reduced 5-40% without affecting fatty acid composition.

We anticipated alterations in carbohydrate and protein in response to reduced lipid accumulation in seeds. However, starch and protein was not significantly affected. Seeds were lower in weight; this is the subject of future research. We have also extended these informative studies into soybean plants. Dramatic reductions in oil content may be achieved through manipulation of ACP levels; this may be used to decrease oil content of agronomically important crops. Also, this may be achieved without major adverse effects on other storage components.

We have conducted significant amounts of research to demonstrate the potential of honey as a source of antioxidants to protect foods from oxidative deterioration and thus protect consumers from the damaging effects of consumption of oxidized food lipids. This has included the demonstration that honey provides protection against oxidative stress in humans. After consumption of honey in water the antioxidant capacity of blood was increased.

We also demonstrated that processing of honey has an impact on the antioxidant capacity and that this impact varies greatly with honeys from different floral sources. Even though the processing reduced antioxidant capacity of certain honeys, the levels of antioxidant capacity observed were still significant in terms of being able to provide protection against oxidative reactions that have been tested previously in our laboratory. We have also begun the formulation of

salad dressings incorporating honey as a source of antioxidants to replace the synthetic antioxidants normally used, such as EDTA. We have screened several honey floral sources and selected four that would be most likely to serve as powerful antioxidants based on antioxidant capacity and phenolic composition.

b. Impact - This basic work on ACP has resulted in the collection of much information about the specific roles of ACP isoforms in plant fatty acid and lipid biosynthesis.

Our work has dramatically impacted plant research by demonstrating the impact of various ACP isoforms in terms of function and regulation. ACP is proving to be an effective tool for manipulation of lipids in plants. This could greatly impact genetic engineering efforts for creating new plant oils.

Our laboratory has significantly advanced the scientific basis for using honey as a healthy food/ingredient. This has received enormous attention from industry and consumers. Honey as a source of antioxidants has demonstrated effectiveness at preventing food lipid oxidation (a major food deterioration problem) and as a potential dietary antioxidant to enhance human health. This will be of benefit to consumers and to the food industry.

c. Source of Funds – Hatch, State, Industry Funds

d. Scope of Impact – National

Component Interactions for Efficacy of Functional Foods

a. Progress - This program has nine projects: four research, two education, and three outreach. Three institutions and one USDA-ARS lab are collaborating. Four foods are targeted.

Soy: Content of estrogenic isoflavones varied five-fold in 11 soybean types at five locations with a genotype x location interaction.

Estrogenic effects of dietary plant sterols were tested in estrogen-dependent breast cancer cells in culture and in mice. Whereas sterols stimulated growth in culture, there was no effect of dietary sterols in mice. There may be potential benefit to dietary sterols for post-menopausal women without risk of stimulating breast cancer.

Berries: 14C labeled berry and grape cultures were fractionated. Compounds with chemoprotective properties have been identified in wild blueberries. Fractions containing sterols and flavan-3-ols protected against cancer initiation. Fractions rich in proanthocyanidins demonstrated antipromotion activity.

Broccoli: Genetic variability suggests that traditional breeding can enhance antioxidant capacity and cancer protection. A clinical study of high Se broccoli has 22 of 30 healthy men enrolled or completed. In cultures, Se and sulforaphane increased thioredoxin reductase activity synergistically. Se is required for activity; sulforaphane transcriptionally upregulates thioredoxin reductase synthesis via the antioxidant response element.

Tomatoes: Specific carotenoids were produced in tomato culture by inhibiting enzymes in the carotenoid pathway. Aglycone polyphenols inhibited proliferation in liver and prostate cancer cells while glycone polyphenols had no effect. Combining both produced additive inhibition of growth. Metabolism and tissue distribution of radiolabeled (14C) lycopene showed prostate tissues exhibited unique metabolism of ingested lycopene.

Education: The Research into Food and Health information site (http://web.aces.uiuc.edu/ifafs) was initiated. It promotes communication among researchers and informs consumers about research and educational projects on the four foods. A Functional Foods Learning Center has consumer-based information including color handouts for consumers and a streaming video.

Extension and Outreach: A web-based training program on functional foods and cardiovascular health has been developed with 6 modules: Introduction, Soy, Tomatoes, Oats, Cholesterol Lowering Margarines, and Fatty Fish. Registered dietitians who complete the program gain continuing education credit and can access a kit for use in consumer education. The kit includes a 30-minute slide show with script, handouts, resource list, and tips for using functional foods. A nation-wide survey of oncology nurses had a response rate of 64% with 513 validated questionnaires.

This research, which revealed a very low level of knowledge in the area of functional foods and dietary supplements, is being used to shape a second web-based program on functional foods and cancer, and the associated media kits that will be provided to nurses for communication with patients.

b. Impact - Health effects of semi-purified or purified dietary supplements may not always reflect effects of the foods from which they were extracted. Because dietary supplements are regulated as foods, there is an error in the popular assumption that whole foods and isolated bioactive components act similarly. This assumption could impact the health and safety of the consumer.

c. Source of Funds – CSREES Grant Funds

d. Scope of Impact – National

Key Theme – Human Nutrition

Also see Camp Clover under Goal 5, Key Theme – Youth Development/4-H

Youth Cooking Schools

a. Cooking Schools have taught basic nutrition, food safety and food preparation to youth between the ages of eight and 12 years. Directed toward low-income youth, the educational campaign is conducted at no cost to the children.

In the past three years, more than 30,000 youth have participated in more than 400 schools; each school consisting of five half-days of hands-on educational activities.

Getting children involved with food is an effective way to improve eating habits and health. Hands-on cooking experiences can expose children to new foods, teach them about healthful eating and develop their sense of self-efficacy. This experience increases the likelihood of a change to better eating habits. Plus, according to the young cooks, "It's lots of fun!"

Cooking Schools are a collaborative effort. For instance, a retired chef from Marriott donates his time at one site in Peoria. And all the programs have achieved a high degree of visibility and success in their communities.

Outcomes have been determined by pre- and post-tests. After participation in the program, more children reported following safe food practices, preparing food items and selecting foods according to the Food Guide Pyramid. Typical outcomes (summarized across multiple sites and two years of pre- and post-tests) include: over 18

percent showed increases in knowledge about how bacteria can cause food poisoning. On average, 12 percent gained knowledge on how to avoid cross-contamination of food. In 2000 study more than 20 percent increased their post-test score in their ability to safely handle ground meet. The increase in youth who can correctly identify the number of servings of bread and cereals, fruits and vegetables and meat and meat alternates was statistically significant across sites and years. Youths showed a statistically significant average gain of two points on the post-test after the program. Over two-thirds (68 percent) showed a gain in post-test scores over pre-test scores.

More recent schools have emphasized the role of activity increase a child's health and combating childhood obesity.

b. Impact – Sixty-eight percent of youth show gain in food safety, nutrition and preparation tests

c. Source of Funds - Federal, State, Local

d. Scope of Impact – Illinois

Nutritional Adequacy of Food Selections of Hospitalized Patients

a. Progress - We are analyzing the data from our study on the impact of traditional a la carte meal selection approach in the hospital environment compared to a novel limited alternative structured diet. Primary outcomes are nutritional adequacy and patient satisfaction.

Our data demonstrate that overall patient satisfaction remained high and was similar between the ala-cart and structured diet. Patient's perceptions of meal variety were minimally diminished with the more restrictive diet approach. Perceptions of quality appeared to increase. Assessment of portion sizes remained essentially unchanged. We are proceeding with analyzing data concerning actual food consumed with both menu/diet selections. We are examining whether the patient's perceptions of satisfaction, variety, quality, and portion size are reflected in actual food consumption. In addition, we are examining the comparative nutritional adequacy of the two diet approaches.

b. Impact - Assessment of the nutritional adequacy of diets provided in the hospital is important as meal selection options change due to nutritional and non-nutritional factors. Furthermore, it is important

to understand the impact that these changes have on the quality of the diet consumed by patients in the hospital. This knowledge will allow for the design of nutritionally optimal diets with high patient satisfaction ratings.

c. Source of Funds – Hatch, State Funds

d. Scope of Impact – National

Key Theme – Infant Mortality

Impact of Dietary Fat Composition on Intestinal Function of Neonates

a. Progress - Research at Illinois is studying the effect of long chain polyunsaturated fatty acids (LCPUFA) on neonatal intestinal development. Necrotizing enterocolitis (NEC) is a life-threatening gastrointestinal disease that affects 10% of infants weighing <1.5 kg. Clinical studies demonstrated that supplementing infant formula with the LCPUFA, arachidonic (AA) and docosahexaenoic acid (DHA) reduced the incidence of NEC in preterm infants; however, the underlying mechanisms are not fully understood.

We investigated the impact of supplementing formula with LCPUFA on intestinal morphology, barrier function and proinflammatory cytokine expression. We successfully induced NEC-like responses in neonatal piglet intestine as indicated by reduced villus height and mucosal barrier function and increased PGE2 abundance. However, the acute nature of the insult (3 hours in duration) may have been insufficient to induce an inflammatory response as no effect of NEC on cytokine mRNA expression or MPO protein abundance, a marker of neutrophil activation, was observed. Thus, in this animal model, incorporation of DHA into intestinal brush border membranes did not reduce the severity of NEC.

We are currently establishing a piglet NEC model that more closely approximates the clinical scenario of NEC in the premature human infant in order to further test our hypothesis that DHA incorporation will reduce the inflammation associated with NEC.

b. Impact - In 1995, 11% of U.S. infants were born prematurely. These infants are at risk for the development of necrotizing enterocolitis (NEC).

Clinical studies as well as data from a rat pup model of NEC has shown that long chain polyunsaturated fatty acids reduce several markers of intestinal inflammation and the severity and incidence of NEC. The Food and Drug Administration recently approved the addition of AA and DHA to infant formulas.

Our data show that feeding AA and DHA at similar levels to those in infant formulas increases the incorporation of DHA into intestinal membranes without altering normal intestinal development.

c. Source of Funds – NRI Competitive Grant Funds

d. Scope of Impact – National

Key Theme – Medicinal Plants

Modeling Plant Cell Culture Systems for Bioactive Product Recovery and Analysis

a. Progress - We have achieved radiolabel enrichment of flavonoid-containing fractions from two plant cell culture production systems, and have separated the product into 14 subfractions containing 1) primarily anthocyanins (grape cell cultures) and 2) primarily oligomeric and polymeric proanthocyanidins (ohelo berry cell cultures). By elevating the levels of 14C sucrose in the cell culture broth to 5 millicuries/L, sufficient levels of enrichment were achieved for animal testing. Oligomeric and polymeric proanthocyanidins from both cell cultures and in vivo fruits were highly active in antiproliferation (MTS) assays.

b. Impact - Our most recent achievement has been the semi-purification of intact proanthocyanidins and mixtures as they occur in situ, which permits definitive assessment of levels of potentiating interactions between flavonoid compounds in modulation of biological functions.

c. Source of Funds – Hatch, State, Public Health Service Funds

d. Scope of Impact - National

Factors Affecting Production of Phytomedicinal Chemicals by Plants

a. Progress - Phytochemical analyses were conducted with greenhouse grown Kava (Piper methysticum) plants as well as plants that were

regenerated from tissue cultured cells. For this medicinal plant, a family of strylpyrones called kavapyrones are responsible for the medicinal, sedative action of root extracts.

Analysis of kavapyrones from the arial and the root portions of Kava plants demonstrated that for the arial region (leaves, petioles, stem) the kavapyrones were enriched in reduced forms including dihydromethysticin and dihydrokavain whereas for roots the oxidized forms, kavain and methysticin were enriched. Elevation of these oxidized kavapyrone forms may be important for the medicinal action of root extracts as compared to other regions of the plant which are not used medicinally. For tissue cultures established from leaf explants, analysis of kavapyrones indicated that the total amount of kavapyrone production relative to in vivo roots was very low, and that the levels of different kavapyrone types were similar to the pattern observed for leaf tissue. This pattern remained as these cultures were put through the regeneration process up to the final stages. Hence, a leaf-type pattern of kavapyrones was observed for organogenic cultures and microshoots. Only at the later stages when true roots were developed in plantlets did a pattern of kavapyrone production similar to what is observed for in vivo roots develop. Regenerated plants grown for 1 month only displayed levels of kavapyrone production in root extracts that were less than 10% of that found for in vivo plant roots.

Work is currently in progress to determine if additional growth of regenerated plants led to increases in the level of kavapyrone production with regenerated plants. With kava tissue cultures, experiments were conducted to determine if treatments with different elicitors (acetate, salicylic acid, jasmonic acid, GABA) could cause increased kavapyrone production. Of the compounds tested, only GABA and acetate caused an overproduction of kavapyrones. Using microsatellite (ISSR) molecular markers, the tissue culture/regeneration system was also examined for its potential to increase genetic variation in Kava via somaclonal variation. Based upon differences in the pattern of molecular markers it was found that growth of Kava cells in tissue culture did result in an increase in the genetic variation of these cells.

b. Impact - There is widespread world interest in the use of Kava as a medicinal plant. Extracts of kava have a sedative action similar to benzodiazepine drugs but without problems of addiction. Production of kava as a medicinal plant is limited by the slow growth of this shrub and the plant is sterile.

With the sterility of kava, production of plants with improved characteristics is not possible through conventional breeding methods. Tissue culture and plant regeneration provide alternative means for kava medicinal production, propagation and genetic improvement of this plant. However, for this approach to be useful the tissue culture produced plant materials must have the appropriate levels of active phytomedicinal chemicals. The phytochemical analyses conducted in this study indicate that while the initial tissue cultures did not have the appropriate combination of kavapyrones to be medicinally active, the roots of young regenerated kava plants do have an appropriate combination of active kavapyrones but at levels which are much lower than what is observed for roots of in vivo plants. Additional growth of these regenerated plants may be necessary for increased levels of active phytochemicals.

Given the sterility of Kava, genetic modification of this plant is not possible through conventional breeding/selection methods. The molecular marker studies conducted here suggest that tissue culture based somaclonal variation could provide a means for increasing the genetic variation of this plant which could lead to useful traits being identified through selection.

c. Source of Funds – Hatch, State Funds

d. Scope of Impact – National

CSREES GOAL 4 – Greater Harmony Between Agriculture and the Environment

Indications of the Scope of Research and Extension Programs under Goal 4 - See Appendix A.

Last year the College had 77 research projects under this goal with an investment of 25 scientist years and more than 87 technical and support staff. Paid U of I Extension staff reported more than 161,000 face-to-face teaching contacts, a slight increase over 2003.

Key Theme – Agriculture Waste Management

Animal Manure and Waste Utilization, Treatment and Nuisance Avoidance for Sustainable Agriculture

a. Progress - An extensive survey of the program year 2002 participants of the Illinois Certified Livestock Manager Training workshop series was conducted to evaluate effectiveness of the training on livestock producer's management skills and practices. Survey results indicated several areas of impact and some points that need to be refined in the training.

A project to develop thermochemical conversion of swine manure solids into crude oil product was expanded. Laboratory scale continuous flow processing hardware was built and tested. On-farm controlled-experiment evaluations of several processes and technologies were evaluated including: (1) large concentric dedusters (dust removal equipment) for swine facilities, (2) activated carbon filtration for ventilation air, (3) room washing effects on odor and emissions, and (4) shallow pit flushing frequency effects in farrowing rooms.

b. Impact - Livestock producer training for environmental stewardship was refined and the impacts of training in Illinois were evaluated.

Thermochemical conversion of swine manure solids to crude oil product shows considerable value-added potential to swine producers, as well as great environmental protection benefits (80% volatile solids reduction in swine manure, reduced odor) once commercial scale processors can be built and deployed in the state.

On-farm evaluations of equipment and technologies will enable farmers to select the best odor and emissions controls while containing production costs.

c. Source of Funding – State, Multi-State Research Funds

d. Scope of Impact – AL, AR, CA-D, CO, FL, GA, GU, HI, IA, ID, IL, IN, KY, LA, MI, MN, NC, OH, PA, SC, TN, TX, VA, WI

Key Theme- Pesticide Application

Pesticide Safety and Education Program (PSEP) for Private Applicators

a. During the 2004 fiscal year 6,979 individuals were served by the 109 University of Illinois Extension training and testing clinics. In addition to on-site evaluations conducted at many clinics, a detailed practice change survey was developed.

From the 8,945 Private Applicators who were certified or re-certified during the 2002-2003 training season, 600 individuals were randomly selected to participate in this survey. Participants were asked demographic information as well as how much they improved in seven key areas:

1) Reducing pesticide exposure to yourself
2) Worker Protection Standard compliance
3) Protecting environmentally-sensitive areas
4) Calibration and application procedures relating to accuracy, uniformity, and drift
5) Pest control decision-making
6) Storing and protecting pesticides
7) Restricted Use Pesticide application record-keeping compliance.

In total, the mailed survey tool included 50 questions and the effective response rate was 70%. **Of those reporting attending Extension sessions – more than 93 percent reported improvement on one or more practices as a result of the Extension session they attended.**

b. Impact – More than 6,400 private applicators improved pesticide safety practices as a result of participating in an Extension sponsored session.

c. Source of Funding – Federal, State

d. Scope of Impact – Illinois

Pesticide Safety and Education Program (PSEP) for Commercial Pesticide Applicators

a. Commercial pesticide applicators are required to be certified and to be re-certified every three years. University of Illinois Extension works cooperatively with the Illinois Department of Agriculture to provide training clinics for both private and commercial pesticide applicators. University of Illinois Extension's stake in these clinics extends beyond merely enabling the participants to pass the examination. These clinics are use to promote safe practices and best practices in pesticide application.

Pesticide Training and Certification Clinics for commercial applicators and operators were conducted at 29 sites during the months of November 2003 through May 2004. At these meetings, 7,932 commercial applicators and operators were trained. In addition to General Standards (core) Training, Category Training was offered in the areas of Field Crops, Turf, Ornamentals, Rights-of-Way, Aquatics, Plant Management, Seed Treatment, Demonstration and Research, Mosquito, and Grain Facility. Bilingual General Standards workbooks in Spanish and English are provided for Hispanic clientele.

b. During the spring of 2003, a sample of 500 participants in that spring's training clinics were asked to complete a mail survey. Fifty-one percent responded. Participants were asked about 15 key practices for environmental and personal safety. Ninety-three percent reported making some or great improvement in at least one practice. More than 80% reported improvement on five or more practices.

Specific practice areas where participants improved (some or great improvement) included:

67.5 % - Pest control decision-making (IPM techniques)
67.4% - Including non-chemical methods of control
66.3 % - Identifying environmentally sensitive areas before making a pesticide application
65.6 % - Increasing the frequency of calibration

63.1 % - Application procedures (relating to accuracy, uniformity, drift)
61.1 % - Calibration procedures

Generalizing these results to the 7,932 applicators trained during FY2004 means that more than 6,300 applicators improved on five or more practices.

c. Source of Funding – Federal, State

d. Scope of Impact – Illinois

Key Theme – Air Quality

Indoor Air Quality for Livestock Buildings

a. Progress - Within this air quality program, progress has been made in several projects. An aerodynamic deduster (a device to reduce dust particulate matters in airstreams) has been developed for livestock building exhaust air. Based on the same principle, several prototypes are under development for combines and off-road vehicles to clean the engine intake and cooling air. The research group has also developed a unique total suspended particle sampling (TSP) system for the measurement of aerial pollutant emissions from confinement livestock buildings. This system utilizes a critical flow rate controller and isokinetic sampling heads to ensure accurate sampling efficiency. The sampling system has been adapted by 8 other states in their emission studies. Particle size distribution study from different livestock buildings are in progress.

b. Impact - Indoor air quality has a profound impact on quality of life and our economy. Increasing concern of indoor air quality is largely contributed to the awareness of poor health, the so called sick building syndrome (SBS). The SBS of the building inhabitants can be defined as the illness and discomfort associated with poor indoor environments but with no clear identification of the source substances. Symptoms of SBS include irritation in sensory organs (eyes, noses, throat, ears and skin), fatigue, headache, respiratory disorder and nausea.

Approximately one million buildings in the United States are sick buildings, within which 70 million people reside or work (Cone and Hodgson, 1989). These sick buildings do not include agricultural buildings such as animal facilities and grain elevators. Most of these

agricultural structures have unique, often more serious, air quality problems.

c. Source of Funding – Hatch, State, Public Health Service Funds

d. Scope of Impact – National

Key Theme – Forest Resource Management

Emerging Needs and Opportunities for Wildlife Management in the Forested Lands of North America

a. Progress – The second year of the research was directed to elk nutrition and habitat use in relation to common silvicultural practices on privately held timberland in the Pacific Northwest. Selected regions in Oregon and Washington were identified as study areas. Randomized plots were selected and visited for characterization of habitat (e.g., plant structure, species composition, and plant nutrients). A captive elk herd was constrained to forage in representative plots to consider animal nutrition and condition relative to habitat characteristics. On-site habitat features were also characterized with remotely sensed data for subsets of study areas and plots. A radiotelemetry study of wild elk was also initiated to describe habitat use and foraging preferences in selected settings.

b. Impact – The project will ultimately (1) apply indices of nutritional forage conditions in the study areas to predict body condition and productivity of wild elk utilizing these areas; and (2) help determine the inherent capability of a given landscape to support elk based on forage conditions.

c. Source of Funding – McIntire-Stennis, Non-Federal Funds

d. Scope of Impact – National

Long-Term Ecological Processes in Riparian Forests

a. Progress – A long-term study of growth rates of silver maple in flood plain environments has been conducted on a variety of sites in central and southern Illinois and in western Kentucky. Study sites span almost 400 miles on a longitudinal gradient and include locations on the Illinois, Mississippi, Ohio and Wabash Rivers.

Results show average annual growth rates for the 10-year period of 1.45-1.59 cm for the 20-30 cm size class on the southernmost sites and 0.95-1.10 cm for the northernmost sites. Short duration (2-3 week) flood events in the spring months of February, March or April resulted in a 15-20 percent growth increase on average.

b. Impact – Knowledge of flood plain forest productivity has direct input on forest planning for timber production and income potential for private landowners.

c. Source of Funding – McIntire-Stennis, State Funds

d. Scope of Impact – National

Ecology of Forest Snakes in Agricultural Landscapes

a. Progress – The fieldwork begun in the Cache River State Natural Area in southern Illinois was continued. The goals were to capture black rattlesnakes and blue racers as they emerged from hibernation sites, implant a subset of these with radio transmitters, radio track the snakes through the active season, obtain data on snake body temperatures, and to continue quantifying the habitat used by the snakes. Substantial progress toward meeting all these goals was realized.

We captured 99 racers and 54 rattlesnakes. Transmitters were implanted into 7 rattlesnakes (in addition to the 11 individuals implanted in 2002) and 12 racers. Snakes were located every 48 hours through the spring and summer, and twice a week beginning at the end of September. Eight snakes were lost during the summer, two due to transmitter failure and the rest to predation. The remaining snakes were tracked until they went underground, which occurred between October and mid-November.

Tracking in 2003 yielded approximately 950 snake locations and approximately 75,000 body temperature measurements. Habitat variables were quantified at every second new snake location (approximately 420 thus far), and at randomly selected locations (approximately 200 thus far). Two female rattlesnakes and three female blue racers were captured while gravid and laid eggs in the lab. Those eggs were incubated and blood samples collected before releasing the hatchlings. Overall, therefore, substantial progress was made on all major objectives.

b. Impact – Agricultural landscapes are characterized by both decreases in the area of original habitat and fragmentation of the original habitat that remains. Preserving biodiversity in natural habitats within agricultural ecosystems requires an understanding of how individual species respond to habitat reduction and fragmentation and how those responses affect their interactions with other species.

There is abundant evidence documenting the decline of forest birds in fragmented forests, and increased nest predation is often implicated as a proximate cause of the decline. Snakes are the most important avian nest predators in forests in the Midwest, and the snakes' preference for edge habitats may increase their impact on birds nesting in fragmented forests.

By determining how black rat snakes respond to habitat fragmentation and how this affects nest predation of breeding birds, it will be possible to assess the impact of potential habitat management practices on the abundance and distribution of snakes, and thus on nesting birds.

c. Source of Funding – Hatch, State Funds

d. Scope of Impact – National

Key Theme – Global Change and Climate Control

The Role of Ethylene in Ozone-Induced Damage to Photosynthesis

a. Progress - Ozone is one of the most prevalent and phytotoxic air pollutants. Data of the U.S. EPA indicates that rural ozone pollution decreases soybean yields 10-20% on average in Illinois. Identifying and/or developing soybean varieties that are resistant to ozone-induced damage would result in economic gains for farmers. One well-known response of plants to ozone is increased production of the plant hormone ethylene. This is associated with loss of photosynthetic capacity and accelerated senescence. The exact mechanism of ozone-induced damage to photosynthesis and the role of ethylene in the damage induction pathway are unclear.

There appears to be a correlation between increased ethylene production and increased ozone-induced damage, so cultivation of ethylene insensitive soybean mutants or germplasm may result in greater yields under current and future ozone levels. In addition,

there may exist natural variation in ozone tolerance within soybean germplasm.

An ethylene-insensitive mutant strain of soybean (T119N54) was significantly less affected than the wild type from which it was derived (cv. Hobbit) in repeated and replicated short-term exposure to ozone in controlled environments. During growth in the field within the SoyFACE (www.soyface.uiuc.edu) research facility, there was no difference between the wild type and mutant.

To resolve this difference the experiment was repeated in the 2003 SoyFACE experiment. One plot within each of four blocks was exposed to elevated ozone, raised 122% above the continuously measured ambient in one control plot within each block. Treatment was from emergence to maturation of the crop. Eighteen germplasm lines were tested including T119N54 and cv. Hobbit. Although the elevation of ozone decreased biomass production and grain yield in all germplasm, the decreases in the cv. Hobbit and its mutant were similar and not significantly different. In both genotypes there was an acceleration of senescence, as tracked by leaf chlorophyll content. The results indicate that the protection observed in short-term chamber experiments does not translate to field conditions or that ethylene may have longer term effects which defend the plant against ozone, e.g. decreased stomatal conductance or increased capacity for active oxygen metabolism. Significant differences in the responses of photosynthesis and production to ozone were found among some of the other soybean germplasm. A characterized mutation is only available for one locus involved in ethylene sensing in soybean, however several are available in Arabidopsis. Arabidopsis ecotypes and mutants were grown within the SoyFACE experiment in 2003. Although senescence was similarly accelerated in Arabidopsis, analysis of steady-state mRNA levels indicate an increase in transcripts associated with delayed senescence, implying a response by the plant to counter the accelerated senescence induced by ozone.

b. Impact - Rural ozone pollution is estimated to be decreasing Midwest soybean yields by 10-20%. Previous studies indicate ethylene insensitivity may lead to ozone insensitivity; therefore, ethylene insensitive mutants or lines may be useful in developing soybean varieties resistant to ozone.

We have tested one mutant under open-air elevation of ozone, simulating the future increased ozone levels forecast for the region

over two growing seasons. This mutation failed to show protection in the field in contrast to short-term laboratory studies. However, analysis of Arabidopsis gene expression indicates that factors delaying senescence are protective responses. Although mutation did not protect soybean in the field, the results with Arabidopsis indicate that tests with mutations for all sensing and production loci would be valuable and provide clues to identifying variation in tolerance within the germplasm that could be exploited in breeding.

c. Source of Funding – Hatch, State Funds

d. Scope of Impact - National

Key Theme – Hazardous Materials

Mediating Exposure to Environmental Hazards through Textile Systems

a. Progress – At Illinois, work was done on selection of challenge liquids for testing barrier efficacy of chemical protective clothing materials for the development of performance specifications. Also, work was done to develop alternate methods of measuring repellency, retention, and penetration of challenge liquids and pesticides in protective materials.

The gravimetric method was refined and tested. It is a simple, less costly, and less time intensive method, yet it showed good correlation with gas chromatographic method of chemical detection. Based on the alternate method (gravimetric) predictive models were developed to assess the barrier properties of woven and non-woven fabrics used for chemical protective clothing.

We validated the predictive models by comparing actual laboratory data with the calculated data from the predictive models. Also, an inter-laboratory round robin test using the gravimetric method was conducted in conjunction with the submission of a Standard Method Proposal, ISO/DIS22608 to the International Standards Organization (ISO). The participants of the round robin test were the laboratories of Illinois, Maryland, New York, Spain, and India.

b. Impact – Work done at Illinois provides systematic and critical knowledge about the protective efficacy of various textiles and polymeric film systems used in the making of protective clothing.

Also, the predictive models developed in our laboratory are a major contribution to the industry-wide use of standard procedures for screening of newer protective clothing and materials.

c. Source of Funding – State, Multi-State Research Funds

d. Scope of Impact – CA-D, CO, IA, IL, MD, MI, MN, NE, NYC, OK

Key Theme - Integrated Pest Management

Crops Workshops - Northern Illinois Crops Training Center

a. University of Illinois Extension educators work closely with Department of Crop Sciences researchers in developing and maintaining more than 20 replicated research plots at Department of Crop Sciences/Agricultural Research & Demonstration Centers, on farm locations and joint efforts with community junior colleges. These same centers provide the opportunity to provide hands-on education to grain producers and crop input suppliers.

During 2004, three workshops were held during the growing season at the Northern Illinois Crops Training Center. These workshops focused on different issues pertaining to crop development, crop production and field crop pests. Similar workshops have been held over the last four years. The workshops incorporated formal presentations, field exercises and hands on exercises for all participants. Attendance for the past four years totals more than 460 participants.

A mail survey of those attending the 2004 workshops had a 67 percent response rate. Respondents could identify themselves in multiple ways: 49 percent checked "seed dealer," 37 percent "crop consultant," 22 percent "producer," 22 percent "chemical dealer," 21 percent "fertilizer dealer," and six percent "farm manager."

b. Impact – Producers and farm managers reported growing 150,971 acres while ag dealers and consultants reported servicing more than 1.2 million acres of crops.

Total of 1,350,000 acres impacted

The percentage of respondents "strongly agreeing or agreeing" to each item for the three workshops were:

Met my expectations averaged 96%.
Increased my knowledge averaged 94% over six items.
Provided useful information average 97%.
Provided hands-on learning averaged 86%.
Would recommend to others averaged 97%.

c. Source of Funding – Federal, State

d. Scope of Impact - Illinois

Multi-State Soybean Aphid Management Workshop

a. During the 2003 growing season, soybean aphids created considerable concern for soybean growers due to their numbers in the field and the potential damage they may have done. There were many questions from growers and agri-business on managing this problem and at what level of infestation was a treatment justified. Natural enemies in a field help reduce aphid populations, so natural enemy populations had to be taken into account when a treatment decision was made. Will the problem repeat itself in 2004? This is a question on the minds of a lot of people.

To help both soybean growers and agri-business gain an understanding of the biology of this pest, potential yield loss associated with this pest, field monitoring (where and when) and making treatment decisions, an in-depth workshop was held using distance education. The workshop was a four-state effort involving Extension entomologists from Illinois, Iowa, Minnesota, and Wisconsin sharing research information on field monitoring, treatment thresholds and timing of treatment for maximum benefit.

The utilization of distance education technology is an excellent example of how producers and specialists from other states can be brought together in an educational setting. Distance education technology allowed Illinois farmers and agri-business personnel to benefit from the expertise of specialists from other states.

The workshop was delivered to 61 sites in the four states. The sites were hosted by Extension personnel at all locations. Approximately 800 people listened to the program while PowerPoint slides were projected over the Internet or from CD-ROM. The audio portion of the program was taped for later, requested use. Because of the demand for the PowerPoint slides after the program, the slides have been made available on the University of Illinois' IPM Web site at:

http://www.ipm.uiuc.edu/fieldcrops/insects/soybean_aphids/workshop/index.html

b. Impact – In a survey of participants:

92% of respondents indicated that the information presented helped them better understand pest management options for soybean aphids.

91% of respondents indicated that they would scout their fields for soybean aphids because of the information presented at the workshop.

72% of respondents indicated that they would change or adopt a pest management practice for soybeans the following growing season.

c. Source of Funding – Federal, State

d. Scope of Impact – Illinois, Iowa, Minnesota, Wisconsin

IPM Technique Benefits Apple Producers

a. Apple production is among the most pesticide-intensive crops. The economic survival of more than 350 commercial apple growers in Illinois, with approximately 6,000 acres of orchards, is threatened by crisis over pesticide use. The standard control procedure for summer apple diseases is to spray trees with fungicides six to eight times until approximately two weeks prior to harvest.

Between 2001 and 2004, 14 orchards in Illinois compared the standard procedure to a weather-based, disease-warning system which uses Integrated Pest Management (IPM) principles. The amount of fungicide required was dramatically less for the IPM method. Many apple growers have already begun implementing IPM techniques realizing that utilizing these methods can cut costs by 48%, pose less risk to the environment and human health, and delay development of resistance to fungicides while protecting fruit yield and quality.

b. Impact – Pesticide usage reduced by 48 percent in 14 orchards
- Reduced environmental and human exposure to pesticides
- Delaying the resistance to fungicides

c. Source of Funding – Federal, State

d. Scope of Impact - Illinois

Genetic Variability in Heterodera Glycines

a. Progress – The objective of this research is to determine whether the soybean cyst nematode can be managed by modifying the gender of the organism. Parasitism by females of Heterodera glycines, the soybean cyst nematode (SCN), is responsible for most of the soybean yield losses attributable to H. glycines. Males feed for only a short time during their development before they exit the root. Therefore, if SCN juveniles can be induced to become males rather than females, their potential for plant injury would be reduced. To determine whether currently used sources of resistance (soybean Plant Introductions [PI] 548402, 88788, 90763, 437654, 209332, 89772, and 548316) influence sex ratios in SCN, inbred lines of the nematode characterized by zero or high numbers of females on resistant soybean were used to observe the number of adult males produced.

Nematodes were allowed to infect soybean roots for 5 days in pasteurized sand. Infected plants were washed and transferred to hydroponic culture tubes. Males were collected every 2 to 3 days up to 30 days after infestation (DAI), and females were collected at 30 DAI. Resistance that suppressed adult females also altered adult male numbers. On PI 548402, 90763, and 437654, male numbers were low and close to zero, whereas on PI 88788, male numbers were higher.

In a separate test, the same PI were infected by an inbred line that tested as an HG Type 0 (i.e., the numbers of females that developed on each PI were less than 10% of the number that developed on the standard susceptible soybean cultivar Lee). In this test, male numbers were similar to female numbers on PI 548402, 90763, 437654, and 89772, whereas male numbers on PI 88788, 209332, and 548316 were higher than those of females. In all tests, the total number of adults that developed to maturity relative to the number of second-stage juveniles that initially penetrated the root was significantly less on resistant than on susceptible soybean, indicating that host resistance and not sexual development influences H. glycines survival.

b. Impact – This research shows that attempts to shift soybean cyst nematode populations to increase the proportion of males (which do

not damage soybean plants to the extent that females do) cannot be accomplished with currently available resistance.

Unlike some other important plant-parasitic nematode species, sex of the soybean cyst nematode is not influenced by host resistance. These results are important in developing strategies to manage the soybean cyst nematode.

c. Source of Funding – Hatch, State, Industry Funds

d. Scope of Impact – National

Dynamic Soybean Pest Management for Evolving Agricultural Technologies and Cropping Systems

a. Progress – Soybean aphid densities in Illinois during the 2003 growing season were at their highest since the initial detection of this insect in 2000. In many parts of the state, populations reached economic levels for the first time. On April 23, hundreds of soybean aphids were observed on buckthorn (Rhamnus cathartica), the overwintering host; aphids were first observed on soybeans in northeastern Illinois on May 29.

A suction trap network has been operating since 2001 and was expanded from 8 traps to 9 this year. This network has proven to be an important tool to monitor the movement of winged forms of soybean aphid. The first captures of winged aphids in suction traps occurred during the week ending July 11 at three locations in northern Illinois. Winged aphids were common in soybeans by the middle part of July. The highest number of soybean aphids captured in one week was 6,755 during the last week of July at DeKalb in the northeastern portion of the state. During the first week of August, heavy infestations of soybean aphids were common in east-central Illinois soybean fields. Suction trap captures of up to 1,500 aphids per week were detected at three trapping locations across the central portion of the state during the week ending August 15. During the third week of August, densities were highest in southwestern Illinois at the Brownstown locations, which captured 4,113 aphids compared to only 264 in DeKalb. Seven of the nine traps in the network captured over 100 aphids in at least one week in 2003.

This is a significant increase in aphid density over the previous two trapping seasons which had highest weekly captures of 800+ in 2001 and only 41 in the 2002 season. Conversely, aphid captures during

September and October were higher in 2001 and 2002; almost no winged aphids were captured in the fall in 2003. Summer trap captures have allowed tracking and prediction of aphid buildup in soybean fields following a north-south gradient. We may be able to predict the severity of a regional infestation in the following year based on fall trap captures.

Other goals of this project are to develop guidelines for managing soybean aphid, including insecticide recommendations and the development of soybean aphid-resistant varieties. Insecticide efficacy trials showed all products tested gave good initial control; however, Nufos provided the greatest residual control of soybean aphid. Screening of soybean germplasm for resistance to soybean aphid found four new accessions (Sugao Zarai, Sato, T260H, and PI 230977) with resistance to soybean aphid. Additional studies were completed to determine in detail the effects of resistance on aphid biology. Aphid fecundity, longevity, and maturation rate were decreased dramatically on resistant soybean lines. Chemical analysis showed the concentration and constitution of flavonoids in soybean leaves may be associated with aphid resistance/susceptibility. Several hundred crosses were made between aphid resistant and susceptible cultivars; hybrid plants are currently producing seed in the greenhouse.

b. Impact – Based on estimates from the Illinois Agricultural Aviation Association and reports from U of I Extension personnel, we believe as many as 1 million acres of soybeans were treated with an insecticide to control soybean aphid in Illinois in 2003. This represents 10% of the total soybean crop. This translates to approximately $12 million in treatment costs.

Many of these treatments were likely unnecessary because of low aphid densities or because of natural declines in populations; however, it is also likely that many fields suffered yield losses due to lack of treatment. These studies are aimed at improving treatment guidelines and providing additional tools for management and control of soybean aphid.

c. Source of Funding – Multi-State Research Funds

d. Scope of Impact – AR, GA, IA, IL, IN, KS, KY, LA, MI, MN, MO, ND, NE, OH, TN, TX, VA, WI

Key Theme – Soil Erosion

Tillage Seminars

a. Best management practices are critical to limiting soil erosion and preventing water problems. Regional tillage seminars are held annually throughout Illinois. Over the past three years more than 1,100 participants have attended. Typically three-fourths to two-thirds of the participants are farmer owner/operators. The remaining participants are agribusiness and agency staff.

b. Impact – Total number of participants over three years – in excess of 1,100.

Typical results are that all participants rate the seminars as “good” to “excellent.”

Typically, all will rate the program as useful to very useful.

As a result of attending one of the seminars this past February, 44 percent of the farmer/owner operators reported intentions to make changes in their farming operations. At the top of the list was "use more strip-till" and "trying one of the light tillage tools."

c. Sources of Funding – Smith-Lever, State and Local

d. Scope of Impact – Illinois

Key Theme – Natural Resources Management

Ecosystem-Based Management for Agricultural and Natural Lands in Illinois

a. Progress – This project continues to provide research results and practical applications for ecosystem-based management in disturbed landscapes. The project focuses on social dimensions of watershed planning and land management. In most cases, watershed committees need to employ several different methods for acquiring useful socio-economic data. One technique is to collect primary data from first hand sources using a variety of surveys and/or interviews. Other socio-economic data already exists as secondary data, or data that has already been compiled by other sources for a variety of purposes. The U.S. Census Bureau data is a good example of secondary socio-economic data. The Census Bureau generates

statistics based on several divisions of land area. These divisions are based on population and include county, census tract, and census block groups. However, the census data is most often available and presented on the county scale. Due to the irregularity of watershed boundaries, it has been difficult for watershed planning groups to use Census Bureau data that is generated by counties.

We developed a model demographic and socioeconomic profile and are in the process of producing profiles for all Illinois Department of Natural Resources Ecosystem Partnerships. Using Microsoft Excel and Access, Census Bureau data were assembled into large databases and manipulated to generate relevant statistics. In order to retrieve statistics for a particular watershed from a statewide database generated for counties, we joined statewide census data with statewide geographical data using a geographic imaging system, ESRI's ArcGIS. This way we could select census data at block and block group levels within the irregular boundaries of a watershed.

Using this system, we can essentially draw any arbitrary boundary on a state map and generate accurate Census Bureau data for the area. Using the data generated, we are constructing base maps in ArcGIS. The maps use block group or block level census data, which is at a finer or smaller scale than county-based data. The maps allow for the overlay of watershed boundaries and the ability to select and zoom in on a particular area of the map for a reading of socio-economic data.

We also conducted random mail surveys of residents in the La Moine River and Vermilion River Ecosystem Partnerships. The surveys queried respondents about their perceptions of natural resource and environmental problems. Respondents also reported the desired land use types for their watersheds and their participation and desire for outdoor recreational opportunities.

b. Impact – We are providing socio-economic profiles to the 39 Ecosystem Partnerships in Illinois.

The profiles summarize Census Bureau data that is relevant to their watershed. The watershed planning committees will use this information when identifying watershed problems, defining goals, and developing watershed management plans. The watershed planning committees will also use the information from the mail surveys in the same manner. The development of this new approach

of using GIS technology to access socio-economic data based on watershed boundaries should have wide impact in other natural resource applications as well.

c. Source of Funding – McIntire-Stennis Funds

d. Scope of Impact – State

Key Theme – Water Quality

Development and Evaluation of TMDL Planning and Assessment Tools and Processes

a. Progress – The objective of this project is to develop, improve, and evaluate watershed models and other approaches for TMDL development and implementation. We have been collecting data from two watersheds in East Central Illinois on hydrologic data and water quality for developing and improving computer simulation models.

One of the watersheds (Little Vermilion River watershed) has been monitored for the last several years. An excellent set of data has been developed from several monitoring stations in this watershed for the period 1993-2003. These data include tile flow, river flow, nutrient, and herbicide concentrations. We are using DRAINMOD, DWSM, and WEPP models for simulating water quality parameters from this watershed. The SWAT model will also be used to analyze the data from this watershed. The long-term monitoring data from the LVR watershed are being analyzed to understand the effects of various agricultural management practices on water quality. These results will help develop TMDL guidelines for tile-drained watersheds.

The other watershed (Lake Decatur watershed) has predominantly soil erosion problems. The WEPP model is being used to simulate sediment and flow from this watershed. The major work done during 2003 is the development of a phosphorus transport model and coupling this model with the existing WEPP model. Currently, we have been using data collected from the two watersheds and several other sites to verify model predictions on sediment, flow, and phosphorus fate and transport from these watersheds.

b. Impact – Evaluating the accuracy of a computer model using data from a single site is risky. It is of critical importance that models be

evaluated with the widest range of possible conditions. This need can best be met through this multi-regional project with a broad range of conditions from which the models can be tested.

This Illinois study will also provide a new phosphorus transport model and its suitability for use in developing TMDL guidelines.

c. Source of Funding – State, National Science Foundation, Multi-State Research Funds

d. Scope of Impact – AL, AR, FL, GA, IA, IL, IN, KS, KY, LA, MD, MI, MN, NC, NJ, OK, OR, SC, TN, TX, VA, WVA

Farm and Watershed Level Policy Analysis: Agro-Environmental Implications

a. Progress – We examined the effectiveness of crop land retirement programs, in particular, the Illinois Conservation Reserve Enhancement Program (CRAP), which targets environmentally sensitive crop land in the Illinois River basin. We evaluated the environmental effectiveness and cost effectiveness of the program in achieving its sediment reduction goals in the Lower Sangamon watershed in Illinois by developing a framework that combines a microeconomic model and a hydrologic model that simulates the movement of sediment from the watershed to water bodies. The latter is facilitated by incorporating detailed GIS data about the spatial and physical attributes of heterogeneous land parcels and recognizing the inter-dependencies between them in determining off-site sediment abatement.

We first apply this framework to examine the extent to which actual CRAP enrollments in the Lower Sangamon watershed have reduced sediment loadings and we determine the opportunity costs of these enrollments. We then use this framework to identify land parcels that should be targeted for enrollment by a social planner to achieve the same level of sediment abatement at the watershed level at least cost. A comparison of the characteristics of the actually enrolled parcels and the least-cost enrollment obtained from the model is used to derive policy implications for the implementation of CRAP in Illinois. We also examine the design of alternative land rental payment instruments that could be used to target the land to be enrolled in the program. Our analysis shows that the actual enrollments in CRAP in the Lower Sangamon watershed have achieved only 12% sediment abatement instead of the 20% program

goal. Moreover, it has done so at a much higher cost. This is because a large proportion of the land enrolled in the program was in the flat flood plains and 24% was outside a 900 foot buffer. This land is less erosive and traps less sediment from inland areas of the watershed while being more productive and costly to retire. Instead, our optimization model results show that we should focus more on the land parcels that are highly sloping, closer to a water body, receiving higher upland sediment inflow, generating more on-site erosion and having a lower quasi-rent per acre to achieve the abatement goals of the program cost-effectively.

It must be noted, however, that our analysis has focused only on the sediment abatement objective of the CRAP. The wildlife habitat or wetland preservation benefits provided by existing enrollments that are in the flood plain or away from the 900 foot buffer are not being considered here. We also find that by supplementing the eligibility criteria with a rental payment instrument that varies rents based on observable site-specific characteristics, more precise targeting could be achieved to closely replicate the cost-effective land enrollment pattern. Observable characteristics, such as on-site erodibility, soil productivity and distance from a water body can play an important role in determining rental payments to target cost-effective enrollment.

b. Impact – The results of this study have several important policy implications for achieving cost-effective sediment abatement through land retirement programs. The finding that cost-effectiveness can be achieved by primarily enrolling land parcels within 300 feet of the water body implies that enrollment targeting could be improved by defining the eligible region even more narrowly than flood plains in the Illinois River Basin and restricting it to a narrow buffer along all streams and tributaries of the river.

Modifications in certain program criteria are also desirable. For example, the program currently seeks to select 85% of the land from the 100-year flood plains and only 15% from the erodible lands next to a riparian buffer. Since sloping land contributes more to sediment abatement and is also less productive, and thus cheaper to retire, it would be preferable to modify the eligibility criteria to include all crop land in the riparian buffer as eligible land. Additionally, supplementing the eligibility criteria with a rental payment instrument that varies rents based on observable site-specific characteristics, more precise targeting could be achieved to closely replicate the cost-effective land enrollment pattern.

c. Source of Funding – Hatch, State Funds

d. Scope of Impact – State

Key Theme – Weather and Climate

The National Atmospheric Deposition Program [NADP]

a. Progress – NRSP-3, the National Atmospheric Deposition Program (NADP) provides quality assured data and information on the exposure of managed and natural ecosystems and cultural resources to acidic compounds, nutrients, base cations, and mercury in precipitation. This is made possible through cooperative support (SAES, universities, government agencies-federal/state/local/tribal, and NGOs) for the 252-station National Trends Network, 78-station Mercury Deposition Network, and 9-station Atmospheric Integrated Research Monitoring Network. The NADP provides the only database of precipitation chemistry measurements from across the United States, and these data support informed decisions on air quality issues related to precipitation chemistry. NADP data are used by scientists, policy-makers, educators, and the public and are freely available via the Internet (nadp.sws.uiuc.edu), which enables on-line retrieval of individual data points, seasonal and annual averages, trend plots, concentration and deposition maps, reports, and other information.

In FY 2003, the NADP Internet site received 68,075 unique visitors (up 46 percent) and user sessions rose by nearly 64 percent. This site now regularly receives more than 1.5 million hits per year. About 40 percent of NADP Internet usage is for educational purposes, and the balance is for research. In a recent report, the U.S. EPA described NADP as providing one of two key data sets used to assess the effectiveness of the 1990 Clean Air Act (CAA). In particular, the U.S. EPA used NADP sulfate and nitrogen (nitrate plus ammonium) maps to describe current deposition rates and compared 2000 and 1990 average sulfate deposition to demonstrate that sulfate has decreased nearly 30 percent, which is consistent with CAA-related sulfur dioxide emissions reductions.

New legislation under consideration would expand the CAA emissions cap-and-trade program to nitrogen oxide and mercury emissions. Proponents of this legislation cite the cost-effectiveness of the current cap-and-trade program and its demonstrated success in reducing acid deposition, as monitored by the NADP. The NADP

Program Office participated in the University of Illinois Extension Service program Environmental Stewardship Week, designed to engage elementary school students in hands-on learning activities in the environmental sciences. Staff members led a learning activity that focused on air pollution, acid rain, and water quality. Students measured the pH of selected household chemicals, water from a central Illinois lake, and NADP rain samples. Approximately 100 5th and 6th grade students participated in the activity.

The NRSP-3 Technical Committee held its annual meeting in Washington, D.C., followed by an ammonia workshop jointly sponsored with the Chesapeake Bay Program. At this meeting, NADP celebrated its 25th anniversary and attracted 163 registrants. A one-and-a-half day symposium addressing how long-term monitoring supports science and informs policy followed regular meetings of NADP committees and subcommittees. The ammonia workshop offered a forum for presenting the latest information on ammonia measurements, modeling, and policy-relevant topics.

b. Impact – Measurements of hydrogen and oxygen isotopes in precipitation samples from 80 National Atmospheric Deposition Program (NADP) sites have been provided to the World Meteorological Organization database of Global Network for Isotopes in Precipitation, which scientists from around the world use to study surface and groundwater hydrology, plant-water interactions, and climate and paleoclimate processes.

c. Source of Funding – Multi-State Research Funds

d. Scope of Impact – CA-D, CO, FL, GA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MT, NC, NE, NYC, OH, OR, PA, TX, UT, VA

Impact of Climate and Soils on Crop Selection and Management

a. Progress – Illinois updated the North Central Region's county climate and crop yield data for 1971, 2000, and 2001. Illinois also computed climate statistics for each county which were transferred to Michigan for creation of a climate and soil atlas. Illinois, with cooperation from South Dakota, conducted a study of the effects of the Pacific Decadal Oscillation (PDO) on corn, soybean, and wheat yields. In cool PDO phases (negative PDO) corn and wheat yields were higher than the yield trends, and soybean was slightly lower. During the cool phase, precipitation was greater in the southeast part of the region in the winter, greater in north during the spring, and in

the west in the fall than precipitation during the warm phase. Fall daily minimum and maximum temperatures were greater in the cool phase. During the winter and spring, temperatures in the south were greater during the cool phase than during the warm phase. In the summer, the minimum daily temperatures were lower in the south during the cool phase than in the warm phase. While there were significant differences in the response of crop yields to the PDO, no strong relationships were found with the precipitation and temperature variables.

Illinois, with cooperation from Indiana, Georgia, Kansas, and Nebraska, created county database files that included modeled solar radiation data for all counties and years from 1971 through 2001.

Illinois, with cooperation from Indiana, Georgia, Kansas, and Nebraska, evaluated three daily solar radiation models that used daily maximum and minimum temperature and precipitation to estimate daily solar radiation. This work identified a model developed by Nebraska as the best of the three models, and a manuscript describing the results has been submitted for publication in the scientific literature.

b. Impact – This work will provide information to better understand the climate of the North Central Region and its direct impact on the crops grown as well as the indirect effects through the soil climate interactions.

c. Source of Funding – Multi-State Research Funds

d. Scope of Impact - GA, IA, IL, IN, KS, MI, MN, MO, ND, NE, NYG, OH, SD

CSREES GOAL 5 – Enhanced Economic Opportunity and Quality of Life for all Americans

Indications of the Scope of Research and Extension Programs under Goal 5 - See Appendix A.

For 2004, the College had 44 projects under Goal 5 and invested more than 75 scientist, technical and staff years to these project. Forty-five percent of Extension's staff effort was reported under Goal 5 with a total of just under one million face-to-face teaching contracts dropping form 1.1 million for 2003.

Key Theme- Farm Financial Management

Farm Income 2005 Workshops

a. Each year, farm income workshops are held at locations throughout Illinois. In 2004, five such workshops were held at strategic locations to update 600 Illinois landowners, operators, lenders, and other agribusiness people. The workshops included four general sessions on "Illinois Farm Income Outlook," "Outlook for Commodity Prices," "More Corn and Less Soybeans? Does it Pay?" and "The WTO, the Federal Budget and Future Farm Policy."

In addition, the following breakout sessions were offered: "FAST Tools: Hands-On Computerized Applications," "Farmland Markets in Illinois : Historic Context and Contemporary Issues," "Legal Check-Up: Land and Recreational Use Liability," "1031 Farmland Exchanges, Friend or Foe," and "Sizing Up Your Marketing Advisory Program."

b. Impact – Evaluations of similar programs in the past have shown that more than 90 percent of participants find such sessions useful or very useful. For example, an evaluation of the FAST workshops conducted in 2003 found that 98 percent of the participants found these workshops useful or very useful.

Using a conservative coefficient of 90 percent, **at least 540 Farm Income 2005 Workshop participants** would have found the workshops useful or very useful and more than half, **at least 300** would use the information in decision-making.

c. Source of Funding – Federal, State, Local

d. Scope of Impact - Illinois

Key Theme- Promoting Housing Programs

Illinois Rural Housing Task Force

a. "From aging seniors hoping to stay in their neighborhoods, to homeless families who have fallen on hard times, to business owners looking to attract workers - affordable housing is key to the success of our communities" according to Illinois Governor Blagojevich. If people cannot afford a place to live, they are at risk of becoming homeless. Families and individuals are losing their housing at unprecedented rates. In rural areas, research indicates that families, single mothers, and children make up the largest group of people who are homeless.

According to the US Census Bureau, 2000, more than 1.3 million people, or 11.9% of the population, in Illinois live in poverty. At least 536,000 households (12.8%) in Illinois are extremely low-income and earn less than $22,000 per year which is 30% below median income. However, achieving affordable housing remains a challenging problem to address. This is largely due to the significant capital investment that is required to provide affordable housing within a community.

The Illinois Rural Housing Task Force was organized in 2000 with U of I Extension as a full partner. The Task Force has two goals: the first, to provide all parties interested in addressing housing needs with a venue for exchanging ideas and information; and secondly, to inform and educate community members and state policymakers of the housing issues faced by rural residents. In accordance with these goals, the Task Force sponsored seven Affordable Housing Workshops conducted between November 2002 and December 2003 with more than 200 community and agency representatives participating. The purpose of these workshops was to provide an introduction to affordable housing development tools, techniques, financial resources, and provide success stories to communities.

b. Impact - In the fall of 2003, phone interviews were conducted by a Western Illinois University graduate student with randomly selected participants from each workshop session. The following is a summary of responses given by those respondents:

Three-fourths of participants responding reported meeting with at least one of the following groups or organizations regarding information gained from the workshop:

Local government officials
County or municipal officials
Agencies such as Housing Authority and USDA
Service organizations to include Habitat for Humanity and Chamber of Commerce
Economic Development Organizations

More than one-half of participants responding reported that they were able to put the skills and information learned from the workshop to practice in their communities.

Approximately one-half of the participants responding indicated they used the information gained form the workshop to organize a local group to explore housing issues.

Slightly fewer than half of participants have actively pursued funding options from the list of resources/organizations identified at the workshops.

Success Stories:

"Since the workshop, we have taken over and repaired apartments in Mason City with funds from USDA."

"After the workshop, I met with a broker about affordable housing for our community. He has since purchased a 22-unit apartment complex which he is planning to convert to affordable condos."

"We were able to use surveys provided at the workshop to conduct our needs assessment."

"We have raised interest in two communities for senior housing from sharing case studies provided at the workshops."

"Our local housing authority is moving towards independent senior housing."

c. Source of Funding – Federal, State

d. Scope of Impact - Illinois

Key Theme – Aging

The Urban Forest and the Urban Elderly: Vitality and Longevity in the Inner City

a. Progress – For older adults, social integration and the strength of social ties are profoundly important predictors of well-being and longevity. This research examined the extent to which residential landscapes might be designed to promote older adults' social integration with their neighbors. We examined this possibility by testing the relationships between varying amounts of exposure to green outdoor common spaces and the strength of ties among neighbors. Results of interviews with 91 older adults (age 64 to 91) from one inner-city neighborhood show that the use of green outdoor common spaces predicted both the strength of neighborhood social ties and sense of community. While the strength of these relationships was modest, the findings suggest that green outdoor common spaces play a role in the formation and maintenance of social ties among older adult residents of inner-city neighborhoods. The results have implications for designers, managers, and residents of housing developments.

b. Impact – Findings suggests that exposure to green common spaces near elderly individuals' homes may be an inexpensive way to improve their social integration.

When choosing a place to live, elderly people would do well to choose housing locations that include green outdoor common spaces. In addition, elderly individuals may benefit from actively creating or caring for green neighborhood common spaces.

c. Source of Funding – Hatch, State and USDA Grant Funds

d. Scope of Impact – National

The Effects of an Aging Population on Rural Places and People

a. Progress – Two data sets were analyzed to determine: 1) Growth and distribution of the older population in Midwestern counties (1990-

2000) and 2) Effects of age on farmer behavior and their adoption of agriculturally-related innovations in Illinois.

Findings from the first analysis include: 1) Most rural counties in the region had low rates of elderly population growth; 2) Most (80%) of the increases in elderly population were in metro counties; and 3) Many counties have fewer older persons now than they had a decade ago. Research on older farmers demonstrated that they are less likely to have adopted recent technologies, to belong to or want to belong to an agricultural organization, or to have off-farm employment or businesses. Age has no effect on farmers' belief in the efficacy of organizing or on various types of information.

b. Impact – Findings will have an impact on Extension, rural communities, and agencies which provide services to older persons. Results of the research were presented at professional meetings which focused on the future of Extension in light of structural changes in farming, and at an international conference on the new agricultural economy and rural development. Research on older farm operators was also presented in press releases, which resulted in numerous radio and television interviews and calls for further information. Results were distributed to all Extension unit leaders and crop system educators in the state.

c. Source of Funding – Hatch, State Funds

d. Scope of Impact – State

Key Theme – Agricultural Financial Management

Market Risk Management, Information and Price Relationships: Illinois Commodities

a. Progress - Research during the past year evaluated several dimensions of market risk management, information, and price relationships for markets important to Illinois market participants. The most recent evaluation of the pricing performance of market advisory services used data over 1995-2001 for corn and soybean crops. When both average price and risk are considered, only a small fraction of services for corn and a moderate fraction for soybeans outperformed market benchmarks. On the other hand, a majority of the services outperformed a farmer benchmark for both crops. Since farmers can subscribe to one or more services, it is also important to

analyze the potential risk reduction gains from diversification across market advisory services.

Results show that increasing the number of (equally-weighted) services reduces portfolio expected risk, but the marginal decrease in risk from adding a new service decreases rapidly with portfolio size. Based on these results, farmers are better off choosing portfolios with as few as two or three programs, since the relatively high total subscription costs associated with larger portfolios can be avoided while obtaining most of the benefits from diversification. Further research was conducted to estimate marketing profiles and loan deficiency payment/marketing loan gain profiles for the advisory services. Marketing profiles provide information to evaluate the style of advisory services by making it possible to investigate the evolution of price sensitivity of each set of recommendations made by the advisory services along the marketing window. These profiles will be used to analyze the effect of the style of advisory services on price performance within and across soybean and corn crops over time.

Other research has investigated the ability of selected agricultural futures and options markets to forecast price and its volatility. Volatility forecasts are particularly useful in identifying the price risk associated with buying or selling at specific points in the future. Work on the corn market suggests that the implied forwards volatilities generated by the options incorporate effectively market information in their forecasts of price variability in the future. Other work in futures markets has investigated market depth by examining trader perceptions of price changes with order imbalances, the determinants of heterogeneous hedging behavior, factors affecting the success and failure of futures contracts, and the feasibility of a new boxed beef contract.

b. Impact - The research provided valuable information that will improve marketing decisions of crop producers.

The results suggest that corn and soybean producers can improve their revenue by about $12 per acre by following the recommendations of the services. While this was not without substantial risk, this improvement also is not inconsequential when compared to the net returns experienced in recent years.

The research has had a positive impacted on the way grain is marketed in the U.S. through the stimulation of new and innovative

marketing contracts. Specifically, the findings have been used as the empirical foundation for a new generation of pricing contracts offered to producers by the grain industry. Firms such as Diversified Services, Cargill and e-markets have developed new contracts that simply assure that producers receive the average price for grain over some pre-specified time period. An example of the influence of AgMAS research in this regard can be found at the e-markets website. The use of these new-generation marketing contracts appears to be growing rapidly.

On another level, the research on the determinants of heterogeneous hedging behavior and the evaluation of market advisory services has been particularly productive as we have introduced new constructs and measurement procedures to the agricultural economics literature that will be used in future analyses of marketing behavior and performance.

c. Source of Funding – USDA Hatch and State Funding

d. Scope of Impact – State

Financial Agriculture and Rural America: Issues of Policy, Structure and Technical Change

a. Progress – Alternative methods of data generation for credit risk assessment and contributions to economic capital methodology are compared and tested. Included are the distance to default concept in which variability of asset values relative to debt levels is the design element and use of farm-level simulation models to generate data for estimating predictive default models that can be classified according to default probability intervals of major rating companies. A third methodology employs an extension of credit risk migration analysis to determine the strength of effects internal financial variables and external macro variables have on changes in migration rates and risk classifications. Also being addressed are potential risk-adjusted rates of return to farmland, linkages between farmland sales values, and financial stress indicators in agriculture, and the relationships among risk, incentive payments, and financial structure of contract hog producers.

b. Impact – The goals of these studies are to achieve greater granularity and accuracy in credit risk measures through the cycle in order to facilitate risk adjusted interest rates, determine financial institutions

capital needs, and relate those capital needs to the risk characteristics of agricultural borrowers.

c. Source of Funding – State, Multistate Research, and Other Non-Federal Funds

d. Scope of Impact – AR, GA, IA, IL, IN, MI, MN, ND, NJ, NYC, OH, PA, TX , USDA

Key Theme – Child Care / Dependent Care

Neighborhood and Community Factors, Social Support Networks and Preschool Children's Socio-Emotional Development

a. Progress – Data were collected on preschool children and their families that parallel data collection efforts over the previous years. Since the last reporting period, data have been collected on approximately 100 additional children and 30 additional families. Participants included preschool children who were attending the university affiliated Child Development Lab (CDL) as well as preschools in two rural Illinois communities. Data have been collected on child social adaptation among peers as well as the nature and quality of children's relationships with their parents. With respect to children's socioemotional behavior and adaptation, we have collected data using classroom observations of children's behavior, social network and support interviews, and sociometric interviews of peer acceptance. Teachers also rated children's behavior using two standard social behavior rating scales. Data regarding parent-child relationships and family process were collected using laboratory procedures, home visits and self-report questionnaires.

The combined longitudinal dataset has been assembled and partially analyzed. Several findings contribute to the literature on family-peer relations. For example, there is considerable stability in children's socially competent behavior and perceived social networks/support over a one year period, and support from network members early in the preschool years predicts social competence with peers in subsequent years. Furthermore, the quality of parent-child interaction assessed in the home as well as characteristics of the neighborhood/community context in which families reside influence children's socioemotional development. Finally, parents who are more elaborative in their conversations with their children have

children who are more likely to have flexible and adaptive social problem skills.

b. Impact – These data highlight the utility of using a multi-method and multi-informant approach to examining young children's social development. They also demonstrate how relationships in the home, school, and community contexts influence children's behavior in classroom settings. These data served as an empirical base for a grant proposal examining how children construct beliefs about parent and peer relationships. This four-year longitudinal project was funded by NSF's Children's Research Initiative, and data collection is still in progress. The information obtained from this project is valuable for parent, teacher, and community outreach education programs that promote the well-being of children and families. Additionally, workshops will be conducted with child-care teachers that focus on issues defined by the teachers as important in their centers. Finally, this project has served as a valuable research experience for over 90 undergraduate students since its conception and as the basis of a thesis for two doctoral students.

c. Source of Funding – Hatch, State, National Science Foundation Funds

d. Scope of Impact – National

Key Theme-Community Development

Also see Camp Clover under Goal 5, Key Theme – Youth Development/4-H

The Illinois Rural Recreation Development Project (IRRDP)

a. The Illinois Rural Recreation Development Project (IRRDP) is designed to assist rural communities of under 7,500 population develop their recreation potential. Urban areas in Illinois have long enjoyed year-round public recreation programs. Rural communities, however, lack resources and professional leadership for the provision of general recreation services. The purpose of the Illinois Rural Recreation Development Project was to address the immediate unmet needs in small rural communities for summer recreation programs leading to long-term development for recreation services.

In 2004, eight communities participated in IRRDP. Also, two communities became self sufficient; meaning they operate without direct IRRDP support.

b. Impact – Overall, approximately 800 youth and 80 adolescents (i.e., youth leaders) were served through the program.

The annual program evaluation revealed that on average, youth participants made five new friends through the program and over 75% (of the youth) stated that being in the program made them want to play outdoors more often. This is a significant finding since being indoors has been shown to be the most important predictor of childhood obesity.

Satisfaction among parents of participants remained relatively high (i.e., 8.1 on a 10-point scale).

In 2005, IRRDP staff will focus on helping participating towns identify funding sources that will foster sustainability.

c. Source of Funding – Federal, State, Local

d. Scope of Impact - Illinois

The Conversion of Agricultural Lands by Urban Development

a. Progress – Research funded in part by this project focused on the spatial dynamics of urban development and its impact on agricultural land use. This project has concentrated on urban development in the Illinois/Missouri area in the following places: Kane County, the Tri-County area around Peoria, East St. Louis and St. Louis (MO) and a large watershed near Rockford.

In the first two projects we have run urban growth scenarios that compared normal development in the years up to 2030 with the development that would occur if a minimum size were allocated to each rural residence. The result of the later regulation was that development occurred in and adjacent to the cities to a much greater degree, adding to the preservation of prime farm ground in the area. The environment impact (water quality, wildlife populations) was also lower. The web site for the study is: http://www.rehearsal.uiuc.edu/projects/leam. We intend to improve and apply this procedure in the next two areas noted above.

b. Impact – Urban sprawl is a major consumer of farmland and the environment in the U.S. today. That detailed (30 meter cells) dynamic projections of this growth is of great interest to farm organizations, urban planners and those federal agencies concerned with protecting the environment.

c. Source of Funding – Hatch Funds

d. Scope of Impact – Illinois and Missouri

Communication Technologies for Rural Development: An Evaluation of Community Readiness

a. Progress – Focus groups explored the types of outcomes that can be expected from digital divide investment. The content of the discussions provide the basis of the design of a comprehensive evaluation instrument measuring outcome from telecommunication outreach activity. Two new evaluation instruments have been created that address the key issue identified in the focus group discussions. The themes of the evaluation design include: the diversity of users; changes in literacy skills; demand for computer content and applications; improvement of self esteem and self confidence in using communications and information technologies; and community collaborations and networking to eliminate the local digital divide. The evaluation explores the characteristics of stakeholders, for example, are more people involved as advocates and partners; the community and professional networks in place to address digital divide issues. The focus group discussions enabled stakeholders to create a shared understanding of what is the digital divide that can be used to build an evaluation strategy of quantifiable performance indicators to measure how well this program contributes to eliminating it. The stakeholders presented many different, and often complementary, perspectives about how they perceive the existence of the digital divide and what strategies are needed to minimize the gap between people who have access and who can effectively use communications and computer technologies and those who cannot and who do not have access.

Defining the digital divide focused on the inequality of human capacity and digital literacy skills. Furthermore, stakeholders emphasized that the definition of the digital divide extends to not only individuals without access or skills to use communications and information technologies but also to businesses, schools, organizations, and governments.

Eliminating the digital divide is about accessing the Internet and its resources; about using telecommunications and computer technology to communicate and create; about creating and building knowledge to effectively function in the current economy; and finally it is about creating a better community and improving the quality of life for all Illinoisans. New tools continue to be added to the Community Development Toolbox and earlier tools received makeovers this year. The Community Programming for Youth Assessment Index designed to assess and benchmark the status of youth programming has been added to the toolbox.

b. Impact – The evaluation of telecommunications investment strategies has not been well documented. The focus group discussions have led to a comprehensive definition of digital divide. The evaluation strategy developed will be used by a set of pilot Community Technology Centers in Illinois and will be proposed to be used as a standardized evaluation instrument by the National Association of Community Technology Centers.

The definition of digital divide coming from this research has been acknowledged and recognized by the Center to Bridge the Digital Divide at Washington State University. Additionally, the project team has been awarded the evaluation of a $560,000 Department of Commerce project designed to explore how technology, a wireless network, creates a learning environment within an inner city public housing facility. The Community Development Toolbox has been recognized as truly innovative. In the arena of community development, this is the only online, interactive technical assistance and knowledge-building program. The overwhelmingly positive feedback from the many presentations and workshops offered in the state, and nationally suggests that the Community Development Toolbox is on track and provides community leaders with information that allows them to make more knowledgeable decisions related to community and economic development. In addition, hundreds of communities have accessed our online tools in a meaningful way.

c. Source of Funding – Hatch, Smith-Lever, State Funds

d. Scope of Impact – State

Key Theme – Family Resource Management

Plan Well, Retire Well – Delivered via the Internet
www.RetireWell.uiuc.edu

a. To make the jump from surviving financially on a day-to-day basis to effectively saving and investing money towards a financially secure later life, people need to know how to make informed decisions about investments. Unfortunately, many people do not.

To find out how best to serve peoples' retirement planning needs, a series of five focus groups were conducted with people with 15 or more years to retirement. The discussions focused on what people needed to know to plan for retirement and how they preferred to receive the information. The message we received from these focus groups was clear:

- plan for retirement early
- keep the information simple to understand
- put the information on the Internet

Using the results of these focus groups as well as a series of other needs assessment tools, U of I Extension Educators and Specialists decided to develop a website that would target people in their 20s and 30s to provide a research-based, reviewed, interactive retirement education website. The *Plan Well, Retire Well* website introduces people to:

1) strategies on how to save money
2) how money grows over time
3) tax-deferred saving plans such as IRAs and employer-sponsored plans
4) the basics of investment choices
5) forecasting for retirement

The website is designed to engage users with calculators and worksheets that encourage users to input their own financial information, evaluate their current financial position, and set goals for the future.

The website went live in October 2003.

b. Impact – Within the first year the website has averaged 11,219 hits each month with a total of 6,682 visitors to the website. Of these

visitors, 1,552 people have chosen to log-in as new users and are completing sections of the website. Approximately 10% of the users have returned multiple times to the website to continue their learning.

Plan Well, Retire Well was recently awarded the "Cool Website Award" for Outstanding Technical Programming by the University of Illinois at Urbana-Champaign's Webmaster's Forum. This was in large part because of the interactive nature of the website.

The use of the website appears to increase when new material is added and then marketed to the public. An example of this spike is seen in August 2003; the number of hits went from 33,420 to 55,701. In August, new *Parent Smarts* fact sheets were added to the website. A lot of marketing for the fact sheets on the website occurred in August, and as the numbers show, ***this promotion did lead to more people viewing the fact sheets!***

Financial professionals not affiliated with University of Illinois Extension review all content. Reviewers' comments include:

> "You have a done a very careful and really wonderful job. More people should see this type of site when they begin their careers."
> *Professor in Economics*

> "You cover many of the topics I cover with individual clients as part of the investment education process as we develop an individual investment policy statement for them. I think this will be very useful for a general audience interested in learning more about investing. The examples are especially good for explaining underlying concepts."
> *Certified Financial Planner*

c. Source of Funding – Federal, State

d. Scope of Impact - Illinois

Gender and Security: Employment and Enterprise of Immigrants in Central Illinois

a. Progress – The project objectives of identifying and assessing gender aspects of human security of immigrant families in Illinois are especially important given the budget cuts in the state during the

post-9/11 period. Women are slightly more than half the immigrants in the U.S. and the proportion has been increasing since the mid-1990's. Our project focuses on Illinois, which is the fifth largest recipient state for immigrants and by far the largest destination in the Midwest. Immigrants comprise about 13-15% of the population in Illinois. Most come from Latin America, particularly Mexico. The 2003 PUMS [U.S. Census Bureau Public-Use Microdata Samples] for Illinois was released, showing that women make up 45% of Latino immigrants and 51% of Asian immigrants. Yet in most studies of the Midwest, they are still invisible.

After holding focus groups with Muslim immigrants the preceding year, we worked with Latino immigrants during 2003. We held separate focus groups in Spanish with women and men in Champaign county and conducted interviews with service providers. We have set up a symposium for March 2004 and have invited state officials and policymakers as well as academics and community groups. In the focus groups, we explored the connection between employment and health insurance coverage.

We found that most of the men and women in our focus groups did not have insurance. Those who live in the city of Champaign usually go to a local clinic that has Spanish-speaking staff. Although children in poor families are eligible for KidCare insurance, most providers will not accept them as patients, and their parents must wait for hours when taking them to the one, overcrowded clinic that accepts them. For emergencies, they may go to the hospital, but language is a problem and unauthorized immigrants fear that immigration officials will be notified. Some of them received medicines from Mexico. The women use health care services more than the men and mentioned that they had access to additional health care programs when pregnant. For all of the immigrants contacted, health care issues were linked to the need to learn English, have a good job and ability to get a driver's license.

Our work shows a behavioral model for immigrants settling in rural communities. The immigrants who come to rural areas and small cities of Illinois are usually not farmers but often are engaged in working for the agro-foods industry and in food service work. Agricultural field workers in central Illinois are usually internal migrants who live the rest of the year in Texas rather than those crossing the border from Mexico. Meat packing has been a common field of work for immigrants in the Midwest in recent years, and Cass County in central Illinois had over 1,000 percent growth of

Mexican immigrant residents between 1990 and 2000, largely because of new jobs at a pork processing plant. Meat packing is not, however, the only area of employment in central Illinois. A study in two small towns in Iroquois County found that most immigrants were working in jobs with more comfortable working conditions; this contributed to better integration into the towns.

b. Impact – The research is expected to help in creating more appropriate human security policies related to employment, health care, and quality of life for women and men who are immigrants from developing countries who settle in small and rural communities in the Midwest.

c. Source of Funding – Hatch and State Funds

d. Scope of Impact – State

Improving Illinois' Family Functioning in Stressful Rural Settings

a. Progress – We have completed a study of Chinese immigrant parenting stresses and resources and are planning follow-up work. We secured additional funding to carry out some of that research and it provided the foundation for a research article under review, 2 conference presentations and an Extension brochure to address the needs of stressed immigrant parents. Another student has finished her Master's degree studying the church as a resource for non-metropolitan African American parents. This paved the way for a conference presentation and a paper on church-educational/service partnerships to benefit families in these types of communities. Together, these data represent a scientifically unique effort to provide in-depth information about rural African American families', Chinese immigrant families, and European American farm families' parenting stress and resources as well as the special role of community organizations like churches in family and parental coping. We have a publication in press based on literature review funded by Hatch that should be useful for researchers, program developers and policy makers in the coming year. Additionally, we have submitted another paper providing a theoretical basis and literature review for improving parenting in the context of managing work stress.

b. Impact – This project has examined several communities and has provided valuable information that has not existed before.

We have explored the various sources of stress in ethnically diverse Illinois non-metropolitan communities during a time when many families are struggling with heightened economic challenges. Such information is desperately needed to inform policy and outreach efforts to these families.

We have created several products to help parents utilize resources and minimize stressors. These include a brochure for Chinese immigrant parents to help them cope with acculturation stress and improve parenting outcomes. This was distributed to a national audience of family life professionals at a national conference.

We have also developed a curriculum for managing work and life in part based on research funded by this project. This curriculum is being distributed nationally and evaluated rigorously. Its aim is to help families, including non-metropolitan Illinois families, maximize the mutual facilitation of work and non-work life and minimize the interference of these important domains. Use of these tailored resources via community-based institutions/organizations should increase the chances for effective outreach and thus the prevention of family and community disruption.

c. Source of Funding – Hatch and State Funds

d. Scope of Impact – State

Economic Well-Being of Families: Education, Child Support, Health Care Access, E-Commerce and Financial Management

a. Progress – Under Objective One, we focused on the impact of schooling incentive programs on child labor and the school enrollment of children in Bangladesh and in Brazil. A paper was submitted to Comparative Education Review titled "The effects of schooling incentive programs on the time allocation of children in Bangladesh". In addition, we have continued to study the impacts of education policy changes and other factors on child labor and the schooling of children in Brazil. Preliminary results were presented at a workshop in Brasilia, Brazil in July.

With respect to Objective Two, we have continued to examine the impact of experiences such as living in a single-parent family, receipt of child support, and other effects on the well-being of children and young adults.

Under Objective Three, we have submitted a paper concerning the economics of Critical Access Hospitals to the Journal of Rural Health. With respect to Objective Five, we have developed analyses of consumers and their credit behavior, including the credit behaviors of college students.

b. Impact – An audience at the U.S. Treasury learned that the responses of families to changes in income are different during economic crises in Brazil, implying that special, temporary policies might be needed to keep children in school during the worst years of a crisis.

The government of Bangladesh re-instituted doorstep delivery of contraceptives to women of reproductive age. The government had moved towards a fixed delivery point system, but contraceptive use by women has stalled. Past work warned that women who were poor and uneducated would be most affected by the movement to a fixed delivery point system.

Under Objective Two a 12-year research and educational effort paid off earlier this summer when a bill containing new guidelines for child support in Illinois was signed into law. The law increases the percentage a non-custodial parent pays for support of the second child in a two-child family. Under the old system, the non-custodial parent paid 20 percent of his income for the first child, 5 percent more for the second child, and 12 percent more for the third child than the first child. Based upon the literature on costs of raising children, the increment between the first and second child was too small. As a result, Illinois fell among the bottom-level of states in terms of providing the necessary support for the second child in these families. The new guidelines call for 8 percent more for the second child for a total 28 percent of income for a two-child family.

c. Source of Funding – Hatch, State and Public Health Service Funds

d. Scope of Impact – National

Key Theme – Impact of Change on Rural Communities

Impact of Technology on Rural Consumers Access to Food and Fiber Products

a. Progress – Scientists from 11 states are exploring the attitudes of rural consumers toward television and Internet sources for information search and purchase of food and fiber products.

Experimental data collected from 358 rural consumers in six states suggest that exposure to Internet sources leads to positive changes in attitudes toward the sources, but exposure to home shopping networks leads to negative attitudinal changes. Publications describing this research are in progress.

These experimental consumers were surveyed in late 2002 to early 2003 to determine effectiveness of incorporating hands-on experiences on actual purchase behaviors. Survey data collected from 2,198 rural consumers in 11 states were analyzed to test Roger's Diffusion of Innovation theory; data suggest factors that speed up or slow down the adoption of the Internet for purchase of products. Furthermore, factors have been identified that discriminate between adopters and non-adopters of the Internet for purchases. Additional analyses of these data include determination/development of the following: a) differences in information search based upon product category and demographics, b) levels of satisfaction with product sources, c) levels of innovation of adopters of the Internet for purchases, d) effect of perceived time poverty on frequency of Internet purchases, and e) a profile of adopters and non-adopters of the Internet for purchasing products.

Fact sheets and a website have been developed to describe progress on this project. Follow-up panel data are currently being analyzed.

b. Impact – Eleven states are participating in this regional research project that accesses rural consumer shopping patterns and attitudes toward the use of computer and television shopping technologies. The project will increase understanding of rural consumers and will facilitate development of programs and familiarize rural consumers with the broad array of product information about and convenient sources of food and fiber products.

These data will also help rural retailers adjust to the changing marketplace, thereby enhancing economic and community development in small town areas.

All consumers purchase food and fiber products, making the project relevant to all areas of the U.S. In particular, non-metropolitan areas in the U.S., being a growing segment of the population, will benefit. Specific outcomes include the following: a) decrease barriers to consumer use of emerging communication technologies, b) provide basis for development of Extension consumer counseling programs related to survival and quality of life in rural communities, c) inform

both product and service providers as well as consumers about access to product information, d) develop Extension and rural community programs that strengthen rural small business development through technology transfer, and e) help small retailers incorporate appropriate technologies into their business operations to adjust to the changing business climate in the 21st century.

c. Source of Funding – State and Multistate Research Funds

d. Scope of Impact – IL, IA, MN, NE, ND, OH, SD, WI, CO, NYC

Key Theme – Leadership Training and Development

Also see Leadership Development in 4-H Community Clubs under Goal 5, Key Theme - Youth Development/4-H

An Assessment of the Leadership Greater Galesburg (LGG) Program

a. To maintain the quality of life they enjoy, communities must continually learn new ways of working together. For community and neighborhood leaders, additional challenges are gaining participation from all residents; involving them in making decisions and planning for the future and encouraging the entire community to take responsibility for the decisions that must be made and the work that must be completed.

It is becoming increasingly difficult to find people willing to spend their time in leadership roles, including elected offices and formal and informal positions in communities and organizations. Often, those who might be willing to give their time do not feel qualified or have leadership skills.

For more than a decade, University of Illinois Extension has been partnering with other organizations as a sponsor of the Leadership Greater Galesburg (LGG) to develop a strong corps of leadership. In 2004, Dr. Kenneth Pigg, Associate Professor of Rural Sociology, University of Missouri-Columbia agreed to provide leadership for and expert assistance in conducting an assessment of the alumni of LGG. A total of 244 past participants from programs offered from 1993 to 2004. Of these, 212 have addresses which were usable in a mail survey of this group. In all, 111 or more than 52 percent responded to survey. While the study was a post hoc one, Dr. Pigg, who has considerable experience in evaluating community

leadership programs, was able to draw the conclusions reported under item "b. Impact". The leadership for LGG plans to continue this kind of assessment using either a pre-/post- or a post-then-pre design which will link participants' assessments of their leadership skill prior to their participation to post-program ratings.

b. Impact – From Dr. Pigg's report of December 1, 2004:

If the results of this survey of LGG participants is considered to represent the outcomes of the LGG program, then it is reasonable to conclude that the outcomes have merit and are noteworthy in their impact in the community.

It seems reasonable to conclude that the Leadership Greater Galesburg is creating a strong corps of leadership capacity that should benefit the long-term health of the community in significant ways.

c. Source of Funding – Federal, State

d. Scope of Impact - Illinois

Illinois Leadership Development Academies

a. To maintain the quality of life they enjoy, communities must continually learn new ways of working together. For community and neighborhood leaders, additional challenges are gaining participation from all residents, involving them in making decisions and planning for the future and encouraging the entire community to take responsibility for the decisions that must be made and the work that must be completed.

University of Illinois Extension works in collaboration with other organizations such as Chambers of Commerce, economic development organizations, businesses, government, and schools and community colleges to provide leadership development opportunities. In 2004, U of I Extension took an inventory of the leadership academies held for the three year period of 2000 to 2002. During that time, Extension helped provide 24 different leadership academies serving 17 counties. (One of these academies would be the Leadership for Greater Galesburg that was reported above.)

b. Impact – More than 600 Illinois citizens have participated in Leadership Academies over the past three years (2001-2002). Specific impacts cited by Extension Unit Leaders included:

1. *By participating in the program, participants gain confidence in themselves. As they become better acquainted with the area they gain confidence in their potential to make a difference.*

2. *Increase in number of community service/volunteer opportunities.*

3. *Increased Extension awareness as a result of the program.*

4. *Increased involvement of participants in community programs.*

5. *The most important result would be understanding the various skills and qualities required to be a true servant-leader, thus encouraging participants to be trustees of their community.*

6. *The network and friendships that were established between the participants as well as knowledge gained of the county and the services available.*

c. Source of Funding - Federal, State, Local

d. Scope of Impact - Illinois

Food and Agricultural Sciences National Needs Graduate Fellowship

a. Progress – The Division of Nutritional Sciences at the University of Illinois at Urbana-Champaign received support for four predoctoral fellowships in Human Nutrition in July 2002. The aim of this program is to prepare students to be full and active participants in the new frontiers of nutrition research by equipping them with the necessary technical capabilities and by educating them in interdisciplinary, integrative approaches to nutrition research.

Research training will concentrate on protein and amino acids or lipids and short chain fatty acids and their roles in brain, intestinal, hepatic or skeletal muscular function. Students will receive training in a wide variety of state-of-the-art technical approaches, including multi-gene and protein expression analyses and multiple pathway

analysis using stable isotopic kinetics. Three of the four fellowships were filled in August 2003. The first fellow received her B.S. in Nutritional Sciences from Michigan State University and is working with Dr. Lee Beverly on nutritional effects of amino acids on brain function. The second fellow received her B.S. in Biology from the University of Utah and is studying the transcriptional regulation of betaine-homocysteine methyltransferase expression in the laboratory of Dr. Timothy Garrow. The third fellow received his B.S. in Chemistry and M.S. in Chemistry Education from Southern Illinois University. His doctoral research is focusing on the metabolic basis of high protein/low carbohydrate diets in weight loss in the laboratory of Dr. Manabu Nakamura. The final fellowship will be filled in January or August of 2004.

b. Impact – Nutritional genomics and delineating novel functions for nutrients are two areas of nutrition research destined to experience significant growth in the coming decade. The aim of this National Needs training program is to prepare nutrition graduate students to be full and active participants in the new frontiers of nutrition research by equipping them with the necessary technical capabilities and by educating them in interdisciplinary, integrative approaches to nutrition research.

c. Source of Funding – State, Multi-State Research Funds

d. Scope of Impact – CO, IA, IL, MI, MN, ND, OH, SD, TN, WI

Key Theme - Workforce Preparation

Also see Camp Clover under Goal 5, Key Theme – Youth Development/4-H

Key Theme - Youth Development/4-H

Also see 4-H "CAN" Make a Difference under Goal 2

Camp Clover-Your Summer Fun Adventure 2004

a. During the summer of 2004, University of Illinois Extension's Camp Clover-Your Summer Fun Adventure once again provided a fun learning experience to an expanded youth audience. Just over 2,000 youth participated in the summer day-camp type experience targeted at youth 8-12 years of age with special emphasis on reaching those from limited resource environments. This program enables U of I

Extension to reach many youth who have not be served by Extension previously. The camps were conducted at 100 different locations in 35 Extension Units in Illinois.

Each four-day camp included three sessions—one social science session, one nutrition and wellness session and one natural science session using curriculum developed at the state level. Local coordinators could choose Adventures in Our Community, WOW! Wild Over Work, Polish 4-H Adventures, or Latino Cultural Arts for the social science segment, and likewise, could choose from Aerospace Adventures, Adventures with Plants and Soils, Wonders of Science, or More Wonders of Science curriculum for the physical or natural science adventure. The three choices available in the nutrition and wellness area included Food Pyramid Revisited, Food Science You Can Eat, Physical Activity for Fun or Jumping for Health.

Camp Clover staff, volunteers, and collaborating agencies agreed that campers had a fun-filled learning experience. "Can we do this again next week?" was a request shared by many campers at the conclusion of the program week in both rural and urban areas. Due to budget issues, limited funding was available to support the Camp Clover Program in a reduced number of Extension Units during 2004. The funding that was available was only provided to support materials and resources. There was no funding available for hiring staff to implement the program. While any increase in funding may not be available in the future, plans are to continue supporting Camp Clover curriculum development and staff training through the State 4-H Office of University of Illinois Extension.

b. Impact –

Local Community Awareness and Improvement

The 383 campers who participated in the Adventures in our Community sessions participated in discussions among themselves and interviewed others to discover strengths and needs in their local communities, as well as ways they could improve their community. On the final day of camp, the groups of campers completed a community service activity. Information collected from the youth indicated:

- 97% of the campers identified a community strength
- 93% identified a community need

- 95% could name a good citizen deed
- 86% completed a community service project

Workforce Preparation

Over 300 campers gained knowledge of the skills and behaviors needed to succeed now and in the future through the Wow! Wild Over Work sessions. The youth played games, made books, studied maps, created models of places of employment, and studied food product labels. These activities helped them discover jobs in their community and beyond. At the beginning of camp, youth were only able to list an average of 2.0 jobs per camper, but by the end of the camp, youth listed an average of 3.0 per camper.

Multicultural Diversity

During this summer outreach experience, 145 youth participated in a global education opportunity through 4-H Polish Adventures. The experiences provided an opportunity for youth to develop knowledge, skills and attitudes needed to live in today's world of diverse cultures. Data collected from the youth indicated:

- 100% completed the prepared Polish paper cutting art
- 50% designed their own Polish paper cutting design
- 100% helped prepare a Polish food
- 100% tasted the Polish food
- 96% wrote a letter to a Polish friend describing themselves and life in the United States
- 41% identified information they learned about Poland

A new social science curriculum, Latino Cultural Arts was used by 940 youth as they gained a greater understanding of their own cultural identity and expanded their knowledge of the Latino/Hispanic culture. Youth left the program each day having learned more about Latino culture by exploring the Spanish language, food, celebrations, clothing, art, and geography.

- The number of Spanish-speaking countries that campers could correctly identify by the end of their Latino Cultural experience nearly tripled.
- 71% of the campers could identify five of the elements that define Latino/Hispanic Culture

Human Nutrition

A second segment of Camp Clover focused on improving campers' nutrition and health practices.

Some 186 youth learned which foods to eat and how to safely prepare them in Food Pyramid Revisited sessions. Activities focused on learning the five food groups, the number of servings of vegetables and fruit needed each day, and why it is important to drink milk. The campers also learned skills while preparing nutritious food dishes. A number of methods including the nutritionaire quiz were used to measure the impact of the activities on the campers. The results indicated:

- 48% of the campers could name all five food groups at the end of day one
- 90% demonstrated the proper way to use kitchen knives
- 95% named correct serving sizes in fruit and vegetable and milk groups

Over 325 youth participated in Food Science You Can Eat. During the four days of camp, they investigated the three types of carbohydrates, discovered ways to recognize high-fat foods, realized the importance of water to health, and examined the process of bacteria growth and how to slow the growth of bad bacteria. Records of experiments and written responses to questions indicated the following:

- 67% correctly identified a carbohydrate food source
- 80% identified a high fat food source
- 41% identified 3 or 4 causes of bacterial growth
- 40% identified a factor that slows bacterial growth

Physical Activity – Human Health

Physical Activity for Fun involved 278 campers in activities to motivate youth to be more physically active. Through various recreation games and activities, campers discovered fun ways to increase flexibility and balance, endurance, strength, and agility. They were also introduced to the concepts of energy in--energy out and the need to consume a healthy diet and plenty of fluids for active play. Observation and discussion with the campers provided evidence that:

- 94% believed that it is important to warm up muscles before exercising
- 100% planned to try new physical fitness activities at home
- 100% learned how to take a pulse rate to determine if exercise raised heart rate
- 93% enhanced their agility by decreasing the time it took to complete an obstacle course

The Jumping for Fun curriculum emphasized the importance of increasing physical fitness, while at the same time learning to make wise decisions when choosing snacks. Over 880 youth participants were involved in daily learning experiences to impact their physical fitness behavior. Campers learned how to warm up prior to getting active to help prevent damage to muscles. They also learned different styles of jumping rope that promote fitness and coordination.

- 53% identified three foods commonly categorized as "healthy" on day one
- 89% identified three foods commonly categorized as "healthy" at the end of day four
- 64% identified three activities that they can do that are commonly categorized as active or "healthy" on day one
- 87% identified three activities that they can do that are commonly categorized as active or "healthy" at the end of day four

Youth and Science

The third daily segment of Camp Clover provided an opportunity for campers to increase knowledge and skills in the natural science area.

Aerospace Adventures allowed slightly over 435 youth to become aeronautical pioneers exploring the many mysteries of flight, airplane design, and rocket propulsion. Campers made huge bubbles, designed airplanes and created and launched rockets while learning the scientific facts about the air around us. Observations of the campers' activities indicated:

- 100% designed and tested an airplane and/or rocket
- 89% modified their airplane design
- 55% modified their rocket design

Wonders of Science involved 116 campers in exploring four different areas of natural science. Youth were involved in examining "fossils" for signs of ancient plant life and in discovering how pollution can interrupt the lives of insects, which in turn, impacts all other living things. They also learned how to test plants for starch and to see first-hand what life is like under the sea. Each day's activities also included a glimpse into the exciting and interesting life of a scientist. Through observation of and discussion with the campers, instructors were able to determine:

- 79% recognized that detergent in water is harmful to some animals
- 91% predicted and then determined the presence of starch in different foods
- 94% identified three positive aspects of being a sea otter biologist
- 93% demonstrated the importance of recording scientific findings

More Wonders of Science was introduced as a curriculum designed to expose youth to the "wonders" of the science world. Through use of this curriculum, 693 campers learned about the rain forest exploring how the food chain operates. Campers studied genetics, learning how certain traits are passed from one generation to the next. They made an ascaris worm (parasite) model to gain a greater understanding of the harm parasites can do to their hosts. They also examined how craters are formed and conducted a simulation to see what happens when a large object strikes the earth.

- 93% correctly identified which species would survive in the food chain
- 98% correctly created a DNA model
- 100% successfully completed making an ascaris worm with a food tube and reproduction organs
- 97% demonstrated the importance of scientific observation and recording scientific findings

The 539 youth who participated in Adventures with Plants and Soils completed hands-on experiences with different parts of plant growth. They discovered the components and nutrients found in soil by handling and then mixing their own soil. They dissected seeds and flowers and examined the parts of a tree, including the inside of a tree trunk. As a part of each day's activities, staff reviewed

worksheets completed by the campers to measure what the campers learned. Evaluations indicated:

- 79% identified the best soil for retaining the correct amount of water for plants
- 92% identified the three parts of a seed
- 82% identified the seven parts of a flower
- 93% ate a seed or flower for the first time
- 93% identified the age of a tree

c. Source of Funding – Federal, State, Local

d. Scope of Impact - Illinois

Schools Online – U of I Urban Extension Website
http://www.urbanext.uiuc.edu/SchoolsOnline/

a. Understanding of science is critical for all people for leading an informed life, especially in a society so dependent upon science and technology. An awareness, appreciation and understanding of science are best developed when one is young. University of Illinois Extension is working to improve science literacy through its Urban Extension website. This website provides elementary school teachers with research-based science through imaginative curricula and teaching ideas with user-friendly programs that are lots of fun and educational to boot. Most of the programs are also available in Spanish. Programs include:

"The Adventures of Herman the Worm"
"My First Garden"
"Let's Talk About Insects"
"A Walk in the Woods"
"The Great Plant Escape"
"Trees Are Terrific…"

b. Impact – Over the last 12 months these five programs have received 14,543,964 hits (page loads).

Teachers are enthusiastic about these programs. Comments received include:

Yea! This site looks perfect for my 3rd grade class. I can't wait to try it out on them. Thanks.

This website is fabulous. I will use this site in my 3rd grade science next year.

Great site for kids to learn about plants! Thank you!

I love it!

GREAT INFO!!!!

It was an EXCELLENT way for me to reinforce the lessons we had done in class and review before our test on the unit.

I work in a school for dyslexic children who require as many visual connections as they do tactile. This website has helped them tremendously.

c. Source of Funding – Federal, State

d. Scope of Impact - National

Fish Tales

a. Fish Tales, a summer youth camp held in southern Illinois, has created a positive conservation education experience for more than 440 young people over the past four years.

Camp Fish Tales has two main objectives:

1) to provide an out-of-school recreational opportunity for children.
2) to use fishing as a springboard to teach conservation education and land stewardship principles.

b. Impact - Participants in this program:

Developed decision-making, communication, organizational, and leadership skills. They also learned the importance of teamwork, critical thinking techniques and increased creativity and self-confidence.

87% (382) realized the importance of establishing and enforcing fishing regulations.

90% (396) gained knowledge about ethical rights for angling, the need to avoid polluting the land and water and staying away from drugs.

40% (176) of participants stated they now intended to make fishing a lifetime hobby after initially indicating that they probably would not fish again.

c. Source of Funding – Federal, State, Local

d. Scope of Impact - Illinois

Leadership Development in 4-H Community Clubs

a. Anecdotal evidence, especially from 4-H alumni, about the value of 4-H life skills abound. Extension Youth Educators in Northwest Illinois, however, wanted to see if they could document life skill development of current 14-year-old 4-H members. They first identified specific behaviors which 14-year-olds might expect to gain from the 4-H club experience. These included confidence in parliamentary procedures, public speaking skills, skills in working with younger 4-H members, experiences or skills in working with people whom they would not have met outside of 4-H, and knowledge of the local community gained through 4-H.

Using the Reflective Appraisal of Programs (RAP) study design, a total of 41 14-year-olds were interviewed by telephone. The members were sampled at random from six counties. These members were asked about their years of experience in 4-H and leadership positions held in community clubs. Members were then asked to reflect upon each of the "life skill" areas listed above. They were then asked to what extent 4-H had helped them develop or feel comfortable with the skill. If the member responded that they had the skill, the interviewer asked them to recall what they had learned and how they had used the skill. Members were then rated as having evidence or no evidence of the skill. To be categorized "as having evidence of the skill," they first had to claim to have a skill or experience and they also had to give a reasonable and plausible evidence of actually having the skill or experience. For example, they were first asked the extent to which they felt comfortable using parliamentary procedure **as a result of their 4-H club experience**. Then they were asked to recall some of the things they learned about parliamentary procedures. The rating was done independently by two raters who did not take part in the actual interviews.

b. Impact - More than three-fifths stated they felt comfortable in using parliamentary procedure and could substantiate that claim.

- Two out of five reported and substantiated the claim they had used parliamentary procedure learned through 4-H in other settings.
- Almost nine out of ten reported 4-H helped them to be more comfortable in public speaking situations.
- Almost three out of four reported that 4-H had helped them learn to work with younger members and they could give examples of how 4-H had helped.
- More than four out of five reported 4-H had helped them meet people they would have not met outside of 4-H.
- Three out of four said 4-H had helped them learn about their community and could cite examples.
- In 2004 Illinois had 9,242 4-H members ages 14 and older who were members of a community club. It would seem reasonable to extrapolate these findings to this larger group.

c. Source of Funds – Smith-Lever, State, Local

d. Scope of Impact - Illinois

CSREES Management Goals

Key Theme - Multicultural and Diversity

Also see Camp Clover under Goal 5, Key Theme – Youth Development/4-H

Swine Reproductive Programming for Spanish Speaking Employees

The Illinois Swine Reproductive Program, an introductory level reproduction program, is also being offered in Spanish for the non-traditional Hispanic-speaking workforce. This work force is growing and will continue to be an important component to the future of the Illinois swine industry. This program was offered for the first time in June, 2003 and again in June 2004. The programs attracted 50 individuals from businesses in Illinois and surrounding states that influence production of more than 50,000 sows. Attendees are introduced to basic swine reproductive management using sequential translation of English to Spanish.

A new program is scheduled for February 2005 and is an advanced program that focuses on improving and understanding replacement gilt management and also on sow management strategies to limit sow culling and improve longevity. The impact of these programs has been through improved comprehension of tasks and job performance, improved worker retention, labor efficiency, and improved animal management for reproduction. The new advanced program is aimed toward enhancing the skills and knowledge base for the more sophisticated Spanish-speaking audience involved in breeding herd management for the Midwest.

B. Stakeholder Input Process

Stakeholders provide continuous feedback in terms of programming needs as well as programming results. The College of ACES has many channels for stakeholder input. The College, the Office of Research, the Office of Extension and Outreach, all academic departments, and many programs and projects in the College have advisory councils made up of stakeholders. The advisory councils meet at least yearly, but in many instances more frequently than that, and are active participants in determining the direction of the College units as well as specific programs. Several hundred stakeholders, representing both organizations and individuals, participate in this process on an annual basis. Stakeholder input is typically oriented towards input in the nature of the decision-making within the units and projects in the College, as well as focusing directly on the results from the College's activities for the stakeholder groups or for the state population at large. Stakeholders who function in an advisory capacity typically do not distinguish between research and outreach outcomes, and they form a powerful voice for the effective integration of research and extension activities.

The Council on Food and Agricultural Research (C-FAR) was organized to increase state funding for food and agricultural research. C-FAR is made up of such organizations as the Illinois Farm Bureau, the Audubon Council of Illinois, the Illinois Dietetic Association, the Horseradish Growers of Illinois, Illinois Rural Partners, and nearly 50 other equally diverse state organizations. While these organizations frequently disagree sharply on specific aspects of agricultural production and policy, nutrition, and rural development, all agree that a results-focused research program will provide a valuable contribution to resolving many of the issues affecting the health of the Illinois population, agricultural production and rural development. C-FAR has been successful in obtaining additional funding from the state legislature to enhance College-based agricultural research at the University of Illinois and other state institutions. Because C-FAR has been willing to expend the effort to increase the support for research it has acquired a significant role in helping to define the research agenda. By focusing continuous attention on the need to solve "real- world" problems and insisting on the timely sharing of research results with constituent groups, C-FAR has made a significant impact on the way in which the research and outreach agendas are being defined in the College.

Every Extension unit has a local council, which provides ongoing input in Extension program planning and evaluation. Councils are active in helping to identify local needs and provide formal and informal feedback on

Extension activities. During 2004, more than 3,000 volunteers served on local Extension councils and planning committees throughout the State. The chair of each council, or his/her designee, also serves on the regional advisory council in each of the five regions in Illinois. Finally, Extension has a state advisory committee made up of three representatives from each region who meet at least twice a year for a multiple-day session with the state Extension administration to provide input on programming needs and Extension processes.

To strengthen the role of advisory councils at all levels, Extension has initiated an ongoing program of council training. In addition to training that takes place at the council level, a statewide-organized training effort is taking place through regional meetings to strengthen the capabilities of council members. The training sessions have targeted new council members. In addition, Extension has completed a Council Guide that provides all council members with background information on Extension policies, procedures, and programs.

Extension is currently engaged in a multi-year review of all local units, with special emphasis on programming quality, local programming impact, diversity of stakeholder input and the needs of underserved audiences.

In program planning, Illinois relies very heavily on local input. The program planning process is structured on a four-year "rolling" basis. Each year, one of the four core programming areas, Nutrition, Family and Consumer Sciences, Agriculture and Natural Resources, 4-H Youth Development, and Community and Economic Development, is engaged in an in-depth program needs assessment process.

Planning has already begun for the 2004-5 cycle with emphasis on 4-H Youth Development. One special focus of the youth effort will be to reach youth who are not currently being served by other youth organizations or school extracurricular activities. To this end, more than 100 focus groups have been conducted with Illinois youth, many of whom are "non-jointer" to improve program access to those who have traditionally been under served or not served at all.

C. Program Review Process

No significant changes have been made in this process.

D. Evaluation of the Success of Multi-State and Joint Activities

Throughout this report we have reported consistently on integrated Extension and Research activities in terms of programming and outcomes.

Multi-State Activities

The following multi-state activities have both an extension and research component: Midwest Plan Service; Illinois-Indiana Sea Grant Program; North Central Regional Center for Rural Development (NCRCRD); the Agri-Ecology/Sustainable Agriculture Program; the National Needs Assessment for Agricultural Safety and Health; and the FSNEP National Program Coordinators Team. All are ongoing processes that include institutionalized review. Illinois participates in the institutionalized reviews of each of these groups, but does not necessarily undertake an evaluation of its own. The entities just mentioned each have an advisory or executive committee that is multi-state and combines Extension and research representation. The committees report to the North Central Regional Extension Directors at regular intervals.

The Illinois-Indiana Sea Grant Program was evaluated in preparation for the hiring of a new Extension specialist in aquaculture. As part of the preparation for the hiring process, representatives from the University of Illinois, Purdue University, and the Sea Grant program evaluated the accomplishments of the program and identified the directions in which the program needs to progress.

The collaboration between the University of Illinois and Purdue University in terms of producing the grain and livestock marketing newsletters (Ag Outlook Guide) has been a very successful ongoing activity. The collaboration has allowed both states to provide useful and timely information to producers in areas in which they may not have sufficient research and outreach strength to carry out this activity independently. A similar collaboration exists to produce the National Pork Industry Handbook – a resource with a national reputation.

The fact sheets for the Local Government Information and Education Network have undergone peer review as well. The Journal of Extension is itself a peer reviewed publication.

The multi-state conferences are evaluated to ask if they have contributed to improved program development and implementation to meet the needs of

Illinois stakeholders. For some it is too soon to assess their overall impact in meeting the needs of all Illinois citizens.

The Spanish language conference has been evaluated by the cooperating states. A report of the follow-up efforts by the states was presented to the North Central state Directors who have agreed to continue the regional efforts in Spanish language programming.

E. Multi-State Activities

An image of the CSREES report form for Multi-state Extension Activities may be found in Appendix A.

Multi-State Extension Activities

Midwest Plan Service - Midwest Plan Service provides a regional opportunity to publish research-based Extension publications of use to the North Central Region. States in the North Central Region participate financially in Midwest Plan Service and are users of the publications. The base of publications for Midwest Plan Service has been in agricultural engineering, but more recently farm management and agricultural production areas have been added to the publications of Midwest Plan Service.

Illinois-Indiana Sea Grant Program - The Illinois-Indiana Sea Grant Program provides up-to-the-minute information on great Lakes issues, emphasizing concerns in the southern Lake Michigan region. Topics addressed include water quality, aquaculture and seafood safety, biological resources, sustainable coastal development, and coastal processes. It is funded by NOAA, University of Illinois, and Purdue University. http://www.iisgcp.org/

North Central Region Center for Rural Development (NCR CRD) - NCR CRD coordinates and supports research and Extension activities in the areas of community and economic development throughout the North Central Region. The NCR CRD has a number of programmatic emphases which vary over time as the needs arise. Funding is provided to Iowa State for coordinating programs.

Agroecology/Sustainable Agriculture Program (Part-Time Farming) - The Agroecology/Sustainable Agriculture Program (ASAP) promotes research and extension which protects Illinois' natural and human resources while sustaining agricultural production over the long term. The program includes cooperative efforts of North Central land grant institutions and other partners, as facilitated and funded in part by the USDA Sustainable Agriculture Research and Education (SARE) program through the University of Nebraska. SARE offers competitive grants related to applied research and extension pertaining to sustainable agriculture.

Ag Outlook Guide - This is a collaborative effort of Illinois, Purdue and Indiana to produce grain and livestock price newsletters.

National Needs Assessment for Ag Safety and Health - Three year project to convene a consensus-building process that would host a conference and publish a document on ag safety and health to serve as a resource in national policy discussions. Representatives from Colorado State, Purdue, University of California and others are included on the planning committee.

FSNEP National Program Coordinators Team - The Food Stamp Nutrition Education Program National Program Coordinators Team is funded by the North Central Region to facilitate communication between FNS and CSREES and to build state capacities for effective program delivery and evaluation to ensure the quality of the nutrition education programming associated with FSNEP.

National Pork Industry Handbook - This is a collaborative effort of Illinois, Purdue and other states to provide pork producers with up-to-date information on all phases of pork production and marketing.
http://www.extension.iastate.edu/Publications/PM1420.pdf

4-H Centennial Celebration - Travel to participate in the national 4-H Centennial Celebration in Washington, D.C.

Local Government Information & Education Network - This program provides a variety of educational programs, materials and services to local government officials. Includes an annual series of informational updates via audio conferences, planning of annual conferences for professional associations, quarterly newsletters, fact sheets, and a series of publications on the roles and responsibilities of governmental officials. The network continues to work in areas of poverty, land use and civic education. As a result of work with the multi-state land use team, the fact sheets, written by Extension staff in Indiana and Ohio, have been adapted for Illinois.
http://www.uic.edu/UI-Service/programs/UIUC289.html

NELD North Central Assessment - NELD North Central is a program of the twelve north central states' Cooperative Extension Services as part of the National Extension Leadership Development Program. The program is designed to enhance leadership in the Cooperative Extension Service at all levels and provide vision as well as cutting-edge organizational tools for Extension leaders and administrators.
http://www.aces.uiuc.edu/~neld/about.html

Journal of Extension Professionals Assessment - The Journal of Extension is the peer-reviewed journal of the U.S. Cooperative Extension System. It seeks to expand and update the research and knowledge base for Extension professionals and other adult educators to improve their effectiveness.
http://www.joe.org/

Distance Diagnostic Training - This agreement between the University of Illinois and the University of Georgia Cooperative Extension Services provides increased coordination and multi-state expansion of distance

diagnostics technology by providing a system to facilitate rapid submission of text and digital images as educational tools for solving problems related to agricultural crops and their pests and for archiving data for future educational uses.

Regional Forage Livestock Program - Development of a CD on horse pasture management co-sponsored by the University of Illinois and the University of WI. CD is being sold in IL, WI and several other states as a regional forage-livestock program.

New Horizon Spanish Radio Program - The program is used by the University of Illinois and is distributed bi-weekly and free of charge to communities in IL, IA, KS, MI, MN, MO, OH, and VA. The program is produced by University of Illinois students to educate and entertain and geared toward Hispanic populations who have come to the U.S. looking for a new start. New Horizon becomes a part of that new beginning by providing interviews on current topics of interest as well as informative sections related to health and Hispanic culture. New Horizon programs are also distributed to radio stations throughout the Midwest.

North Central Cooperative Extension Association - Assessment to support Executive Director of North Central Cooperative Extension Association/University of Wisconsin.

Multi-State Conferences - A listing of the multi-state conferences used to sustain multi-state programs FY04 appears at the end of this section..

E-Extension Assessment - Assessment along with The Cooperative Extension Services of the U.S. states and territories and with other components of Land-Grant Universities and the CSREES in cooperation to build a national extension system. The collaborative effort will allow the Extension system to more efficiently serve current and new customers in ways that provide accurate and just in time information for decision making. The information technology and the intellectual capacity for this system are in place to complement the dedicated Extension educators located in the 3000 plus counties of the U.S.

Partnership in the Plant Management Network - PMN is a unique cooperative resource for the applied plant sciences. Designed to provide plant science practitioners fast electronic access to proven solutions, the PMN offers an extensive searchable database comprised of thousands of web-based resource pages from the network's partner universities, companies, and associations. Other state university partners are SD, ND,

NE, VA, OH, IN, KS, CO, AR, FL, MO.
www.plantmanagementnetwork.org

File: multistateextension04.wpd

FY04 Multi-State Conferences

Conference	Location
Midwest Outlook Conference	Ames, IA
2004 American Phytopathological Society	Anaheim, CA
Soil & Water Conservation	Ankeny, IA
Farm Progress Hay Expo	Arlington, WI
National 4-H Congress	Atlanta, GA
4-H Council Board of Trustees Meeting	Chevy Chase, MD
NC Regional Funding Opportunities Workshop	Chicago, IL
Entomological Society of America National Meeting	Cincinnati, OH
4-H Technology Conference	Clayton, MO
Joint Annual Mtg of NAFE & NNGA	Columbia, MO
Innovation Conference	Columbus, OH
Lamb 509-The Ohio State University	Columbus, OH
Smart Marriages Conference	Dallas, TX
Extension Disaster Education Network Conference	Denver, CO
AFCPE Conference	Denver, CO
NC Region Industry Soil Fertility Conference	Des Moines, IA
IL-IA DHIA Technician Conference	Dubuque, IA
NetScreen NAVI Technical Training	El Segundo, CA
Great Lakes Fruit, Vegetable & Farm Market Expo	Grand Rapids, MI
American Dietetics Assoc	Houston, TX
Midwest Fruit Workers Workshop	Indianapolis, IN
Tri State CCA Crop Management	Indianapolis, IN
North Central Director's Meeting	Kansas City, KS
SEA meeting	Kansas City, MO
Program Site Visit	Kansas City, MO
Upper MW Grazing Conference	LaCrosse, WI
2004 ACE International Meeting	Lake Tahoe, NV
2004 Triennial Conference	Lexington, KY
North Central Weed Science Society Annual Conference	Louisville, KY
NC Risk Management Review	Madison, WI
Distance Learning Conference	Madison, WI
4-H Council Board of Trustees Meeting	Memphis, TN

National Junior Horticulture Association Meeting	Milwaukee, WI
NC State Leaders Mtg.	Minneapolis, MN
7th International Conference of Precision Ag	Minneapolis, MN
NEAFCS Annual Conference	Nashville, TN
American Association of Retirement Communities Annual Conference	Nashville, TN
NEAFCS Annual Conference	Nashville, TN
3rd National Conference on Grazing Lands	Nashville, TN
Multi-State FCS meeting	New Harmony, IN
Meeting with IN FCE Educators	New Harmony, IN
NASULGC Conference	New Orleans, LA
CSREES Administrative Officers' Conference	Newport, RH
NAE4-HA Conference	Oklahoma City, OK
Joint ECOPs Meeting	Orlando, FL
National Association County Agriculture Agents	Orlando, FL
SharePoint 2004 JumpStart	Orlando, FL
ASAE	Ottawa, Canada
ECOP National Meeting	Phoenix, AZ
National Collegiate 4-H Conference	Portland, OR
National Junior Horticulture Association	Raleigh, NC
American Forage & Grass Council	Roanoke, VA
AFCPA Conference	Savannah, GA
CYFAR National Conference	Seattle, WA
Beef Improvement Federation Conference	Sioux Falls, SD
Farm Foundation National Public Policy Conference	St. Louis, MO
TAA Meeting	St. Louis, MO
CPS Agri-Business Conference	St. Louis, MO
ADSA AMSAS PSA 2004 Joint Annual Mtg	St. Louis, MO
2004 Priester Conference	St. Louis, MO
Predatory Lending Coalition meeting	St. Louis, MO
Focus Task Force meeting	St. Louis, MO
Meeting with Missouri Extension Staff	St. Louis, MO
St. Louis Builders Show	St. Louis, MO
Coalition Meeting	St. Louis, MO
National 4-H Technology Conference	St. Louis, MO
National Public Policy Conference	St. Louis, MO
Computer Security Conference	St. Louis, MO
EFERMA Conference	Tampa, FL
Meeting with Missouri Staff on Program Planning	University City, MO
IDA Conference	Vancouver, Canada
National Extension Technical Conference	W Lafayette IN

CECEPS Summer Meeting	Washington, DC
NCR ANR Program Leader Meeting	Washington, DC
National Meeting of State 4-H Program Leaders	Washington, DC
Natural Resource Extension Professionals	Wheeling, WV
University of Wisconsin Train the Trainer	Wisconsin Rapids, WI

Multi-State Conferences FY04.xls

F. Integrated Activities (Smith-Lever Act)

An image of the CSREES report form for integrated Research and Extension Activities funded by Smith-Lever Act funds may be found in Appendix A.

Integrated Activities (Smith-Lever Act Funds)

Illinois-Indiana Sea Grant Program - The Illinois Indiana Sea Grant Program provides up-to-the-minute information on Great Lakes issues, emphasizing concerns in the southern Lake Michigan region. Topics addressed include water quality, aquiculture and seafood safety, biological resources, sustainable coastal development, and coastal processes. It is funded by NOAA, University of Illinois, and Purdue University. http://www.iisgcp.org/

Agroecology/Sustainable Agriculture Program (Part-Time Farming) - The Agroecology/Sustainable Agriculture Program (ASAP) promotes research and extension which protects Illinois' natural and human resources while sustaining agricultural production over the long term. The program includes cooperative efforts of North Central land grant institutions and other partners, as facilitated and funded in part by the USDA Sustainable Agriculture Research and Education (SARE) program. SARE offers competitive grants related to applied research and extension pertaining to sustainable agriculture.

Farm Progress Show - The Farm Progress Show is one of the premier opportunities in the Midwest for producers and others associated with agriculture to learn about current innovative technology. The show rotates between Illinois, Iowa, and Indiana. When the Farm Progress Show is located in Illinois, the College of Agricultural, Consumer and Environmental Sciences puts together a major display that integrates the Education Research and Extension functions of the College.

Pest Management Program - On-farm applied research and extension efforts in fruit and vegetable entomology.

Illinois Environmental Policy Review - Newsletter articles written by researchers that educate city and county officials and citizens of Illinois about state, regional and federal policies and issues concerning the environment including safe food and the quality of air and water.

Program Support - Program support for new faculty and faculty who have joint research/extension appointments.

Agricultural Entrepreneur Development Initiative - Designed to provide resources and technical assistance in business planning, product development, value added products and marketing. Program is associated with research projects funded by state funds. The "Illinois Branded

Livestock Project" is an example of product development under this initiative.

Conferences - Various beef, dairy, sheep, swine and grazing meetings and conferences as well as Agronomy Days, Corn/Soybean Classics, Field Days and the Livestock Waste Management Conference showcasing current research and extension initiatives.

Integrated Swine Program - This is a multi-discipline applied research project involving research and extension to investigate approaches to improving physical and financial performance of Illinois swine farms. The research will be carried out on producer units and data will be collected that will allow full economic evaluation of management changes.
http://www.ansci.uiuc.edu/ellislab/ISP_Publications/9_isp_publicationsWF02.html

Information Technology Support - Support for services related to the design, development and web management of research and extension programs as well as program impact and reporting systems.

Global Value-Added Agriculture Center Initiative - This project involves an analysis of value-enhanced crop and livestock markets, technology, farm surveys, and strategic planning for different eco-regions. This project has added a global dimension by investigating markets for value-enhanced corn and soybeans in Japan and Mexico. The project conducts conferences, workshops, and business development meetings for Illinois producers who are interested in pursuing new value-added opportunities.

Human - Environment Research Laboratory Program - This is a multi-disciplinary research lab dedicated to studying the relationship between people and the physical environment. The mission is to generate information about human-environment relationships to guide policy, planning, and design of environments brought by theory and research methods of psychology and concerns of environmental design, policy and planning.
http://www.herl.uiuc.edu

Amish Growers Program - Funding used to conduct a workshop March 22, 2003 for Amish growers to explore the avenues for improvement of production and marketing of crops. Improvements in the Amish communities included establishing and expanding on-site marketing, increasing sale of crops substantially, starting vegetable production, starting successful educational and recreational programs to students, residents of the area, and tourists.

Intentional Harmony: Balancing Work & Life - Funds used to develop new research-based program to help people manage their work and their personal lives. The program is firmly based in family theory and interdisciplinary research and it addresses the needs of working individuals systematically across multiple domains. A series of workshops are planned in FY04. Preliminary analyses of the "Managing Work and Children" unit clearly show that parents report better work-life management in the parenting domain four weeks after the workshop.

Lab for Community and Economic Development - Provides practical, research-based information and programs to help individuals, families, organizations, businesses, farms and rural and urban communities throughout Illinois. Additional information may be found at http://communitydevelopment.uiuc.edu

Marketing and Risk Management, Putting the Pieces Together Newsletter - The objective is to improve marketing and risk management skill of Illinois grain farmers by opening a regular line of communication with 50 Illinois farmers. The audience is Illinois grain farmers and landowners who are looking to share their marketing and risk management experiences and stay on top of dynamic commodity markets. The farmers meet monthly from their home locations via teleconference communication. In between teleconferences, Extension team (Farm Business Management & Marketing) contributes to and mails the newsletter.

Farmdoc Project - The goal of the Farmdoc (farm decision outreach central) Project is to improve farm decision-making under risk through education and research. To meet this goal, the farmdoc website provides Illinois farmers with comprehensive integrated risk management information and analysis. Publications, decision tools and databases related to a variety of risk management issues are found on the site. Subject matter sections cover finance, marketing and outlook, management, law and taxation and policy. Specialty sections are devoted to the AgMAS (Agricultural Market Advisory Services) Project, crop insurance, farmland owners, prices and weather, and ag web resources. www.farmdoc.uiuc.edu

Market Maker - Illinois Initiative for the Development of Entrepreneurs in Agriculture is designed to provide high quality educational support and technical assistant to farmers and others in, or dependent on, the agriculture sector. IDEA staff believe there is an opportunity for farmers to add value to products and increase their profitability by marketing their products through alternative methods as opposed to the commodity marketing. In order to accomplish this, IDEA conducts research, develops educational products and provides services that encourage farmers to incorporate

entrepreneurial strategies which direct their marketing efforts to meeting consumer demand.
www.marketmaker.uiuc.edu

Partnership in the Plant Management Network - PMN is a unique cooperative resource for the applied plant sciences. Designed to provide plant science practitioners fast electronic access to proven solutions, the PMN offers an extensive searchable database comprised of thousands of web-based resource pages from the network's partner universities, companies, and associations. Other state university partners are SD, ND, NE, VA, OH, IN, KS, CO, AR, FL, MO.
www.plantmanagementnetwork.org

Nutrient Management Software - This software is incorporated in The Interactive Illinois Agronomy Handbook. The new soil fertility tools allow farmers to fertilize for optimum production while minimizing potential for negative impact on the environment. The Nutrient Management Worksheet allows producers to select materials and products that are both economical and environmentally sound. The application guides a farmer through the process of selecting nutrient applications for a field based upon the stated needs for that field.

Illinois Green Industry Project - The goal of this project is to follow up and update the 2000 survey of the green industry; to evaluate the impact of changes within the industry on the State's economy; to assess the economic impact of the Illinois green industry as measured by sales, workforce, payroll and taxes paid; to begin to measure the changing structure of the industry; to identify constraints to business and market expansion; to provide crucial information to assist and expand existing outreach programs for training and educational purposes; to implement needs assessment for future program planning; to disseminate survey and program results to the industry and citizens of Illinois.
http://research.nres.uiuc.edu/report01-01/intro.html

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G. Integrated Activities (Hatch Act Funds)

An image of the CSREES report form for integrated Extension and Research Activities funded by Hatch Act funds may be found in Appendix A.

Integrated Activities (Hatch Act Funds)

Illinois-Indiana Sea Grant Program - The Illinois-Indiana Sea Grant Program provides up-to-the-minute information on Great Lakes issues, emphasizing concerns in the southern Lake Michigan region. Topics addressed include water quality, aquiculture and seafood safety, biological resources, sustainable coastal development, and coastal processes. It is funded by NOAA, University of Illinois, and Purdue University. http://www.iisgcp.org/

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http://research.nres.uiuc.edu/report01-01/intro.html

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APPENDIX A

FY2004 Annual Report Statistical Tables

Images of FY2004 CSREES Report Forms

Table 1 - University of Illinois College of ACES: Research Funding and Support

FUNDING AND STAFF SUPPORT							
	GOAL I	**GOAL II**	**GOAL III**	**GOAL IV**	**GOAL V**	**Total**	**Multi-State**
Total CSREES Research	6,772,639	898,632	538,554	1,378,754	635,005	10,223,584	1,265,446
Total Other Federal Research Funds	5,797,626	368,169	620,505	988,736	402,889	8,177,925	542,626
Total Non-Federal Funds	29,803,160	2,928,680	2,148,856	6,730,687	4,584,864	46,196,247	7,498,148
Total All Research Funds	$42,373,425	$4,195,481	$3,307,915	$9,098,177	$5,622,758	$64,597,756	$9,306,220
Total Number of Research Projects	249	22	24	77	44	416	56
Scientist Years	75	16	11	25	22	148	20
Non-Scientist Staff Support	366	30	33	87	54	570	75
Total Staff Support	440.2	46	43.7	112.1	75.8	717.8	94.6

Table 2 - College of ACES: U of I Extension Funding and Teaching Contacts

	GOAL I	GOAL II	GOAL III	GOAL IV	GOAL V	TOTAL
Federal Funding - All Sources	2,108,136	945,838	2,489,981	771,360	5,159,510	$11,474,824
State Funding	6,242,551	2,800,786	7,373,259	2,284,127	15,278,188	$33,978,911
Local Funding	2,314,916	1,038,612	2,734,215	847,020	5,665,588	$12,600,350
Other Funding	1,913,313	858,428	2,259,870	700,075	4,682,695	$10,414,382
Total Estimated Expenditures by Goal	12,578,916	5,643,664	14,857,325	4,602,581	30,785,981	68,468,467
Estimated Teaching Contacts by Goal	325,110	322,624	824,818	169,401	999,492	2,641,446
Estimated Knowledge/Practice Changes using the conservative assumption that 50% of participants achieve some level of change	162,555	161,312	412,409	84,701	499,746	1,320,723

Total 4-H Youth Enrolled: 285,911

Note: Values are extrapolated from the Extension reporting system used to meet U of I positive time reporting requirements and monitor U of I Extension's affirmative action program. Expenditures are assumed to assume the same proportion by source across all five goals. Expenditure data source: fy04uie-expend-source.xls; Effort and Audience Count Source: file: 2004 Effort and Audience Counts by GPRA.xls

U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the Annual Report of Accomplishments and Results
Multistate Extension Activities and Integrated Activities
(Attach Brief Summaries)

Institution: **University of Illinois**
State: **Illinois**

Check one: x Multistate Extension Activities
_____ Integrated Activities (Hatch Act Funds)
_____ Integrated Ativities (Smith-Lever Act Funds)

	Actual Expenditures				
Title of Planned Program/Activity	**FY 2000**	**FY 2001**	**FY 2002**	**FY 2003**	**FY 2004**
Midwest Plan Service	23,112	22,896	22,896	20,000	
Illinois-Indiana Sea Grant Program	31,190	70,509	5,000	3,689	5,000
NCRC for Rural Development	2,684	2,684	2,684		
Part-time Farming/Sustainable Agriculture	37,903	33,311	39,436	24,322	28,021
Farm Progress Show	12,709			24,358	
IL-Missouri Strategies & Opportunities Conf.	22,600				
Illinois Outlook Guide	4,275	5,000	5,150		
National Needs Assessment	11,000	11,000	11,000		
FSNEP Nat'l. Prog. Coordinators Team	8,684	7,845			
National Pork Industry Handbook		2,932	2,932		
4-H National Centennial Celebration			10,000		
Local Gov't Information & Education Network			51,000	49,600	51,886
Neld Assessment			7,500		
Journal of Extension Professionals Assessment			2,000		2,000
Multi-State Conferences			14,065	66,726	77,935
Distance Diagnostic Training				11,500	11,500
Regional Forage Livestock Program				6,500	
New Horizon Spanish Radio Program				25,800	40,850
E-Extension					34,726
Plant Management Network					1,000
NC Cooperative Extension Association				10,947	5,854
TOTAL	**$154,157**	**$156,177**	**$173,663**	**$243,442**	**$258,772**

Form CSREES-REPT (2/00)
csrees-multistate-04.xls - 02/24/05

Glenn Lucas for DRC
Director

3/3/05
Date

Figure 2- Image of the CSREES Report Form for Multi-state Extension Activities - 2004

U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the Annual Report of Accomplishments and Results
Multistate Extension Activities and Integrated Activities
(Attach Brief Summaries)

Institution: University of Illinois
State: Illinois

Check one:
_____ Multistate Extension Activities
_____ Integrated Activities (Hatch Act Funds)
_x_ Integrated Ativities (Smith-Lever Act Funds)

	Actual Expenditures				
Title of Planned Program/Activity	**FY 2000**	**FY 2001**	**FY 2002**	**FY 2003**	**FY 2004**
Part-Time Farming	37,903	33,311	39,436	24,322	28,021
Illinois-Indiana Sea Grant Program	31,190		5,000	3,689	5,000
Farm Progress Show	12,709			24,358	
Pest Management Program	4,500				
Illinois Environmental Policy Review	2,500				
Program Support for new faculty w/joint appts.	158,131	107,429	54,468	82,500	1,843
Program Support for joint res/ext appts.	175,355	195,874	229,181	237,141	207,007
Ag Entrepreneur Dev Initiative		60,085	40,627	75,444	67,523
Conferences and Field Days		35,400	14,825	2,500	6,083
Integrated Swine Program		9,319	45,411	30,726	36,885
Information Technology Support		85,000	50,874	39,979	34,984
Global Value-Added Ag Center Initiative			27,694		
Human-Environment Research Lab Program			3,333		
Amish Growers Program				4,000	
Intentional Harmony: Balancing Work & Life				22,000	
Lab for Community & Economic Development				50,000	54,208
Marketing Risk Management Program				3,600	
Farmdoc Project					37,500
Market Maker Project					5,000
Plant Management Network					1,000
Nutrient Management Program					12,000
Green Industry Project					6,328
TOTAL	**$422,288**	**$526,418**	**$510,849**	**$600,259**	**$503,382**

Form CSREES-REPT (2/00)
csrees-multistate-sl-04.xls - 02/24/05

Glenn Luby for DRC
Director

3/3/05
Date

Figure 2 - Image of the CSREES Report Form for Integrated Research and Extension Smith-Lever Act Activities - 2004

U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the Annual Report of Accomplishments and Results
Multistate Extension Activities and Integrated Activities
(Attach Brief Summaries)

Institution: **University of Illinois**
State: **Illinois**

Check one: ____ Multistate Extension Activities
x Integrated Activities (Hatch Act Funds)
____ Integrated Ativities (Smith-Lever Act Funds)

	Actual Expenditures				
Title of Planned Program/Activity	**FY 2000**	**FY 2001**	**FY 2002**	**FY 2003**	**FY 2004**
Illinois-Indiana Sea Grant Program	24,952				
Sustainable Agriculture/Part-Time Farming	163,767	167,720	185,152	97,454	102,834
Farm Progress Show	13,474			11,078	
Pest Management Program	6,200				
Illinois Environmental Policy Review	6,808				
Program Support for new faculty w/joint appts.	124,040	177,268	132,265	72,900	3,397
Program Support for res/ext joint appts.		208,481	236,020	255,480	254,969
Conferences and Field Days		17,593	7,298		3,032
Integrated Swine Program		86,867	62,102	13,724	44,835
Information Technology Support		40,016	42,701	23,035	17,754
Global Value-Added Ag Center Initiative			25,000		
Human-Environment Research Lab Program			3,333		
Amish Growers Program				9,458	
Intentional Harmony: Balancing Work & Life				7,749	
Lab for Community & Economic Development				14,209	14,413
Marketing & Rish Management Program				5,000	
Farmdoc Project					25,000
Market Maker Project					3,677
Plant Management Network					1,000
Nutrient Management Program					12,000
Green Industry Project					15,000
TOTAL	**$339,241**	**$697,945**	**$693,871**	**$510,087**	**$497,911**

Form CSREES-REPT (2/00)
csrees-integrated-hatch-04.xls - 02/24/05

Director

3/7/05
Date

Figure 3 - Image of the CSREES Report Form for Integrated Extension and Research Hatch Act Activities - 2004.