Five Year Plan of Work

Lincoln University

Cooperative Research Programs

Federal Fiscal Years
2001-2005

Introduction

Lincoln University is a comprehensive institution which is part of the Missouri state system of higher education. Founded in 1866 through the cooperative efforts of the enlisted men and officers of the 62nd and 65th Colored Infantries, Lincoln University was designed to meet the educational and social needs of freed African-Americans. On March 13, 1891 Lincoln became a land-grant institution. While remaining committed to its founding purpose, the University has expanded its historical mission to embrace the needs of a significantly broader population. Lincoln University is dedicated to excellence in teaching research, service and outreach.

Agricultural and allied research programs began at Lincoln University in 1967, when the campus received $18,239 in federal funds from the U.S. Department of Agriculture. Since that time, our annual budget has grown to more than two $2 million, and the program employs more than 40 people on either a full time or part time basis. Also numerous undergraduate students assist our scientists each year with their projects. This experiential learning allows students to earn incomes while gaining hands-on knowledge.

The primary mission of Lincoln University's Cooperative Research Programs is to enhance the quality of life for diverse limited resource audiences through supportive research at the state, regional, national and international levels. Research within our program is conducted at both fundamental and applied levels. At each level the goal is to advance knowledge and to improve the quality of life of minorities, limited resource people and small-farm families. Our interdisciplinary team approach to research is designed to enhance an integrated, mutually supportive program of extension, campus instruction, and research in agricultural and environmental science. Current research focus areas are: Plant and Soil Science; Environmental Science, Food Science and Human Nutrition and Animal Science.

Accomplishments reporting on the research activities of Lincoln University Cooperative Research Programs will be achieved through the review and compilation of annual AD-421 reports and as requested and gathered for other special and routine purposes. All work during the 5-year plan of work will be evaluated and documented based on outcomes, outputs and overall program impacts.

For further information on the LU Cooperative Research Plan of Work contact either:

Dr. Marjorie Campbell
Assistant Director, Lincoln University
Cooperative Research Programs
820 Chestnut Street
Room 107 Foster hall
Jefferson City, Missouri 65102-0029
Telephone: (573)681-5312
Fax: (573) 681-595
E-mail: campbell@lincolnu.edu

Dr. Michael Heard
Lincoln University, 1890 Land-Grant Administrator
900 Chestnut Street
Room 103 Allen Hall
Jefferson city, Missouri 65102-0029
Telephone: (573)681-5109
Fax: (573) 681-5520
E-mail: heardm@lincolnu.edu

Cooperative Research Programs
Lincoln University

Overview:

Lincoln University's Cooperative Research Programs consist of four primary program areas: *Animal Science, Food Science and Human Nutrition, Plant Science* and *Environmental Science*. Each program area consist of a team of research investigators and technicians who work together to achieve the primary objectives of each area. Research projects under this Plan of Work addresses some aspects of the following broad national goals adopted by the National Agricultural Research, Extension, Education, and Economics Advisory Board:

Goal 1: An agricultural system that is highly competitive in the global economy.

Goal 3: A healthy, well-nourished population.

Goal 4: An agricultural system which protects natural resources and the environment.

.

As a revision to the original 2000-2004 Plan of Work, the following plan will continue to address selected key themes under each of the above goal areas. Some of the primary themes are: animal production efficiency; aquaculture; plant production efficiency; human health and nutrition; agricultural waste management; pesticide applications/control; soil quality; and water quality.

The 5-year, estimated budget for this Plan of Work (POW) is based on the current level of federal formula dollars of $1.9 million in addition to a portion of the required state matching funds for an approximate amount of $2.3 million. These funds principally support the salary of personnel and the day to day operations of the research unit including the University farms.

Projected Allocated Resources
Cooperative Research Programs

Year	Clerical Support Personnel (FTE)	Animal Science (FTE)	University Farms (FTE)	Plant Science (FTE)	Food Science and Human Nutrition (FTE)	Env. Science (FTE)	Total FTE	Total Projected Funds
2000-2001	2	8	4	4	7	8.5	33.5	**$2,300,000**
2001-2002	2	8	4	4	7	9.5	34.5	**$2,450.000**
2002-2003	2	8	4	4	7	9.5	34.5	**$2,450,000**

2003-2004	3	8	4	4	7	9.5	35.5	**$2,450,000**

2004-2005	3	8	4	4	7	9.5	35.5	**$2,450,000**

Stakeholders Input Process:

Our stakeholders are important considerations in the development of research projects in each of our program areas. Input is provided in both formal and informal ways. Ongoing formal input is received through our Cooperative Research and Extension Advisory Committee which is composed of representatives from state and Federal agencies. This committee provides agency input and a forum for the development of collaboration on issues and projects that are of concern on local and regional levels. Input is also received from state elected officials who relay concerns and needs of the various public constituents they represent. Informal listening activities at various University and community functions allows the flow of information from the field to our researchers for consideration in the development of research projects and associated activities.

A large percentage of research is developed around data from reports, studies and surveys done by other scientists, federal, state and local agencies and organizations which provides indirect access to potential stakeholders who had already voiced their opinions about issues to a provider.

Direct communication with farmers, community groups and extension specialists provide significant input about needs and concerns of citizens. This input serves as the basis for various program modifications and updating.

Review Process for Proposed New Research Projects:

All Evans-Allen project proposals submitted by our research teams are reviewed in a peer review process consisting of the following steps:

1. Internal Review. Proposals are reviewed by the Assistant Director of Cooperative Research Programs along with the 1890 Administrator. The function of this initial review team are (1) to review all proposals for scientific and technical merits; (2) to ensure that all proposals fulfill the 1890 land-grant mission; (3) to determine if the proposed work can be accomplished based on the expertise and capability of the investigators and the University in respect to official University duties, responsibilities and assignments; and (4) make recommendations for modifications and corrections.

2. External Review. After internal recommended revisions and modifications are made, the proposals are then forwarded to the Dean and Director of the Experiment Station of the College of Agriculture, Food and Natural Resources at the University of Missouri-Columbia (UMC) or to the Director of the Midwest Area, USDA Agricultural Research Service (USDA/ARS) with whom Lincoln University has a continuing understanding for the scientific peer review process. The Dean or Director of these two institutions on a project-by-project basis appoints peer reviewers. At least three reviewers are required for the review of each proposal. The reviewers take anywhere from 4-6 weeks to review a proposal. As this plan of work is implemented

proposals will also be sent to two other Land-Grant institutions for peer reviews.

3. Revisions. After formal reviews are received the comments are anonymously shared with each research team. Appropriate revisions are made before hard copies are submitted to the funding agency. Electronic submissions are made to the Current Research Information System (CRIS)(form AD-416) after official approval.

Submission of Extramural Proposals

The development of extramural proposals begins with the submission of a *Proposal Idea Form* to the University Grants office. The proposal idea is reviewed by the Assistant Director of Cooperative Research Programs and then submitted to the 1890 Administrator for approval. The review and approval involves evaluation of the *proposal idea* in regards to the expertise and capability of the investigators; available University facilities; and official University duties, responsibilities and assignments of the investigators. Full grant proposals are submitted according to University procedures and the guidelines established by the respective funding agencies.

Goal 1: To achieve an agricultural production system that is highly competitive in the global economy.

Planned Programs

Program 1: Animal Science

Statement of Issues:

Improving the efficiency of livestock production is a critical need for ensuring the survival of small farms in Missouri and the United States. It is difficult to keep enough livestock on small farms to support a family without resorting to off-farm employment. Trends in the past have been for specialization in one livestock species and often a single breed of that species. This has not proven consistently successful because of fluctuating market demand for various species and breeds of livestock. There is a need to therefore to develop a farming system that can efficiently raise more than one livestock species under the relatively high densities required for farms with fewer than 100 acres (typical farms in Missouri).

Performance Goals:

The goal of this research effort is to investigate the feasibility of an integrated systems approach using ruminants, swine and aquaculture to increase production on small farms in Missouri.

To increase production efficiency of animals through an integrated system that would include:

- Improved semen storage at body temperature(anestrus uterine storage)
- Improved artificial insemination techniques for ruminants
- Improved protection of soil resource by minimizing waste production in swine
- Documentation of the effects of animal grazing activity around fish/aquaculture ponds on predation.
- Increase the awareness of improved artificial insemination techniques amoung farm producers.
- Adoption of modified diets for swine to decrease waste production.

Output Indicators:

- Data on ways to improve sperm storage technologies.
- Development of an improved artificial insemination process for ruminants.

- Reduction in the amount of waste produced by swine through diet modifications.

- The number of swine producers utilizing the modified diet to reduce swine waste.
- Decreased predation on fish at aquaculture farms.
- An increase in the number of aquaculture operations in Missouri.
- The number of published scholarly articles and professional presentations
- The number of small farmers that participate in the research and demonstrate improved animal production.
- The number of farm producers that participate in formal animal reproductive workshops.

- The number of farm producers demonstrating increased awareness and knowledge of artificial insemination procedures.
- The number of producers demonstrating increased awareness and knowledge of ways to improve aquaculture production.
- The number of extramural funded grants on support of animal science research.

Evaluation Framework:

Routine reports will be examined to document significant research underway or proposed on improving livestock production efficiency on small farms. CRIS reports will be examined to document significant research activities. Output indicators will be integral parts of the evaluation process.

Internal and External Linkages:

Lincoln University Research Investigators (Animal Nutritionists; Reproductive Physiologists)
Lincoln University Extension Specialists
Missouri Livestock and Aquaculture Producers
Missouri Department of Agriculture
University of Missouri Outreach and Extension
Lincoln University Agriculture Marketing Specialists
University of Tennessee
State Producers Organization
North Central Regional Association of Experiment Station Directors (NCRA)
North Central Research Aquaculture Center

Target Audiences:

Small Farmers
Aquaculture Producers
Livestock Producers
Swine Farm Operations

Program 2: Plant Science

Statement of Issues:

Many crops grown by small farmers in Missouri are susceptible to low temperatures in the range of 1-19^{o}C and are classified as chilling sensitive. When planted early, seed germination and stand establishment of these crops are impaired in the cold soils of early spring. However, some of the limitations may be overcome through the development of cultivars tolerant to chilling temperatures, or through modification of cultural practices. Based on whole plant screening, some germination and seedling growth will occur in cowpea and okra at chilling temperatures. Nevertheless, this does not provide enough variation to improve the trait and therefore other available methods such as biotechnology must be pursued. Reliable regeneration systems which can produce large numbers of explant must be developed in order to use this approach. This does not exist for the local cultivars of cowpea and okra.

Very little research data has been collected on sweet potato in Missouri. Direct discussions with clientele in Southeast Missouri has led us to believe that small farmers with limited resources are very interested in sweet potato's potential for improving their income. There is a lack of local research on state sweet potato production or on alternative crops for small farmers.

There is a need to develop cultural management systems to improve adaptation of cowpea, okra, sweet potato and other alternative crops in Missouri. Assessment of the economic implications of adopting new cultivation practices and alternative crops by small farmers is also needed.

Performance Goals:

The overall goal of this program is to investigate modified and alternative crop development, adaptation and production in Missouri.

- Determination of chemical factors that will promote the development of cold tolerant cowpea and okra cultivars.

- Determination of the growth of selected commercial sweet potato varieties when treated with different rates of nitrogen fertilizer and variable irrigation rates.

- Determination of new alternative crops that can successfully be cultivated by small farmers in Missouri.

- Determination of the economic implications that result from the cultivation and management of modified and alternative crops by small farmers in Missouri.

Output Indicators:

- Development of cultivars of cowpea and okra that can tolerate cold temperatures
- In-field growth and harvest of cultivars of cowpea and okra that can tolerate cold temperatures
- Identification of the sweet potato varieties that grows best under fertilization and irrigation practices most likely to be adopted by small farmers in Missouri.
- Identification of alternative crops for small farmer cultivation under Missouri environmental conditions
- The number of small farmers adopting new cultivars or alternative crops
- The number of research reports, articles published in referred journals, professional presentations, technical reports and workshops for producers.
- The number of workshops presented to farmers on alternative crops
- Increased awareness and knowledge among small farmers of alternative crops
- Publication of information on the economic impact or implications of adopting modified and alternative crops by small farmers in Missouri.
- Improved economic profits for farmers adopting alternative crops.
- The number of extramural funded grants in support of plant science research.

Evaluation Framework:

Routine reports will be required and examined to document significant research underway or proposed. CRIS reports will be examined to document significant research activities. Output indicators will be integral parts of the evaluation process.

Internal and External Linkages:

Lincoln University Researchers and Agricultural Economists
Lincoln University Extension Specialists
Missouri Department of Agriculture
Small Farmers in Southeast Missouri

Target Audiences:

Goal 3: To achieve a healthier, more well-nourished population.

Program 3: Food Science and Human Nutrition

Statement of Issues:

Adequate nutrition is essential for the health and well-being of humans. However, some dietary factors also contribute to preventable diseases and death in the United States. Dietary factors are associated with obesity, hypertension, cardiovascular diseases, stroke, some types of cancer, non-insulin-dependent diabetes mellitus and arteriosclerosis Epidemiological studies suggest that a disproportionate consumption of foods containing high levels of fat at he expense of foods containing complex carbohydrates, fiber and trace essential nutrients are correlated with chronic diseases described above.

The combined effects of dietary fat and exercise on blood pressure have not been studied and need to be explored. Information on the role of dietary antioxidants for prevention of cellular damage during high polyunsaturated fat consumption and moderate exercise is needed since they can be used to lower blood pressure.

Epidemiological surveys indicate that the prevalence of overweight and obesity has increased dramatically in the United States. Overweight is particularly prevalent in minority populations, especially among minority women. The relationship between consumption of vegetables and fruits and chronic disease in African-Americans needs to be explored.. Also, we need to determine if an increased consumption of vegetables and fruits through nutritional education can improve health in this population.

Performance Goals:

The overall goal is to determine what dietary factors are associated with chronic diseases such as hypertension and obesity. Laboratory rats and human subjects will be used in the study.

- Determination of the effects of increased dietary omega-3-fatty acids on hypertension
- Determination of the effects of low dietary protein levels and supplementary amino acids on energy metabolism and obesity.
- Determination of the role of dietary antioxidants in fruits and vegetables in preventing cellular damage.
- Determination of the influence of dietary fats on carotenoid absorption.

Output Indicators:

- Number of workshops that help inform the target audience on effects of diets and chronic diseases.

- Number of workshops that help inform the target audience on healthy eating practices.

- Number of individuals improving their nutrition and lifestyles to help prevent chronic diseases as a result of workshop attendance and participation.

- Number of extramural funded grants in support of food science and human nutriton research.

- The number of research reports, articles published in referred journals, professional presentations, and technical reports.

Evaluation Framework:

Routine reports will be required and examined to document significant research underway or proposed. CRIS reports will be examined to document significant research activities. Output indicators will be integral parts of the evaluation process.

Internal and External Linkages:

Lincoln University Food Science and Human Nutrition Research Group
Lincoln University's Center for Minority Health and Aging
Extension Specialists
Missouri Department of Public Health
State Nutritionist
University of Missouri

Target Audiences:

African -Americans
Individuals with Chronic Diseases

Goal 4: To achieve greater harmony (balance) between agriculture (production activities) and (stewardship and protection of) the environment.

Program 4: Environmental Science

Statement of Issues:

Environmental quality is a major concern for people throughout the world. Agricultural practices to meet human demand for food have historically and will continue to impact the environment. The production of synthetic pesticides such as DDT have been highly successful in controlling target pests but at a tremendous cost to environmental integrity. Many agricultural chemicals are persistent in soils and some can leach into ground water or run off to surface water. Consequently, the air we breathe, the water we drink and bathe in, the soil in which our crops are grown, and the habitats for populations of animals and plants are contaminated with a variety of synthetic chemicals. Such contamination is especially acute in agricultural areas where soils, ground water and surface waters are contaminated with a variety of chemicals and their degradation products. Even if these chemicals are present in small concentrations in the environment they are subject to biomagnification and bioaccumulation in the food chain and may reach levels that have toxic and deleterious effects on livestock, wildlife and humans.

Even though farmers have made adjustments and changes in their practice of using certain chemicals the earlier release of persistent or currently banned pesticides did take place. Those chemicals and their degradation products continue to be present in the environment. Concerns about the unintended effects of these chemicals continue to this day, and evaluation of the risk to humans and the environment from present-day levels of pesticides or their degradation products exposure remains highly controversial. Nevertheless, for many synthetic chemicals their degradation products continue to be very toxic for long periods of time and can continue to pose treats to the environment, wildlife and human health. Knowledge of the presence of such toxins is important in planning future and alternative uses of agricultural lands that will help maintain ecosystem integrity and protect human health. This knowledge can also be used to help agricultural communities become aware of pesticide exposure risks and could lead to the development of alternative agricultural practices that will help protect, sustain and enhance water soil and air resources.

Environmental based research that promote environmentally sound, efficiency-enhancing,

innovative technologies and processes that will inform the public and minimize environmental

degradation is crucial.

Performance Goals:

The general goals of this program are (1) to investigate ways to protect the environment and (2) assessment of environmental samples from agricultural communities for organic and inorganic contaminants.

- Protection of groundwater and soil resources through the development of a natural "biobed" model to biodegrade pesticide wastes on farm sites.
- Assessment of environmental samples in agricultural areas of southeast Missouri for the presence of pesticides and inorganic contaminants.
- Integration of Geographic Information Systems (GIS) technology in assessing environmental quality.
- Increased agricultural producer awareness, understanding, and information regarding the adoption of agricultural practices that protect ecosystem integrity and bio-diversity.
- Increased awareness in agricultural communities of the presence of pesticides and inorganic contaminants in soil and drinking water.

Output Indicators:

- Data on optimum biobed conditions for specific pesticide biodegradation.
- Identification and isolation of the evolving microbial consortia capable of bio-degrading selected pesticides in the biobed model.
- Construction of an efficient biobeds model at selected farm sites.
- The number of farm operations adopting the biobed model.
- Data on the occurrence of pesticides and inorganic contaminants in southeast Missouri.
- The number of workshops that inform communities of harmful environmental contaminants and their possible health effects.
- Improved water quality in target communities as a result of an informed public.
- The number of research reports, articles published in referred journals, professional

presentations, and technical reports.

Evaluation Framework:

Routine reports will be required and examined to document significant research underway or proposed. CRIS reports will be examined to document significant research activities. Output indicators will be integral parts of the evaluation process.

Internal and External Linkages:

Lincoln University's Environmental Science Team
Extension Specialists
Missouri Department of Public Health
Missouri Department of Agriculture
Missouri Department of Natural Resources
Natural Resource Conservation Service
Environmental Protection Agency
University of Missouri

Target Audiences:

Southeast Missouri Rural/Farm Communities
Missouri Farmers