AGRICULTURAL RESEARCH SERVICE

FY 2000 and 2001 ANNUAL PERFORMANCE PLANS

The Agricultural Research Service (ARS) was established on November 2, 1953, pursuant to authority vested in the Secretary of Agriculture by 5 U.S.C. 301 and Reorganization Plan No. 2 of 1953, and other authorities.

ARS is the principal in-house research agency of the U.S. Department of Agriculture (USDA). Congress first authorized federally supported agricultural research in the Organic Act of 1862, which established what is now USDA. That statute directed the Commissioner of Agriculture "... To acquire and preserve in his Department all information he can obtain by means of books and correspondence, and by practical and scientific experiments..." The scope of USDA's agricultural research programs has been expanded and extended more than 60 times in the 135 years since the Department was created.

The research currently performed by ARS is authorized by the Department of Agriculture Organic Act of 1862 (7 U.S.C. 2201, 2204), Research and Marketing Act of 1946, amended (7 U.S.C. 427, 1621), Food and Agriculture Act of 1977, as amended (7 U.S.C. 1281 note), Food Security Act of 1985 (7 U.S.C. 3101 note), Food, Agriculture, Conservation, and Trade Act of 1990 (7 U.S.C. 1421 note), Federal Agriculture Improvement and Reform Act of 1996 (FAIR Act), and the Agricultural Research, Extension, and Education Reform Act of 1998 (P.L. 105-185).

The ARS mission is to conduct research to develop and transfer solutions to agricultural problems of high national priority and provide information access and dissemination to: ensure high-quality, safe food, and other agricultural products; assess the nutritional needs of Americans; sustain a competitive agricultural economy; enhance the natural resource base and the environment; and provide economic opportunities for rural citizens, communities, and society as a whole.

The Agency's research focuses on achieving five broad goals identified in the Strategic Plan of the Research, Education, and Economics (REE) mission area of which ARS is a part. The Government Performance and Results Act (GPRA) mandates each agency to establish general goals that will contribute to achieving beneficial societal outcomes that shape and drive the work of the Agency during the five years covered by the plan.

Verification, Validation and Program Evaluation: ARS currently conducts a series of review processes designed to ensure the relevance and quality of its research work and to maintain the highest possible standards for its scientists. This process involves customer input to help keep the research focused on the technical needs of the American food and agricultural system. Each of the approximately 1,100 research projects undergoes a thorough merit review before new or renewed activities are begun. All ARS employees, including the scientific workforce, are subject to annual performance reviews, and the senior scientists undergo a rigorous peer review (Research Position Evaluation System–RPES) on a 3- to 5-year cycle. These processes ensure the continuing high quality of the ARS scientific workforce.

ARS is in the process of restructuring the way it organizes and manages its national research programs. As part of this process, ARS has aggregated its 1,100 research projects into 23 national programs managed by multidisciplinary teams of National Program Leaders (NPLs). The national programs will focus the work of the Agency on achieving the goals defined in the ARS Strategic Plan. In FY 2000, ARS will begin a series of program and program component reviews that will supplement current merit and RPES reviews to ensure the quality, relevancy, effectiveness, and productivity of the work being done in each national program. The annual performance plans will also serve to keep the work of the Agency focused on achieving the goals established in the ARS Strategic Plan. The aggregate effect of all these changes will be a strengthened research program and an accountability system that will measure more effectively progress made towards established goals and outcomes.

Key External Factors that Affect the Ability of ARS to Achieve its Goals and Objectives:

Consumer, Socio-Economic, and Policy Trends - The abundance and affordability of the American food supply is chiefly due to U.S. agricultural research. In recent years, consumer and producer attention has expanded into other areas of concern, such as food safety and quality; the impact of agriculture on the environment; the profitability of the agricultural enterprise; and the effect of government regulations, land use restrictions, and economic options that diminish the supply of farm and grazing land. Global population increases, demographic changes, and economic growth will substantially increase the demand for agricultural products and lead to the development of new markets. At the same time, increased agricultural efficiency in other countries will force U.S. agriculture to be more competitive.

Meanwhile, budget considerations and external pressures on the domestic economy may limit funding for agricultural research in both the public and private sectors.

Congressional Support - The ability of ARS to respond to the many and diverse needs of producers and consumers is determined by Congressional appropriations. In recent years, Congressional appropriations in constant dollars have remained relatively static. As a consequence of inflation and higher operating costs, ARS has not been able to maintain its entire workforce. ARS scientific workforce, which reached a maximum of about 3,400 scientists in 1970, has decreased by almost 40 percent during the following 25 years.

1996 Farm Bill and the Revision of the Research Title - The 1996 Farm Bill, the Federal Agriculture Improvement and Reform Act, set a new direction for American agriculture by beginning the process of phasing out farm subsidy payments based on production levels and introducing free market disciplines. The effect of this legislation will be to heighten the importance of agricultural research as one form of a safety net beneath producers. Research to maintain and improve productivity; to detect, control, and eradicate diseases and pests (insects, weeds, etc.); and to promptly address nontariff trade barriers, especially sanitary and phytosanitary conditions, will take on even greater importance in a market environment. The 1996 Farm Bill also updated and expanded the “Purposes of Agricultural Research” which were first enacted in 1990. As described elsewhere in this introductory section, ARS incorporated the Purposes into its strategic and performance plans as the agency’s objectives.

Competition - The Department of Labor projects an increase of 19 percent in the size of the general workforce in the next decade, which is slightly lower than the rate of growth in the preceding decade. The labor market during this period is also expected to be highly competitive for many occupations that require an advanced education, such as scientists, engineers, economists, and computer specialists. The high earning potential of professions, such as law and medicine, may continue to make a career in science less attractive to many young men and women who have the creative intelligence needed for professional success in agricultural research. Consequently, a major emphasis on recruitment, student employment, upward mobility, and training programs will be needed to attract and retain a quality workforce. The trend toward increasing workforce diversity will continue, and opportunities for encouraging women and minorities into careers in science, engineering, and economics will be given a high priority.

Partnerships and Coordination with USDA and Other Federal Agencies: As the intramural research component of USDA, ARS provides the scientific expertise needed to support the work of most of the Department's action and regulatory agencies and other Federal agencies such as the Food and Drug Administration (FDA), the Environmental Protection Agency (EPA), some components within the Department of Defense (DOD), and the Department of the Interior (DOI). The USDA action and regulatory agencies served by ARS include: Agricultural Marketing Service (AMS); Animal and Plant Health Inspection Service (APHIS); Farm Services Agency (FSA); Food and Consumer Services (FCS); Food Safety and Inspection Service (FSIS); Foreign Agricultural Service (FAS); Grain Inspection, Packers and Stockyard Administration (GIPSA); and the Natural Resources Conservation Service (NRCS). When it is possible to do so, the cooperating agency or the direct customer of ARS research is identified in the appropriate place in the ARS Performance Plan.

Drug-Free Workplace: ARS will continue to use the applicable contract clauses and regulations to ensure compliance with drug-free workplace debarment and suspension requirements in all of its acquisition programs.

In January 1998, ARS requested permission from the Office of Management and Budget (OMB) "to describe specific and tangible products, steps, intermediate goals, and/or accomplishments that will demonstrate that the Agency has successfully met each Performance Measure/Goal in a given fiscal year." With OMB's concurrence, the ARS was able to employ narrative descriptions of intermediate outcomes and indicators of progress instead of numerical metrics, as is specified in GPRA. The indicators listed below represent intermediate outcomes, significant products or anticipated impacts of the Agency's work which will serve as measurable milestones during FY 1999, FY 2000, and FY 2001. The research and technology transfer activities listed in this exhibit are not all inclusive of the Agency's work. The indicators reflect but do not adequately capture the broad range of basic research that underpins most of the work of the Agency. The following qualitative indicators are specific accomplishments that the Agency anticipates achieving in the designated fiscal year, which constitute milestones or indicators of progress towards meeting the Agency's goals, objectives, and initiatives.

Only Federal employees were involved in the preparation of the plans.

GOAL I: Through Research and Education, Empower the Agricultural System with Knowledge That Will Improve Competitiveness in Domestic Production, Processing, and Marketing.

Funding by Program Activity ($000's)	FY 1998	FY 1999	FY 2000	FY 2001
Soil, Water & Air Sciences	769	702	692	670
Plant Sciences	21,583	22,238	23,214	21,991
Animal Sciences	3,792	3,670	3,733	3,382
Commodity Conversion & Delivery	93,454	94,700	92,548	102,469
Human Nutrition	959	938	0	0
Integration of Agricultural Systems	875	1,148	1,140	1,122
Total	$121,432	$123,396	$121,327	$129,634
FTEs	1,296	1,296	1,293	1,289

Means and Strategies: To successfully accomplish the research activities under this goal, ARS will need the level of human, fiscal, physical, and information resources portrayed in the budget estimates for fiscal years 1999 to 2003.

The proposed funding for FY 2001 includes $14,000,000 in program increases. Funding includes increases for biobased products and new uses.

Verification and Validation: ARS currently conducts a series of review processes designed to ensure the relevance and quality of its research work and to maintain the highest possible standards for its scientists. A more detailed description of the evaluation plans can be found in the introduction of this plan.

OBJECTIVE 1.1: Strengthen Competitiveness: "Enhance the competitiveness of the United States agriculture and food industry in an increasingly competitive world environment."

STRATEGY 1.1.1: Cost-effective agricultural production systems: Develop new knowledge and integrated technologies for more efficient and economically sustainable agricultural production systems of all sizes.

PERFORMANCE GOAL 1.1.1.1: Demonstrate and transfer to users integrated systems.

Indicators:

During FY 2000, *ARS will incorporate into the "Decision Evaluator for the Cattle Industry" model for use by cattlemen, new strategies and management systems to reduce feed costs for brood cows and to raise replacement heifers more economically.*

During FY 2001, *ARS will*

incorporate into the "Decision Evaluator for the Cattle Industry" model, the grazing component applicable to the various regions of the United States as part of an improved management system.

modify the rumen submodel of the Cornell Carbohydrate Protein System for evaluating cattle diets to accommodate the effect of pH on ruminant methanogensis and ammonia production.

PERFORMANCE GOAL 1.1.1.2: Demonstrate and transfer to users computer-based simulation models and decision support systems.

Indicators:

During FY 2000, *ARS will continue beta tests with both the new generation cotton model and GPFARM.*

During FY 2001, *ARS will*

begin testing the new generation cotton production model on a field production basis with farmer cooperation.

use a computer model of dairy production to assess long-term impacts of global warming on dairy farms in the Northern U.S.

release a new decision support tool for cattle producers in the Northern Great Plains that will provide aid in managing rangeland in a sustainable manner.

STRATEGY 1.1.2: Postharvest control of pests: Develop postharvest technologies and processes to meet domestic needs and reduce or overcome nontariff trade and quarantine barriers caused by pests (insects, weeds, pathogens, etc.).

PERFORMANCE GOAL 1.1.2.1: Demonstrate techniques to control or eliminate postharvest insects and diseases, and increase market quality and product longevity.

Indicators:

During FY 2000, *ARS will*

continue efforts to understand insect resistance in corn varieties and use the information to develop new alternative pest control methodologies.

continue cooperative efforts in the development of environmentally friendly and generally nontoxic biopesticides and natural product based pesticides.
continue the evaluation of resistance genes and begin the establishment of molecular markers in order to accelerate up the incorporation of this resistance into commercial varieties.

continue development of alternative insect pest control methodologies. Specific protection methodologies will be tested in an areawide IPM Program involving producers, grain elevator operators, and wheat mills in Kansas and Oklahoma.

evaluate various commodity treatments for control of postharvest decay of citrus, apples, potatoes, and other crops.

determine the tolerance of various major varieties of tangerines/hybrids and round orange citrus types marketed as fresh fruits treated with low dose irradiation and conduct preliminary investigations to determine the response of methyl jasmonate for reducing peel injury to grapefruit due to irradiation exposure.
study the effects of heat/long-term controlled atmosphere quarantine treatment of pears and apples on fruit quality. Complete the insect mortality efficacy testing of this treatment to assure that it provides adequate quarantine security for U.S. trading partners.

During FY 2001, *ARS will*

continue cooperative efforts in developing environmentally friendly and generally nontoxic biopesticides. Potential biopesticides such as insect chitinase, chicken avidin, and entomopathogens such as fungi will be evaluated for their ability to protect crops and processed commodities from insect infestations in collaboration with other ARS, university, and biotech industry personnel.

continue evaluating genes in wheat and alfalfa that provide resistance to various insects and pests and begin the establishment of molecular markers to hasten the incorporation of this resistance into commercial varieties.

continue developing alternative insect pest control methodologies. Specific protection methodologies will be tested in an areawide IPM program that involves producers, elevator operators, and wheat mills in Kansas and Oklahoma.

evaluate new low risk insecticides (biopesticides, nontoxic compounds and products with novel chemistries) to control insects in milling and processing facilities, food storage, and bulk grain.

determine the potential for expanded use of aeration of wheat and corn stored in different regions of the U.S.

continue evaluating the effectiveness of diatomaceous earth and heat for cost-effective insect management in food processing facilities and distribution centers.

continue cooperation with food processors and packers to develop insect resistant packaging.

develop artificial diets for parasitoids that attack grain insect pests so that these beneficial insects can be raised commercially.

continue insect behavioral studies and the development of alternative insect pest control methodologies that

incorporate the understanding of pest and natural enemy interactions.

develop alternative strategies to the use of fungicides for limiting postharvest decay of fruits and vegetables. discover and develop natural product-based postharvest materials to protect against insect and microbial damage.

PERFORMANCE GOAL 1.1.2.2: Demonstrate technologies to control quarantine pests.

Indicators:

During FY 2000, *ARS will*

expose commodities to new fumigants at various concentrations to determine their potential as alternatives to methyl bromide. Fruit and nuts will be infested with an appropriate postharvest insect pest, treated, and evaluated as to efficacy and phytotoxicity.

investigate different sorption substrates for their ability to trap methyl bromide in an effluent gas stream. Those considered promising will be further investigated to determine their ability to sorb and desorb methyl bromide under various temperature and relative humidity conditions.

test the new Mediterranean fruit fly attacking strain of parasite, B. arisanus in field cage evaluations in Guatemala and Mexico in preparation to transferring the parasite to APHIS for use in those countries. Assistance will be provided to APHIS for developing colonization and mass rearing procedures.

PERFORMANCE GOAL 1.1.2.3: New and improved diagnostic tests are developed and available.

Indicators:

During FY 2000, *ARS will*

continue the investigation of NIR as a tool for mosquito analysis. The species determination capabilities will be verified and the ability of the instrument to detect the presence of malarial organisms within the mosquito will be evaluated. Such information will provide the first rapid mosquito analytical method available, and save millions of dollars in time and effort worldwide.

evaluate the potential of the semi-automated microplate assay, blot assay, and other assays that can be used to detect and monitor pesticide resistance in insects.

cooperate with the grain industry in Kansas and Oklahoma in using detection technology for monitoring the level of insect infestation in wheat to improve quality through the application of a variety of insect control measures.

begin studies to determine the influence of insect movement behavior and response to pheromones on the implementation and interpretation of pest insect monitoring programs.

determine the optimal density of McPhail traps or others for detecting or delimiting Mexican fruit fly outbreaks. This will be accomplished by conducting research to test the effective distance at which an adult fly would be at risk of capture by a McPhail trap.

develop and test a long lasting lure containing a new synthetic attractant for efficacy in citrus orchards. Bait stations will continue to be improved and tested with emphasis on the Mexican and Mediterranean fruit fly.

transfer to APHIS recombinant antigen-based diagnostic tests for equine piroplasmosis.

validation of a live animal test for scrapie in sheep.

develop methods for rapidly identifying avian influenza viruses and infections by different avian influenza virus strains.

During FY 2001, *ARS will*

develop improved detection and identification tests for plant pathogens in commodities, seeds, and other plant products. Such tests will reduce the risk of spreading disease from one crop to another and reduces commodity losses in storage.

cooperate with industry to develop an integrated insect management system for use in food processing facilities, distribution centers, and grocery stores. The system will rely on sanitation and insect monitoring using spatial analysis so that controls can be specifically targeted to infestations.

cooperate industry to develop improved pheromone baited traps and methods to monitor stored product pests in commercial facilities.

continue with investigations into the movement behavior of insect pests and use the information to develop more effective pest monitoring strategies.

collaborate with the grain industry to apply the characteristics of the Perten 4100 System for determining physical properties to predict end use functionality of wheat and other similar grains.

cooperate with commercial insecticide manufacturers to show that NIR can be used to differentiate parasitized and nonparasitized fly pupae to assist in developing biological controls.

cooperate with industry and researchers to apply NIR to rapidly, by age, grade mosquitoes and flies.

develop new instrumental methods for determining fruit and vegetable quality based on human sensory analysis characteristics.

develop/transfer technology on wheat quality evaluation for detecting the presence of TCK mold spores.

cooperate with the peanut industry and FAO/WHO to implement aflatoxin testing programs for peanuts exported/traded in world markets.

STRATEGY 1.1.3: Measurement of product quality and marketability: Improve quality, uniformity, value, and marketability of commodities and other agricultural products.

PERFORMANCE GOAL 1.1.3.1: Demonstrate postharvest technologies that add value and improve quality.

Indicators:

During FY 2000, *ARS will*

transfer a food product database to users for measuring total dietary fiber in foods.

scale up the enzymatic retting process for commercial development using fiber flax and seed flax straw to produce high and consistent staple length flax/linen fibers tailored for use by specific industries.

continue to update the information in the Stored Grain Advisor software and expand coverage to include corn in addition to wheat. A new version of the software will also be developed that is more applicable to storage conditions and problems found in large concrete grain elevators.

continue to cooperate with various industry partners to develop more effective insect controls and provide information linking the insect trap catch data to the economic impact of specific levels of infestation.

evaluate the application of specific insect monitoring, control, and sanitation programs at each of the areawide stored wheat IPM program test site and evaluate the impact on wheat quality and insect populations.

continue the development of the wheat end use quality relational data base.

conduct grain drying tests to determine the energy performance of an experimental closed-loop heat pump grain dryer in cooperation with a CRADA partner and the Department of Energy. Energy performance was found to be three to four times greater than conventional high temperature batch dryers and 15 to 20 percent higher than that reported in the literature for heat pump-based grain drying, but management, automation and control of grain flow, air flow, and refrigerant flow needs improvement to sustain total system performance. evaluate the potential for development or installation of online sensing devices in a pilot elevator for automatic quality segregation of incoming grain.

cooperate with grain cleaner manufacturers and Kansas State University research associates in reviewing the engineering design requirements for removing dockage from wheat in high capacity systems at grain export facilities.

evaluate strong and weak gluten wheat flours for frozen dough quality through fractionation and reconstitution of the major flour components, and ascertain which component causes dough weakening during proofing and baking.

continue to refine the enzymatic "retting" process to separate flax fibers from the stem of the flax plant. ARS will provide the capability to "cottonize" the fiber, i.e., to cut it into staple lengths so that it can be processed on cotton equipment, and will begin studies on the utilization of this material for cotton-linen blends.

During FY 2001, *ARS will*

continue its five year areawide stored wheat IPM program in Kansas and Oklahoma using early aeration to cool grain and decrease insect and mold population growth, and assess impact on wheat quality and insect populations in cooperation with Kansas and Oklahoma State Universities and farmers and operators of grain elevators.

design and assemble a second generation experimental closed-loop heat pump grain dryer for further validation of energy efficiency and assessment of improved grain quality and functionality when such a system is used to dry grain.

continue to evaluate the potential for development and/or installation of online sensing devices in a pilot elevator setting for automatic quality segregation of incoming grain.

continue to cooperate with grain cleaner manufacturers and research associates in reviewing the requirements necessary to remove dockage from wheat in high capacity systems (20,000-80,000 bu/hr) at grain export facilities.

cooperate with industry in the development of insect monitoring strategies (including the types of traps,

locations of traps, etc.) leading to new trap designs and pheromone combinations that will increase the effectiveness and acceptance of insect pest monitoring. Improved techniques for analyzing trap data will

pinpoint sources of insect contamination and lead to decreased pesticide use and better and more economical control of insect pests.

establish the feasibility of using a patented process to tenderize both the large and small broiler breast muscles without whole carcass chilling. This will reduce the need for water/ice and chlorine used for chilling, and will shorten processing time by eliminating the need for postmortem "aging" prior to muscle removal.

develop hyperspectral imaging technology which can assist industry to measure the quality of deciduous fruits (apples and cherries) during growth and maturation, and in various postharvest stages.

begin pilot plant trials on nonsulfide dehairing processes to eliminate the particularly noxious chemical now used in the tanning process.

complete analysis of grading peanuts with high moisture content to enable industry utilization of continuous flow drying and improved inventory control during harvest and initial marketing.

add the measurement of protein to the food product database used for dietary fiber.

design a pilot plant facility to produce retted flax and determine the feasibility of using enzyme retting by industry.

develop universal calibrations for radio frequency and microwave moisture sensors and evaluate other opportunities for lowering costs that will foster the development of cost-effective reliable online moisture sensing equipment to aid in preserving high quality of cereal grains and their products.

evaluate the effect of selected enzymes and enzyme combinations on weakening of frozen bread during proofing and baking, and subsequent keeping quality of the baked bread after 16 weeks of frozen storage.

complete analysis of grading peanuts with high moisture content to enable industry utilization of continuous flow drying and improvement of inventory control during harvest and marketing.

develop optimum marketing strategies for beef cattle in the Northern Great Plains.

PERFORMANCE GOAL 1.1.3.2: Provide knowledge and technology to expand and improve the grading systems for agricultural commodities and products.

Indicators:

During FY 2000, *ARS will*

implement a new "end use" classification and measurement scheme to be used intermittently for wheat.

continue working with the grain industry to establish an acceptable standard for red versus white classes of wheat. In addition, ARS will test the effectiveness of a modified instrument to predict the end use performance of wheat samples and analyze important properties of other small grains, such as sorghum, rice, and oats.

provide GIPSA with an experimental automatic test weight prototype and specifications for use in developing an evaluation site for automated grain inspection data collection.

continue cooperation with Perten Instruments of North America to add NIR measurements of wheat to the

Perten 4100 Single Kernel Characterization System (SKCS). This instrument, which will be commercially available, objectively distinguishes red and white kernels of wheat and measure the protein concentration in single wheat kernels. The NIR instrumentation can also detect the presence of internal insects in single kernels and bunted kernels in addition to providing standard SKCS measures of single wheat kernel hardness, weight, size, and moisture content.

evaluate the potential for rapid, objective assessment of starch modification in single kernels of malted barley using physical measures similar to those for crushing wheat for hardness classification with the Perten SKCS.

develop and combine a machine vision analysis component with Perten's 4100 Single Kernel Characterization System to increase wheat quality prediction performance. Preliminary studies have demonstrated an increase in the accuracy of hardness classification and the potential for improved flour yield predictions.

develop a machine vision based methodology to objectively evaluate bread crumb grain in ARS bake laboratory evaluations of early generation hard winter wheat varieties.

evaluate, in cooperation with GIPSA, the capability of the FOSS Grain Check 310 to assist inspectors in grading wheat. This instrument is one of the first commercially available that uses the principles of image analysis to measure grain quality.

develop, in cooperation with GIPSA, a knowledge base of the qualitative characteristics that define wheat defects portrayed in the Interpretive Line Slides and develop a machine vision-based inspection system to identify the Line Slide defects in wheat-based on the knowledge base of qualitative characteristics.

continue to transfer the technology that provides accurate standards for repeatable calibrations of HVI strength measurements of cotton fiber. Research will continue to improve the accuracy and repeatability of other measurements, such as fineness, maturity, color, and length uniformity.

During FY 2001, *ARS will*

continue developing a combined machine vision and single kernel wheat characterization system to improve wheat hardness and flour yield predictions, and automate wheat inspection.

continue developing a machine vision-based inspection system to rapidly identify Line Slide defects in samples of wheat.

continue developing a machine vision based methodology for objectively evaluating bread crumb grain in ARS bake Laboratory tests and commercial bread baking processes.

continue cooperation with GIPSA to evaluate the capability of the FOSS Grain Check 310 to assist inspectors in grading wheat, corn and soybean and provide objective physical measures that relate to corn dry milling yield of yellow corn market samples.

cooperate with GIPSA and other grain industry segments to demonstrate the applicability of the Perten 4100 with the NIR attachment for identifying the presence of scab, vomitoxin levels, and kernel vitreousness in wheat.

continue assisting GIPSA in research and development of an inline automatic test weight device and components needed for automated grain inspection data collection at a commercial grain elevator facility.

transfer sorting technology enabling the U.S. tree nut industry to consistently meet foreign import standards for quality and aflatoxin presence.

test performance of the grain protein Artificial Neural Net against the current grading system for full

implementation in the field.

determine whether microwave measurements for sensing moisture content of grain samples through their microwave dielectric properties can improve the accuracy of moisture sensing in grain.

implement studies to define and characterize the sensory texture profiles of major cuts of red meat and poultry, and relate the profiles to the development of improved instrumental procedures to estimate tenderness.

design fumonisin inspection programs for grain evaluation and transfer technology in cooperation with FDA and the grain industry.

design/develop aflatoxin inspection programs for farmers' stock peanuts, the peanut industry, and the Peanut Administrative Committee.

PERFORMANCE GOAL 1.1.3.3: Demonstrate methods to measure the critical processing and end use properties of agricultural commodities important to the agricultural marketing system and the processing industry.

Indicators:

During FY 2000, *ARS will*

implement a rice database to be used for the measurement of rice quality.

evaluate near infrared transmission spectroscopy to determine quality standards for beef and pork trimmings produced from AMRS in cooperation with the National Meat Association and the American Meat Institute Foundation.

continue to determine which proteins in wheat are important for specific end use qualities and investigate the use of protein finger prints as a means of quality identification.

continue to determine the role of lipids in end use quality of wheat.

develop the methods and technology needed to acquire NIR spectral data during flour-water-dough mixing with an instrumented 10 gram mixograph, and relate spectral data to mechanical mixing energy requirements and compositional changes during wheat flour mixing.

investigate the potential use of durum wheat translocation lines for breadmaking.

During FY 2001, *ARS will*

continue development of the technology needed to acquire NIR spectral data during flour-water-dough mixing related to protein quality, dough development, strength and tolerance in wheat flours, and spectral properties of single wheat kernels.

develop a commercial scale hydrodynamic pressure system for meat products (either inline or batch system).

demonstrate the feasibility of profiling the status of raw poultry meat by identifying volatile organic compounds generated during storage and distribution. Develop a hand held instrument to measure the compounds in parts per billion.

in cooperation with the U.S. peanut industry, complete the feasibility of technology transfer of chemical testing for aflatoxin and farmer stock screening for all industry segments, and determine the impact of the technology on domestic and international competitiveness of U.S. peanuts.
expand the previously implemented rice database for the measurement of rice quality to include additional varieties of rice, and fill data gaps to make it more rigorous and widely accepted.

continue to investigate the use of durum wheat translocation lines for both breadmaking and pasta processing quality.

characterize the effects of genotype and environment on oat grain yield, quality, and dry milling characteristics, in collaboration with North Dakota State University.

determine the most efficient and accurate measurement system for oat groat percentage determination by mechanical means.

STRATEGY 1.1.4: International technology interchange: Develop a strategy for selective international research interchange to supplement ARS technology developments and strengthen competitiveness of U.S. agriculture.

PERFORMANCE GOAL 1.1.4.1: Strategic alliances formed with specific foreign institutions, leading to the joint development of germplasm and value added technologies, mutually protected through intellectual property agreements.

OBJECTIVE 1.2: Develop new uses and products: "Develop new uses and new products for agricultural commodities, such as alternative fuels, and develop new crops."

STRATEGY 1.2.1: New and alternative crops: Develop new and alternative crops with economic and social value.

PERFORMANCE GOAL 1.2.1.1: Experimentally demonstrate the production of new, improved, and alternative crops and horticultural products with potential for successful introduction and demonstrate the successful operation of aquaculture systems.

Indicators:

During FY 2000, *ARS will*

develop management practices for the specialist non-Apis bee pollinators for enhancing commercial production of a new avocado introduced at two groves in Ventura County, California.

improve guayule production by working with cooperators to identify strategies necessary to control annual and perennial grasses and broadleaf weeds, determine the optimum time for seed harvest, and determine methods for optimizing the yield and quality of guayule latex.

develop and release a root knot nematode resistant Habanero-type pepper. The pepper is an extremely pungent one (Capsicum chinese) that is becoming popular in the U.S., however, it is susceptible to root knot nematodes as are all known commercial cultivars. A conventional backcross breeding procedure is being used to move a highly effective resistance gene from a Scotch Bonnet-type germplasm line into commercial Habanero. ARS is ready to initiate the third backcross cycle, and anticipates having advanced breeding lines ready for release by the end of FY 2000.

develop micro-quantification methods for rubber analysis so that guayule plants can be evaluated for potential

performance while young instead of at least two years old.

begin testing rubber yield and quality from genetically engineered guayule.

plant large test plots of elite cuphea varieties in the Midwest in cooperation with farmers and 100 acres of lesquerella in the Southwest, both of which could produce oils for use in industrial products.

During FY 2001, *ARS will*

develop new fruit and vegetable germplasm for culinary, ornamental, and dual purpose culinary/ornamental applications. This material will provide rural development opportunities for mainstream and niche markets. Candidate introductions include new disease resistant and cold hardy citrus rootstocks, peach and nectarine selections adapted to the Southeastern U.S., and dual purpose pepper germplasm. Genetically engineered pears with antibacterial genes for control of fire blight will provide an opportunity for improved profitability in that industry.

complete forage nutritive evaluations of chicory and plantain in the Northeast and test the response of these species to defoliation.

PERFORMANCE GOAL 1.2.1.2: Experimentally demonstrate new and improved production, harvest, and postharvest handling procedures of these crops.

Indicators:

During FY 2000, *ARS will*

develop microquantification methods for rubber analysis so that quayule plants can be evaluated for potential performance while young instead of at least two years old.

begin testing rubber yield and quality from genetically engineered guayule.

During FY 2001, *ARS will*

demonstrate the feasibility of using alternative production practices to manipulate beneficial microorganisms for mitigation of fruit tree replant disease. Preliminary trials demonstrate that short term plantings of wheat are effective in enhancing populations of Rhizoctonia-suppressive fluorescent pseudomonades. Applicable technologies will be transferred to producers. These technologies offer alternatives to methyl bromide for disease control.

plant, harvest, and process up to 30 acres of elite cuphea varieties and 500 acres of lesquerella to develop cropping and processing guidelines.

develop improved methods for handling and storing fresh cut fruits and vegetables to maintain quality and microbiological safety.

STRATEGY 1.2.2: New uses and products: Develop new food and nonfood uses and products from plants and animals, and new processes and other technologies that add value.

PERFORMANCE GOAL 1.2.2.1: Experimentally demonstrate improvements in processing technologies and develop new bioproducts and uses that have potential to increase demand for agricultural commodities.

Indicators:

During FY 2000, *ARS will*

establish the field efficacy of organic based flocculants and soil stabilizers to control irrigation induced soil erosion. NRCS, irrigators, consultants and other water users will be able to use this technology to control soil erosion using "natural" compounds that readily degrade in the environment.

complete development of extruded high fiber and high energy food bars using milk components for possible use in school lunch and other domestic programs.

conduct research with an industrial partner through a CRADA, to complete research necessary for commercialization of Zeagen corn fiber gum, a substitute for imported Arabic gum.

test and modify low oil uptake rice batter for various fried food applications and obtain a more comprehensive scientific understanding of the mechanisms of oil uptake. This will be done in cooperation with a CRADA partner.

continue to develop an improved phytase, including a reduced-cost plant produced phytase. Phytase is an animal feed additive that reduces the level of phosphorus in animal manure which protects the environment. Recent evidence linking Pfiesteria fish kills to runoff from animal production facilities has spurred interest in phytase as a means of helping abate future Pfiesteria-caused fish kills.

work with American tanneries to apply ARS technology to recover chromium in the solid waste byproducts from the tanning process. The recovered chromium is recycled back into the tanning process. The collagen which is also recovered from the solid waste has commercial value.

demonstrate the potential of natural fiber reinforced starch foam materials by moving innovations from the laboratory to the pilot plant stage with industrial partners.

execute license agreements for the intellectual property rights on biobased material for synthetic skin to treat burns and wounds.

commercialize guayule latex as a safe alternative to natural rubber for future production of hypoallergenic latex products by the industrial sector.

seek licensees and a CRADA partner to explore the potential of developing large scale manufacturing methods for a lightweight concrete based on wheat starch gels.

investigate the viability of Fantesk technology in food applications, metal working fluids, and medical applications in cooperation with industrial CRADA partners. Potential areas of commercialization will be pursued.

investigate the viability of utilizing cereal proteins as components for blends in the production of new biodegradable plastics in cooperation with the Biotechnology and Development Corporation.

investigate dry grind ethanol byproduct streams such as "quick corn fiber" and distillers dry grains as alternative feedstocks for new functional (nutraceutical) food products.

develop and evaluate a new low cost method for extraction of valuable pectin from surplus U.S. citrus processing residues.

complete development of a new, lower cost extrusion method to produce biodegradable packaging and edible films from pectin, corn starch, and glycerol.

process up to 75,000 pounds of lesquerella seed to produce crude and refined oil, lesquerolic acid, and meal for industrial partners to use in developing industrial markets.

During FY 2001, *ARS will*

expand the utilization of Fantesk technology in food applications, particularly as a fat replacer in such items as soft serve ice creams and meats. CRADA partners will be sought in the food, medical, and lubrication areas. Potential commercialization applications will be sought.

conduct research to determine the viability of using supercritical fluids as a medium to produce new value-added materials from agricultural products via environmentally friendly processing procedures.

conduct research to evaluate potential industrial applications using cereal proteins. Develop CRADAs with industrial partners to advance commercialization of new cereal protein-based materials.

transfer technology to industry related to the use of corn flour and lignin for formulations of biopesticides. The formulations should make biopesticides more acceptable to end users as well as creating a new market for plant products.

cooperate with customers and stakeholders to overcome technical barriers facing the widespread commercialization of vegetable oil-based diesel fuels (biodiesel).

demonstrate improvement in scale up bioreactor technologies for two patented bioproducts, and develop new uses that have potential to increase demand for agricultural commodities.

commercialize 100 percent vegetable oil-based sheetfed and heatset inks.

conduct research for commercialization of biodegradable vegetable oil-based functional fluids for heavy equipment in cooperation with an industrial partner under a CRADA.

continue bioengineering phytase enzyme to enhance digestion of phytic acid by nonruminant animals and fish.

reduce the cost of enzymes by means of production in transgenic plant bioreactors in collaboration with a major biotechnology company under a CRADA. The byproduct plant fiber from processing, as well as fiber from animal manures, will be evaluated for use in composites, structural panels, filters for removal of pollutants from water, and for conversion to chemical feedstocks including fuels.

fractionate corn gluten meal from the corn wet-milling process to produce additional value added products.

develop new starch graft copolymers with unique properties using prime (never dried) starch as a feedstock in cooperation with a CRADA partner.

develop and commercialize biodegradable starch/polyester blends in continued cooperative efforts with the Biotechnology Research and Development Corporation.

find new uses for high value proteins isolated from soy hulls in cooperation with industrial partners.

continue basic research to characterize the effects of processing and modification on the properties of starch and proteinaceous coproducts.

continue to transfer technology for single bath dyeing of wool/cotton blended fabrics. By cooperating with the textile industry, the use of two domestic fibers in new consumer products will be promoted.

continue technology transfer efforts with American industries to encourage the adoption of ARS technology for the recovery and utilization of protein and chromium from solid tannery waste.

produce biobased polyesters and surfactants from renewable fat and oil feedstocks by using wild type and genetically engineered microorganisms in a fermentation process.

test the potential application of native or chemically/physically modified biodegradable polymers in the production of fiber, film, and adhesives.

develop biodegradable packaging materials from renewable grain resources.

develop and evaluate grain and legume foods that promote health.

complete evaluation of commercial aquaculture feeds that incorporate high levels of fuel ethanol coproducts, and fully document findings and recommendations for stakeholder use.

characterize functional properties of corn gluten meal, an abundant corn wet-milling coproduct, and devise strategies to improve the properties of the meal for new food/feed markets.

further improve the production of fermentable sugars from corn fiber, an abundant corn wet-milling coproduct, utilizing novel bioconversion approaches. These sugars are potential feedstocks for fermentation to produce ethanol and such value added bioproducts as xylitol. Portions of this effort will be conducted in conjunction with collaborators at Cornell University and the Slovak Academy of Sciences.

design new microbes for conversion of agricultural commodities and residues to valuable bioproducts. In particular, methods will be developed and exploited for the introduction and expression of useful biosynthetic pathways in the fungus Fusarium.

improve durable and robust biosensors for monitoring conversions of biomass to fermentable sugars in conjunction with collaborators at the Russian Academy of Sciences.

bring Nu-TrimX to the marketplace. Nu-TrimX will blend with OATRIM (a marketed ARS invention) to expand the food uses of both products. Both of them can reduce the intake of dietary calories and fat and increase the consumption of soluble and insoluble fibers, thus providing consumers with a very healthy alternative to a high fat diet. Nu-TrimX human nutrition studies will be initiated.

cooperate further with industrial partners to utilize Z-Trim technology. Additional CRADAs and human nutrition research will be sought.

continue to develop improved forms of ARS invented OATRIM to provide licensees with new products that will broaden the market. Additional CRADAs and human nutrition research will be continued to strengthen the economic and health status of consumers.

prepare bioplastic matrices of predictable biodegradation behavior.

analyze several additional bioplastic formulations to determine the rate and extent of degradation in various environments. This information will be incorporated in a practical guide for bioplastic manufacturers on how to influence functional properties and the time it takes to break them down.

continue to develop sophisticated instrumentation for the nondestructive evaluation of solid materials. The methodology is needed to determine the interactions of biopolymers at the molecular level which has applications for the new generation of biomaterials, as well as food safety issues.

develop sensory profiles of the dark muscle of broilers and turkeys and develop approaches to link the inherent sensory characteristics with new products.

develop and evaluate an extrusion method for directly converting pectin-containing agricultural byproducts into low cost, environmentally friendly packaging materials.

evaluate the use of pectin modifying enzymes to increase the value and demand for pectin made from U.S. agricultural processing residues. This technology will be transferred to the private sector.

characterize the cellulosic residue from corn fiber gum production, identify useful properties for specific food or industrial applications, and find a suitable CRADA partner for its commercial development.

enhance the demand for grains by developing novel, environmentally friendly enzymatic methods to improve the properties of their major polysaccharide components consisting of starch, hemicellulose (corn fiber gum), and cellulose.

evaluate and transfer technology for a new low cost corn protein fraction.

evaluate high pressure processing of food proteins with carbon dioxide for applications in nonfood products.

work with CRADA partner for use of ARS patented high pressure technology in production of a protein isolate.

characterize the application of oat oil to bread making.

demonstrate an alfalfa developed for biomass production as an alternative energy source.

field test an alfalfa genetically modified to produce a biodegradable plastic polymer.

In FY 2001, *ARS is requesting an increase of*

$2,700,000 *to improve conversion of agricultural materials to biofuels.*

$5,600,000 *to develop biobased materials from agricultural commodities and byproducts using biotechnology, biocatalysis, and other integrated technologies.*

$3,000,000 *to increase knowledge of fundamental biomaterials science.*

$1,200,000 *to expand development of novel crops for value added products.*

$1,500,000 *to improve biomass for energy.*

GOAL II: To Ensure an Adequate Food Supply and Improved Detection, Surveillance, Prevention, and Educational Programs for the American Public's Health, Safety and Well-being.

Funding by Program Activity ($000's)	FY 1998	FY 1999	FY 2000	FY 2001
Soil, Water & Air Sciences	6,239	7,579	8,947	8,787
Plant Sciences	126,197	142,432	151,050	162,344
Animal Sciences	76,455	81,219	86,625	98,737
Commodity Conversion & Delivery	48,904	62,480	73,796	75,353

Integration of Agricultural Systems	6,393	5,506	6,298	6,145
Total	$264,188	$299,216	$326,716	$351,366
	FY 1998	**FY 1999**	**FY 2000**	**FY 2001**
FTEs	2,969	3,070	3,226	3,240

Means and Strategies: To successfully accomplish the research activities under this goal, ARS will need the level of human, fiscal, physical, and information resources portrayed in the budget estimates for fiscal years 1999 to 2003.

The proposed funding for FY 2001 includes $40,865,000 in program increases. Funding includes increases for emerging and exotic diseases, agricultural genomes, invasive species (weeds/pests), food safety, the Food Quality Protection Act, agricultural genetic resources, and combating bioterrorism.

Verification and Validation: ARS conducts a series of review processes designed to ensure the relevance and quality of its research work and to maintain the highest possible standards for its scientists. A more detailed description of the evaluation plans can be found in the introduction to this plan.

OBJECTIVE 2.1: Secure food and fiber system: Maintain a safe and secure food and fiber system that meets the Nation's needs now and in the future.

STRATEGY 2.1.1: Plant and animal production systems: Improve efficiency of agricultural production systems to ensure the security of the Nation's food, fiber, and energy supply.

PERFORMANCE GOAL 2.1.1.1: Demonstrate increases in productivity above current levels using sustainable technologies.

Indicators:

During FY 2000, *ARS will*

develop diverse sources of sunflower germplasm with economically important traits and adaptability to U.S. growing conditions, and investigate genetic inheritance of these traits leading to improvements in production performance.

develop sunflower germplasm with altered fatty acid composition to provide improved vegetable oils for the sunflower industry.

expand and diversify the ARS sunflower collection through additions of underrepresented species from Mexico and the U.S.

develop the means to improve the safety of peanuts by developing germplasm with improved resistance to aflatoxin contamination and acceptable agronomic performance.

develop alternative weed management systems for irrigated peanuts with less dependence on herbicides.

develop peanut germplasm with improved resistance to peanut root-knot nematode, a serious pathogen.

develop improved lines of soybean for yield and seed quality traits and release them to the public.

transfer new knowledge to the food and feed crop pollination industry to enhance food production through

improved pollination of cranberries, blueberries, sunflowers, legume forage, oil seed crops, pears, apples, cherries, almonds, and other orchard crops by bee pollinators - alfalfa leafcutting bees, blue orchard bees, western bumble bees, sunflower leafcutting bees, southeastern blueberry bees, alkali bees, hornfaced bees, and mustached bees.
field test and transfer to cattle growers and others in the animal industry new knowledge on increased productivity through the use of integrated management methods for the control of gastrointestinal nematodes in pasture and range cattle.

continue to develop and test elite, heat resistant lines of pima cotton with outstanding fiber quality, resulting in the eventual release of improved germplasm for use by breeders to produce new varieties.

evaluate the effects of red plastic mulch in the field on the quality of cotton fiber. The mulch is known to alter the spectrum of light in the cotton crop canopy which results in increased fiber length. Studies in 2000 and 2001 will evaluate the utility of light change and begin to understand how this effect can be agronomically manipulated.

During FY 2001, *ARS will*

continue to transfer to the food and feed crop pollination industry new knowledge to enhance food production through improved pollination using native bees, e.g., blue orchard bees, sunflower leafcutting bees, and Southeastern blueberry bees.

continue to develop new and improved vaccines and immunomodulators for protection of animals against arthropod borne pathogens and reduction of diseases in animal populations resulting in increased animal productivity

provide recommendations regarding the use of old world bluestem grasses within native pastures in the Southern Plains.

provide workable solutions to the fescue toxicosis problem while developing methods to entirely eliminate losses which falls disproportionately on producers with limited resources.

PERFORMANCE GOAL 2.1.1.2: Demonstrate a more efficient and cost effective use of resource inputs while increasing productivity above current levels.

Indicators:

During FY 2000, *ARS will develop microorganisms and determine optimum conditions to preserve protein in silage to conserve forage for livestock.*

During FY 2001, *ARS will*

produce recommendations for the best way to provide supplements to calves grazing on bermuda grass in the South Central U.S.

Determine the impact of cattle breed on performance in the Southeast and make recommendations for the small producers of that region.

produce recommendations for the best way to provide supplements to calves grazing in subtropical areas of the U.S.

STRATEGY 2.1.2: Plant, animal, and ecosystems protection: Improve integrated management systems that contribute to the protection of plants, animals, and ecosystems against pests (insects, weeds, pathogens, etc.).

PERFORMANCE GOAL 2.1.2.1: Demonstrate new integrated technologies to protect plants, animals, and ecosystems.

Indicators:

During FY 2000, *ARS will*

continue to monitor the resistance of insect pest populations to transgenic plants that contain the toxin gene from Bacillus thuringiensis (bt). This activity is part of a long-term strategy to keep transgenic pest resistant crops effective, so they can continue to be used in IPM strategies to reduce chemical pesticide use.

continue its five-year corn rootworm areawide IPM program in the Midwestern U.S. using attract and kill technology.

complete its five-year areawide IPM program to control codling moth on apples and pears using mating disruption in the Pacific Northwest U.S.

expand testing of naturally derived materials that reduce populations of blue-green algae in catfish ponds.

continue developing an attractant for Asian longhorned beetle for use as a survey tool to protect urban trees and forests from infestation.

expand testing of a new melon derived attractant for corn rootworm for use in attract and kill programs.

During FY 2001, *ARS will*

expand a new project using areawide pest management for post-boll weevil eradication of pests such as the tarnished plant bug using new insecticidal chemicals, pheromone traps, natural enemies and other IPM practices in the Mid-South.

field test novel selective algicides to prevent algae-related off flavors in catfish ponds.

make control measures available for tall whitetop, an exotic invasive weed that threatens temperate desert rangelands in the Western U.S.

acquire and test in quarantine a biological control agent for yellow star thistle, a widespread weed that is infesting western rangeland.

develop improved methods for biological controls of invasive weeds on rangeland.

demonstrate new methods to reduce leafy spurge, an invasive weed, on rangeland in the Central Great Plains to enable the native species to reestablish.

In FY 2001, *ARS is requesting an increase of*

$1,750,000 *to formulate and deliver pathogens for biocontrol of insects and weeds.*

$1,000,000 *for areawide IPM programs demonstrating alternatives to at-risk pesticides.*

$1,100,000 *to develop new biological information and species discovery.*

$1,500,000 *to increase support of the USDA Office of Pest Management and Policy.*

$620,000 *to develop alternatives to methyl bromide for floriculture crops.*

$417,000 *for development of IPM component technology for fruits, vegetables, and other crops treated with organophosphates and carbamates, and for pests under large-scale action agency radication or control programs.*

$1,000,000 *for supporting registration of minor use pesticides as alternatives to methyl bromide.*

$750,000 *to research systematics of invasive weeds and insects.*

$700,000 *to develop integrated weed management systems for invasive weeds such as purple loose strife.*

STRATEGY 2.1.3: Germplasm resources and genomics: Acquire, preserve, evaluate, describe, and enhance genetic resources and develop new knowledge and technologies to increase the productive capacity and usefulness of plants, animals, and other organisms.

PERFORMANCE GOAL 2.1.3.1: Collections of well documented germplasm of importance to U.S. agricultural security are readily available to scientists and breeders for research and development.

Indicators:

During FY 2000, *ARS will*

release and genetically characterize improved germplasm lines of grain crops designed to optimize their utility for specific feed, food, and health beneficial uses.

release and genetically characterize improved germplasm lines of grain crops with improved levels of resistance to important existing and emerging disease organisms.

acquire, preserve, characterize, document, evaluate, and enhance crop, microbial, and beneficial insect genetic resources so that U.S. crops and beneficial microbes are less genetically vulnerable, an optimal repertoire of genes are accessible for continual crop and microbial improvement through genetic gain.

continue studies using transgenic methods to incorporate antimicrobial disease resistant genes into crops (such as cottonseed) to protect pre- and postharvest seed products from microbial pathogens.

continue studies to exploit natural antifungal resistance mechanisms in corn kernels for protection of the crop from pre- and postharvest attack by microbial pathogens.

identify QTLs affecting meat production and reproductive traits.

During FY 2001, *ARS will*

identify and characterize useful germplasm in wild relatives of cultivated fruit and vegetable crops and develop efficient means for incorporation of valuable traits of these unadapted species into the cultivated gene pool. Genetic resources are critical to maintain and improve sustainable fruit and vegetable crop production.

identify sugarbeet breeding lines resistant to root knot nematode, and distribute seed to sugarbeet breeders in the U.S. and abroad.

begin greenhouse (preharvest) and storage (postharvest) evaluation of transgenic crops (such as cottonseed) for antimicrobial disease resistant activities incorporated in them for protection of the seed against pre- and postharvest microbial pathogens.

begin incorporation of natural antifungal resistant mechanisms into commercial corn hybrids for protection from pre- and postharvest attack by microbial pathogens, with the cooperation of ARS researchers.

develop superior quality lines of fruits and vegetables using genetic engineering with optimal characteristics for quality and shelf life.

collect wild types of white clover to develop populations adapted to the resource-poor Appalachian region.

develop tools for breeding trefoil to provide a legume for the acid-infertile soils of the humid East. This will benefit limited resource producers in the Southeast who need nitrogen fixing legumes that persist without the expense of soil amendments.

conduct approximately seven different foreign and domestic plant explorations to collect crop plant germplasm together with university and private sector partners. This germplasm will first be safeguarded in ARS genebanks and then distributed to plant scientists and breeders as sources of genes for resistance to environmental extremes, pests, and pathogens of potatoes, forage grasses, tropical fruits, and other crops.

release scores of more nutritious, more productive, healthier, disease-, toxin- and pest-free cultivars of grains, oilseeds, forages, vegetables, fruits, and ornamentals with university and private sector partners. This new germplasm will continue to provide secure and safe food, feed, fiber, ornamentals, and industrial products to U.S. consumers.

PERFORMANCE GOAL 2.1.3.2: Documented DNA base sequences of agricultural importance.

Indicators:

During FY 2000, *ARS will*

decode more than 100,000 Expressed Sequence Tags (EST) in soybean in cooperation with partners. Genes express themselves by producing a message which can be cloned and decoded. The decoded message is called an EST. Discovering the function of these genes will make them useful for more effectively improving soybeans.

determine the nucleotide sequence of nearly the entire genome of a mustard plant (Arabidopsis), an important "model species" for understanding plant genomes in conjunction with university and private sector partners supported by ARS, the National Science Foundation, and Department of Energy. This also will provide substantial progress in sequencing the rice genome. Because the DNA sequence of many agronomically-important genes is similar among species, this knowledge may help to identify similar ones in major crops, thus accelerating the progress of crop improvement.

apply bioinformatic tools, biological databases, and information technology to more effectively improve crops, microbes, and beneficial insects.

increase DNA markers on the poultry genetic map.

complete the DNA sequence of serotype 1 Marek's virus.

molecular characterization of new isolates of Avian Leukosis J virus.

During FY 2001, *ARS will*

sequence the gene associated with susceptibility to ESC disease, a major disease of catfish.

complete the whole genomic sequencing of Arabidopsis (a small mustard plant) together with its university and private sector partners, supported by the joint U.S. (NSF, DOE, USDA), European, and Japanese sequencing consortium. Information about the detailed structure of Arabidopsis genes is already being used

to identify similar or identical genes in major crops such as soybeans, maize, and canola that govern important traits such as disease and drought resistance, flowering and adaptation, etc. This new genomic knowledge thereby is accelerating the pace of discovery of agriculturally important genes and their incorporation into crops.

sequence key parts of several hundred genes in wheat and barley in cooperation with university and private sector partners. Information about the detailed structure of those genes, and similar or identical genes in Arabidopsis and other major crops such as soybeans, maize, and canola may elucidate the biological functioning of agriculturally important traits such as disease and drought resistance, flowering and adaptation, etc. This new genomic knowledge thereby is accelerating the pace of discovery of agriculturally important genes and their incorporation into crops.

develop the new USDA/ARS Center for crop genome databases and bioinformatics tools in continued partnership with Cornell University. As a result of multimillion dollar grants from the NSF and commodity groups, ARS research programs that maintain and develop genome databases for soybean and maize will greatly intensify genomic characterization and database efforts for these major crops. Furthermore, initial gene sequence data will be entered into genome databases to test prototype software tools for managing the vast quantities of data that will emerge from genomic sequencing studies.

develop or perfect novel gene transfer, promoter, site-specific recombination and tissue culture systems for several crops (e.g., barley, roses, potatoes) that should facilitate genetic transformation and thereby accelerate genetic improvement together with its university and private sector partners.

In FY 2001, *ARS is requesting an increase of*

$1,450,000 *to provide genomic approaches to elucidating and manipulating the function of important genes in crops.*

$1,800,000 *for bioinformatic tools, biological databases, and information management technology.*

$1,500,000 *for improving economically important traits in livestock and poultry.*

$600,000 *for pathogenic microoganisms, beneficial microbes, and their products.*

PERFORMANCE GOAL 2.1.3.3: Release of improved germplasm, varieties, and breeds based on effective use of genetic resources.

Indicators:

During FY 2000, *ARS will*

use genetic crosses and breeding methods to combine genes for mite and disease resistance into a single honey bee stock. It will be tested and the genetically resistant bee germplasm transferred to commercial queen breeders for use by beekeepers and the pollination industry for enhancing U.S. crop, fruit and vegetable production.

genetically improve crop, microbial, and beneficial insect varieties and strains that are less genetically vulnerable, which will enable producers and processors to maximize yields of high quality products, and minimize environmental degradation and production costs.

introduce a muscat flavored seedless white table grape bred to replace Italiz, a seeded muscat flavored table grape. This introduction is a specialty item in the U.S. and very desirable in Europe and South America where Italia is the number one table grape cultivar.

release a blue/black seedless Concord flavored grape for farmers markets. This new grape provides a seedless type suitable for production in California where Concord grapes do not now grow well.

release new strawberry and blueberry germplasm with improved traits.

During FY 2001, *ARS will*

utilize new gene transfer technologies together with conventional breeding systems to maximize efficiency in development of new fruits, vegetables, and sugar crops having improved pest resistance and fresh market and processing quality attributes. Enhanced quality and genetic resistance to disease and insects will reduce pre- and postharvest chemical inputs. Candidate releases include new improved blueberry and sugarcane varieties, powdery mildew resistant sugarbeet breeding lines, lettuce selections resistant to lettuce mosaic and big vein diseases, and new carrot germplasm with disease resistance and improved flavor.

release an oat cultivar with a higher beta-glucan concentration than any currently in produced in collaboration with North Dakota State University.

release durum wheat germplasm carrying the waxy starch (low amylose) trait in collaboration, with North Dakota State University.

release two cultivars of red clover, two of birdsfoot trefoil, and one of kura.

release a new cultivar of a native plant species called bluebunch wheatgrass.

make available native Canadian Wildrye and Switchgrass cultivars developed from plant material collected on remnant Midwest prairies.

release five white clover cultivars with improved disease resistance for the Southeast U.S.

release improved bermuda grass and pearl millet germplasm for use in the Southeast U.S.

In FY 2001, *ARS is requesting an increase of*

$5,600,000 *for plant genetic resource acquisition and distribution, maintenance and characterization, and evaluation and enhancement.*

$1,000,000 *to maintain biodiversity in livestock, poultry, and microbes.*

PERFORMANCE GOAL 2.1.3.4: Improve methods for identifying useful properties of plants, animals, and other organisms, and for manipulating the genes associated with these properties.

Indicators:

During FY 2000, *ARS will*

complete construction of a catfish genetic linkage map with at least 250 markers.

implement the "Test Day Model" for the genetic evaluation of the U.S. dairy herd.

begin to combine novel technology (e.g., microarray or chip assays of gene activity) with conventional screens of standard agricultural traits (yield, adaptation, stress resistance) to identify coincident patterns of gene expression, occurrence of nucleic acids and proteins, and variation in the preceding agricultural traits. This information will help uncover the function of newly discovered genes so they can be manipulated and regulated in crops.

develop gene markers for coccidiosis which will lead to genetic strategies to control against this poultry disease.

expand the cadre of genes known to interact with food borne bacterial pathogens and develop high throughput genotyping of these genes.

produce large quantities of chicken and pig leptin and evaluate the biological function of this hormone in controlling feed intake.

utilize mutants of pollen development to improve understanding of the signaling process that controls reproductive specificity. This knowledge is expected to lead to the development of processes that will enable geneticists to make much wider crosses than is currently possible, which will result in a vast array of new genes becoming available for "conventional" breeding purposes.

complete the process of transferring genes of the technology protection system into cotton in order to evaluate its value and biosafety.

continue to develop knowledge about the effect of spatial variability in soils on cotton fiber quality, and to determine how to manage fields to improve overall quality and reduce quality variability.

During FY 2001, *ARS will*

provide genetic-based flavor profiling that will impact peanut variety releases.

test new and improved economic selection tools and use them in the national dairy cattle genetic evaluation program.

add genetic evaluation for calving ease as a new trait in the national dairy cattle genetic evaluation program.

using molecular biology, complete cytogenetic analysis of the nine sources of germplasm used to develop all cultivated alfalfa varieties.

STRATEGY 2.1.4: Plant and animal biological processes: Develop biologically based technologies to improve productivity, safety, nutrient content, and quality of plants, animals, microbial organisms, and their products.

PERFORMANCE GOAL 2.1.4.1: Make technologies available for improving productivity, safety, quality, and the security of the agricultural production system.

Indicators:

During FY 2000, *ARS will*

develop a modified live vaccine for Edwardsiella tarda to prevent a significant blood borne bacterial disease of farm raised foodfish.

compare marker vaccines for efficacy in protecting U.S. swine from swine fever.

conduct molecular epidemiologic studies of the ecology of vesicular stomatitis virus outbreaks in the Western Hemisphere.

improve vaccine delivery systems for exotic poultry diseases, such as avian influenza.

develop a DNA sequence database and diagnostic tools for avian leukosis J virus.

enhance control of transmissible spongiform encephalopathies through use of preclinical diagnosis.

develop control strategies for porcine viruses that cause reproductive losses.

develop knowledge of the life cycle of Neospora, the major cause of abortion in cattle that can be used as a management strategy to lower the incidence of abortions in cattle.

continue to clone and sequence genes that promote degreening of maturing seeds. Identify the genes, if possible, and characterize their mode of action, then begin transferring the genes into canola for evaluation.

begin evaluation and testing of cottonseed that carries the technology protection system.

evaluate the determinants of in-field variation of cotton fiber quality. Begin to analyze the data in a way that will make predictions of fiber quality variability possible.

determine factors that regulate u-calpain activity in postmortem muscle and develop strategies to control variation in meat tenderness.

develop national and international surveillance and diagnostic programs using the ARS sheep scrapie test.

study the effects of stress on neonatal pigs and their ability to respond to stress during early development.

develop molecular markers to distinguish karnal bunt from similar fungi.

determine what substances added to the diet of dairy cattle will effectively reduce the pH of their blood to prevent milk fever.

demonstrate that parathyroid hormone is not properly taken up by cell receptors when dietary potassium is elevated and that the mechanism is due to elevation of blood pH by dietary potassium.

During FY 2001, *ARS will*

complete the assessment of environmental risks associated with the use of copper sulfate to control diseases in aquaculture.

conduct target animal toxicity studies and efficacy testing to meet data requirements of FDA for approval of potassium permanganate to treat Ichthyophthirius multifiliis disease in aquaculture.

improve vaccine designs and delivery systems and conduct field evaluations of vaccines against the major aquaculture disease agents, flexibacter columnaris and streptococcus iniae.

continue testing various strains of catfish for natural resistance to columnaris disease which causes catfish industry losses of $50 to 80 million annually.

In FY 2001, *ARS is requesting an increase of*

***$10,000,000** to combat bioterrorism.*

***$608,000** to rapidly identify, prevent, and control emerging and exotic plant diseases.*

***$1,300,000** to prevent and control exotic emerging infectious diseases of livestock.*

***$900,000** to prevent and control emerging domestic infectious and zoonotic diseases of livestock and aquaculture.*

***$1,000,000** to develop vaccines for brucellosis in wildlife.*

***$550,000** to control livestock pests.*

OBJECTIVE 2.2: Safe food: "Maintain a ... safe supply of food to meet human ... needs ...."

STRATEGY 2.2.1: Plant and animal product safety: Provide knowledge and means for production, storage, and processing of safe plant and animal products.

PERFORMANCE GOAL 2.2.1.1: Transfer knowledge developed by ARS to industry and regulatory agencies.

Indicators:

During FY 2000, *ARS will*

complete the development and transfer of information to regulatory agencies, such as APHIS Veterinary Service and FSIS, describing methods for on farm management of pigs to achieve a preharvest parasite free certification program to assure pork product safety.

develop a profile of pathogens present in biofilms on processing equipment. This information will be used to develop methods to reduce the presence of pathogens in biofilms on equipment in poultry processing plants.

develop techniques to improve the effectiveness of experimental and commercial sanitizers to further reduce pathogen levels in fresh fruits and vegetables and minimally processed products from them.

provide the research information necessary to obtain an Experimental Use Permit from EPA for use of competitive strains of Aspergillus flavus and Aspergillus parasiticus to control preharvest aflatoxin contamination of peanuts.

provide the research information necessary to expand the provisions of the Experimental Use Permit from EPA for use of a competitive strain of Aspergillus flavus to allow treatment of 20,000 or more acres of cotton to control preharvest aflatoxin contamination of cottonseed.

expand the capabilities of the multiplex PCR which was developed to specifically detect and identify E. coli O157:H7 in foods. The expanded assay will allow identification of the type of Shiga toxin (Stx1 or Stx2) produced and will make it possible to determine the presence of the H7 antigen (fliCgene which encodes the H7 flagellat antigen). An assay with these capabilities will be useful to the FSIS.

develop a monoclonal antibody-based method for concentrating and identifying Campylobacter jejuni and E. coli in food washes in collaboration with an industry partner. The same reagents will be used to aid in characterizing how C. jejuni attaches to chicken surfaces.

demonstrate the safety of the Brucella abortus RH51 strain in nontarget animal species as a step prior to initiation of a vaccination program of bison and elk within Yellowstone National Park and surrounding areas.

determine whether ballistic delivery of strain RB51 vaccine is a viable and efficacious method of vaccine delivery for bison.

determine the efficacy of a new bovine leptospirosis vaccine for use in the United States.

determine the role of a newly recognized virus in the etiology of poult enteritis and mortality syndrome in turkeys.

During FY 2001, *ARS will*

complete the development and conduct field trials for FDA approval of a defined competitive exclusion bacterial culture for control of Salmonella in commercial swine production.

complete the development of rapid immunoassays for the detection of Campylobacter, Listeria, and E. coli O157:H7, and residues of fluoroquinolone, tylosin and tilmycosin in foods in cooperation with industry partners.

complete studies to optimize the use of a commercial GRAS status herbal extract to reduce the pathogen load on poultry carcasses. This information will be used to develop intervention strategies that assist in reducing and/or eliminating the need to use chlorine.

demonstrate biologically based technology which can reduce the amount of fumonosins and other related mycotoxins accumulating in pre- and postharvest corn.

complete greenhouse evaluations of transgenic cotton that expresses antifungal disease resistant genes incorporated for protection of the seed against aflatoxin producing fungi.

use its experimental use pesticide registration of Aspergillus flavus (a nonaflatoxin producing strain of A. flavus) to develop areawide aflatoxin management programs. Design and develop procedures for the production of a toxigenic strain material by grower organizations for use in local areawide aflatoxin management programs.

obtain an accurate, reliable estimate of the geographic, demographic and seasonal occurrence of the zoonotic pathogen E. coli O157:H7 which can be used to design rational control strategies to reduce the infection in cattle.

develop antimicrobial processes to inactivate or significantly reduce fecal bacteria on beef trim without any reductions in quality attributes of the resulting ground product.

develop techniques to improve the effectiveness of washing technologies for pathogen decontamination of fresh fruits, vegetables and seeds. Determine if ionizing irradiation or a combination of it and subsequent washing with a sanitizer is more efficacious. Develop a profile of the environmental conditions required to minimize growth of pathogens on fruits and vegetables during storage.

complete a microbial evaluation of swine slaughter and carcass dressing and determine limits for the critical control points. Transfer this information to the FSIS for incorporation into the HACCP program.

complete risk assessment models for Listeria, Salmonella, and Campylobacter in poultry products and develop predictive simulation models that assist industry and regulatory agencies in making critical food safety decisions that affect the public health.

develop predictive models and transfer the information to regulatory agencies indicating the effect(s) of food additives on the thermal inactivation of Salmonella in beef or poultry at various fat levels and the effect of temperature on the ability of food borne pathogen spores to initiate growth in cured beef, pork, or poultry.

develop solvent sparing and/or supercritical fluid extraction multiresidue methods for illegal use of animal growth promoting agents, antibiotic residues, dioxins, and triazines in meat tissue and eggs. Transfer the methodology to regulatory agencies such as the FSIS for monitoring use.

In FY 2001, *ARS is requesting an increase of*

<u>for Preharvest Food Safety</u>:

$1,000,000 *to research antibiotic resistance.*

$600,000 *to control pathogens during slaughter and transportation.*

$900,000 *to control plant toxins, heavy metals, and allergens.*

$360,000 *to control Salmonella Enteritidis infection in laying hens.*

for Postharvest Food Safety:

$400,000 *to control pathogens in fruits and vegetables.*

$900,000 *to control pathogens in meat and poultry.*

$1,000,000 *to detect pathogens and residue during slaughter and processing.*

$200,000 *to create safety databases.*

$360,000 *to reduce Salmonella Enteritidis in shell eggs.*

GOAL III: A Healthy and Well-Nourished Population Who Have Knowledge, Desire, and Means to Make Health Promoting Choices.

Funding by Program Activity ($000's)	FY 1998	FY 1999	FY 2000	FY 2001
Plant Sciences	536	58	72	36
Animal Sciences	51	0	0	0
Commodity Conversion & Delivery	101	241	239	420
Human Nutrition	68,804	66,775	72,420	89,773
Total	$69,492	$67,074	$72,731	$90,229
FTEs	257	261	286	324

Means and Strategies: To successfully accomplish the research activities under this goal, ARS will need the level of human, fiscal, physical, and information resources portrayed in the budget estimates for fiscal years 1999 to 2003.

The proposed funding for FY 2001 includes $17,250,000 in program increases. Funding includes increases for research on healthy body weight, nutrition in bone growth and maintenance, biomarkers of nutritional status, cognition and brain function, diet and immune function, and the role of nutrients throughout the life cycle. Also, the National Nutrient Databank will be updated, food composition methods will be developed, and diet survey methodology will be examined.

Verification and Validation: ARS currently conducts a series of review processes designed to ensure the relevance and quality of its research work and to maintain the highest possible standards for its scientists. A more detailed description of the evaluation plans can be found in the introduction to this plan.

OBJECTIVE 3.1: Nutritious food: “Maintain an adequate and nutritious ... supply of food to meet human nutritional needs and requirements.”

STRATEGY 3.1.1: Human nutrition requirements: Determine requirements for nutrients and other food components of children, pregnant and lactating women, adults, and elderly of diverse racial and ethnic backgrounds.

PERFORMANCE GOAL 3.1.1.1: Indicators of function determined and related to diet and health.

Indicators:

During FY 2000, *ARS will*

conduct human feeding studies to determine the effects of soy protein in reducing risk factors for heart disease and cancer. The results will help determine if inclusion of soy protein in the diet has beneficial effects on chronic disease occurrence.

expand the understanding of changing needs for nutrients that occurs throughout the life cycle. Studies will be conducted to determine the relationship between diet and bone health, cognitive and neurological development, and the factors, such as energy intake and energy expenditure that lead to obesity in children.

During FY 2001, *ARS will*

examine the biological activity of phytonutrients which have been shown to have antioxidant activity and may be protective against the development of certain chronic diseases.

identify sensitive biomarkers that can be used as indicators of nutritional status in humans for monitoring the physiological and biochemical factors that are influenced by foods and food components that are indicative of health status.

determine the effects of diet on the immune system and the mechanism by which diet alters the immune system. The results will lead to dietary recommendations that can reduce the incidence of immune related diseases.

In FY 2001, *ARS is requesting an increase of*

***$1,650,000** to update the National Nutrient Databank.*

***$950,000 to** develop food composition methods.*

***$1,750,000** to determine healthy body weight.*

***$3,600,000** to research the role of nutrition in bone growth and maintenance.*

***$3,000,000** to develop biomarkers of nutritional status.*

***$2,425,000** to examine cognition and brain function.*

***$2,175,000** to research diet and immune function.*

***$1,300,000** to research the role of nutrition throughout the life cycle.*

***$400,000** to examine dietary survey methodology.*

STRATEGY 3.1.2: Food composition and consumption: Develop techniques for determining food composition, maintain national food composition databases, monitor the food and nutrient consumption of the U.S. population, and develop and transfer effective nutrition intervention strategies.

PERFORMANCE GOAL 3.1.2.1: Transfer new measurement techniques and data to users, release results of surveys, and disseminate effective nutrition intervention strategies.

Indicators:

During FY 2000, *ARS will*

conduct a study of the validity of 24-hour recall questionnaires conducted both in person and by telephone. Although the costly in-person interview to obtain dietary information is assumed to be the most accurate indicator of dietary consumption, this will be the first test of its validity and comparison with less costly telephone interviews.

work with the National Center for Health Statistics to combine the dietary portions of the USDA's Continuing Survey of Food Intakes with DHHS' National Health and Nutrition Examination Survey. This will eliminate duplication, reduce costs, and allow for the first time linkage of data on food intake with parameters of health status.

develop accurate procedures for the measurement of flavonoids in foods. The importance of flavonoids as antioxidants in the diet is of increasing interest as is the ability to identify them from various plant sources.

During FY 2001, *ARS will*

work with the National Center for Health Statistics (NCHS) to obtain data from a fully merged dietary intake survey. ARS will obtain survey data and begin to process information obtained from this single survey. It will also provide dietary expertise to complement the medical expertise of NCHS.

develop new food composition methods for isolating phytonutrients. This is important for identifying new plant components which may have human health benefits.

update the National Nutrient Database. This database, which must be kept current, provides researchers and policymakers with information about nutrients the American population is consuming.

STRATEGY 3.1.3: Nutritious plant and animal products: Develop more nutritious plant and animal products for human consumption.

PERFORMANCE GOAL 3.1.3.1: Demonstrate improved nutritional quality.

Indicators:

During FY 2000, *ARS will*

determine the bioavailability of specific food carotenoids and their response in plasma tissue. Since nutrient bioavailability can differ between plant species, it is important to know which ones contain the most available nutrients.

determine which plant varieties have increased mineral content with potential beneficial effects on human health. Identification of plant varieties with potentially increased nutrient content can greatly affect dietary recommendations and aid at-risk populations.

During FY 2001, *ARS will*

develop and introduce value added fruit and vegetable germplasm with enhanced phytonutrient content. These value added cultivars will contribute to improved human health and nutritional status. Candidate releases include carotenoid enriched tomato and carrot breeding lines and calcium enriched broccoli germplasm.

determine the bioavailability of minerals in cultivars of beans and rice which increases the knowledge about varieties that are good sources of minerals.

develop methods to maximize the yield of specific phytonutrients in agricultural production through the use of specific cultivars and/or cultivation practices.

GOAL IV: To Enhance the Quality of the Environment Through Better Understanding of and Building on Agriculture's and Forestry's Complex Links with Soil, Water, Air, and Biotic Resources.

Funding by Program Activity ($000's)	FY 1998	FY 1999	FY 2000	FY 2001
Soil, Water & Air Sciences	75,145	73,347	75,107	96,669
Plant Sciences	20,765	25,056	27,594	26,462
Animal Sciences	1,809	2,046	2,076	1,912
Commodity Conversion & Delivery	1,815	3,269	3,227	3,167
Human Nutrition	94	0	0	0
Integration of Agricultural Systems	16,203	17,667	17,644	17,285
Total	$115,831	$121,385	$125,648	$145,495
FTEs	1,289	1,318	1,337	1,380

Means and Strategies: To successfully accomplish the research activities under this goal, ARS will need the level of human, fiscal, physical, and information resources portrayed in the budget estimates for fiscal years 1999 to 2003.

The proposed funding for FY 2001 includes $23,700,000 in program increases. Funding includes increases for air quality, climate change technology, integrated science for ecological challenges, and global climate change.

Verification and Validation: ARS currently conducts a series of review processes designed to ensure the relevance and quality of its research work and to maintain the highest possible standards for its scientists. A more detailed description of the evaluation plans can be found in the introduction to this plan.

OBJECTIVE 4.1: Balance agriculture and the environment: "Increase the long-term productivity of the United States agriculture and food industry while maintaining and enhancing the natural resource base on which rural America and the United States agricultural economy depend."

STRATEGY 4.1.1: Natural resource quality: Develop new concepts, technologies, and management practices that will enhance the quality, productivity, and sustainability of the Nation's soil, water, and air resources.

PERFORMANCE GOAL 4.1.1.1: Demonstrate concepts and on-farm agricultural technologies and management practices that maintain and enhance the environment and natural resource base.

Indicators:

During FY 2000, *ARS will*

provide multi-year results on the feasibility and cost effectiveness of converting from intensive tillage systems to environmentally enhancing direct seeding crop management systems. This information will contribute to establishing sustainable agroecosystems in the Pacific Northwest.

finalize the development of methods using flocculants to reduce the transport of weed seeds, microbes, and pathogens in water. This technology will lessen the risks of environmental contamination and ecosystem impacts from chemicals. This information will be shared with NRCS, canal companies, farmers, consultants, and other water users and providers.

develop cropping systems, rotations and residue management practices to enhance soil quality, while reducing fertilizer and agrochemical inputs.

During FY 2001, *ARS will*

deliver site-specific best management practices to producers of grass seed to protect water quality.

Make available the results of a long-term (more than 60 years) assessment of the impact of grazing on sagebrush rangeland.

develop methods to treat seeds of native grasses to promote their germination and seedling vigor to help restore native species on rangelands.

make technology available for establishing Wyoming Big Sagebrush to restore rangeland disturbed by mining.

make methods available to State regulatory agencies for rehabilitating mined land with excess salinity and sodicity in the Northern Great Plains.

assess the impact of human settlements on grazing ecosystems in the Northern Great Plains using repeated photography and images from the early, middle, and late 1900s.

provide methods to monitor, access, and restore the health and productivity of desert range.

recommend ways to defoliate native grasses to establish and manage them in pastures for persistence in the Southeast.

assess the value of native range as a means of carbon sequestration in the Northern Great Plains.

develop site-specific management practices that result in more effective use of nutrients and agrochemicals.

determine the effectiveness of site specific tillage practices to reduce snowmelt runoff and surface water contamination.

evaluate multiyear results concerning potential pathogen effects on pasture lands for development of mitigation strategies.

begin development of a decision support system to avoid salinity induced decreases in rice yields by modeling ion uptake with growth and environmental factors.

In FY 2001, *ARS is requesting an increase of*

$1,400,000 *to research particulate matter and precursors.*

$300,000 *to develop new knowledge on emission and control of odors.*

$300,000 *to protect agricultural crops from the effects of tropospheric ozone.*

PERFORMANCE GOAL 4.1.1.2: Experimentally demonstrate the appropriateness of watershed-scale technologies and practices that protect the environment and natural resources.

Indicators:

During FY 2000, *ARS will*

develop scientifically defensible guidelines and decision-making tools to assist the national dairy, pork, and poultry producer groups; farmers; NRCS; and EPA in developing nutrient management plans for phosphorus and animal manure application. Tools will be provided to establish agronomically and environmentally sound threshold soil phosphorus (P) levels, determine P-based manure application rates, and select effective remedial strategies to minimize P loss to surface waters. This will assist States and national regulatory agencies in meeting their mandates to revise the nutrient management planning process of animal feeding operations, and provide criteria for managing nutrients in water bodies as requested in the Clean Water Action Plan.

complete an evaluation and assessment of different cropping practices and farming systems from the MSEA program that will provide a comprehensive picture of the fate and transport of herbicides, nitrate, and sediment within Midwestern agricultural watersheds. The Clean Water Action Plan and other conservation programs encourage States to develop Federal-State partnerships to assess the potential for using tax incentives to protect water quality, provide increased wildlife habitat, and encourage conservation of critical private lands.

demonstrate the effectiveness of natural and constructed biofilters, riparian areas, wetlands, and buffer strips for trapping sediment and other contaminants before they reach surface waters. The Clean Water Action Plan calls for farmers to create two million miles of buffers adjacent to waterways by 2002, construct 100,000 acres of wetlands by 2005, and restore 25,000 miles of stream corridors by 2005.

demonstrate how the integration of remotely sensed imagery with ground-based data can be used to obtain spatially distributed information on vegetation and water use in rangeland watersheds. These monitoring strategies and interpretive methodologies will provide ranchers and public land managers with new approaches for improving the management of rangelands.

During FY 2001, *ARS will*

develop and transfer a model to predict the water quality functions of riparian ecosystems of various sizes, vegetation, soils and management.

examine soil moisture data collected from a satellite launched in the year 2000, which will be used to develop hydrologic process models for better water management.

evaluate prototype sensors and algorithms for remotely discriminating crop residues on soils. This technology will be useful for minimizing chemical inputs and potential water contamination, while increasing crop production and profitability.

determine the influences of irrigation methods on water transport and salinity changes within the soil profile and interactions on soybean growth and yield.

STRATEGY 4.1.2: Global change: Increase understanding of the responses of terrestrial ecosystems to manmade and natural changes in the global environment.

PERFORMANCE GOAL 4.1.2.1: Documentation of agriculture's effects on the global environment.

Indicators:

During FY 2000, *ARS will*

compare amounts of organic carbon in plots of soil maintained for decades with different tillage and crop production systems in order to define more accurately the extent that conservation practices have removed greenhouse gases from the atmosphere.

conduct more detailed studies of agriculture's role in greenhouse gas emissions and make more accurate assessments of how changes in soil management can reduce atmospheric CO_2 levels.

During FY 2001, *ARS will*

identify existing gaps in knowledge and technology for predicting the effects of global change on agriculture production.

begin to develop the tools necessary to adapt agriculture to a changing climate.

begin to develop the tools necessary to expand and improve plant biomass production for use as energy so that it will become a viable alternative to fossil fuel and coal produced energy.

In FY 2001, *ARS is requesting an increase of*

$4,700,000 *to develop new information on the carbon cycle research initiative.*

$2,000,000 *to research climate change impacts on food availability.*

$400,000 *to research the impacts of atmospheric and climate change on Alaskan ago-ecosystems.*

$800,000 *to conduct U.S. global change research program national assessment activities.*

PERFORMANCE GOAL 4.1.2.2: Documentation of how changes in the global environment affect agriculture.

Indicators:

During FY 2000, *ARS will*

determine how rising CO_2 levels in the atmosphere will alter the yield and water requirements of sorghum, a crop of major importance domestically and internationally in cooperation with university scientists and the Department of Energy.

conduct research that provides a better understanding of complicated interactions between rising atmospheric CO_2, rising temperatures and changing amounts of rainfall on crop production, competition with crops, and the availability of water for crop and forage production.

During FY 2001, *ARS will*

develop regional data bases and models for analysis and prediction of carbon storage in soils and aboveground plant material with cooperating agencies.

develop the necessary tools for analysis of the agricultural water cycle from the meter to basin scale.

expand research on the effects of elevated CO_2 on plant growth and food availability to include more crops under varied climatic and soil conditions.

assess the value of native range as a means of carbon sequestration in the Northern Great Plains.

In FY 2001, *ARS is requesting an increase of*

$4,000,000 *to develop new technology for predicting and adapting to global change impacts.*

$900,000 *to manage and restore riparian zones and coastal habitats.*

$3,850,000 *to prevent and control eutrophication, harmful algal blooms, and hypoxia.*

$600,000 *to implement the CENR research and monitoring framework.*

STRATEGY 4.1.3: Cropland and grazingland sustainability: Develop cropland and grazingland management strategies that will improve quality, quantity, and sustainability of food and fiber products needed for U.S. competitiveness.

PERFORMANCE GOAL 4.1.3.1: Demonstrate cropland and grazingland management strategies that improve productivity and efficiency of croplands and grazinglands.

Indicators:

During FY 2000, ARS will

test a distributed hillslope sediment yield model coupled with NRCS range site descriptions to assess rangeland health. The simulation model will provide a repeatable means to quantify the soil/site stability component of the rangeland health assessment methodology.

release new varieties of forage grasses better adapted to the environmental conditions of the Great Plains and the Intermountain West, which are more productive and more persistent on grazed rangelands and pastures.

propose prototype procedures and methods for assessing the ecological status or "health" of rangelands in cooperation with NRCS and EPA.

genetically characterize (sequence or clone) at least one of the several genes for asexual seed reproduction of eastern gama grass, a native forage plant. Detailed knowledge of this and related genes will help researchers produce hybrid crops with genetic characteristics that are stable over generations, which may tangibly decrease hybrid production costs.

expand research on grazing management, especially as related to development of approaches to grazinglands utilization which are more environmentally compatible, and will provide land managers with tools for enhancing the ecological condition of grazing lands. Research will also be initiated on the foraging behavior of livestock to provide guidance for testing methods of improving forage utilization by improving the distribution of livestock across extensive areas of rangeland. New research will be directed at integrating multiple sources of forages (from croplands, annual and perennial pastures, and rangelands) to provide green forage over a longer portion of the year, thereby reducing producers' need to purchase expensive feeds from off farm sources.

indicate methods for the establishment of livestock, forages, and trees in agroforestry systems.

During FY 2001, *ARS will*

test the relationship of species diversity on primary production and nutrient cycling in grazing ecosystems in the Northeast so they can be managed in a sustainable manner.

develop protocols utilizing goats to renovate and protect pastures in Appalachia, while providing income sources for limited resource producers.

develop crop rotations that will serve as a viable alternative to wheat fallow in the Great Plains.

complete evaluation of the effects of 25 years of continuous corn cropping in conventional and ridge tillage production. The impact of spatial variability, and water and nitrogen use efficiency on yield will be reported.

OBJECTIVE 4.2: Risk management: "Improve risk management in the United States agriculture industry."

STRATEGY 4.2.1: Economic and environmental risks: Reduce economic and environmental risks through improved management of agricultural production systems.

PERFORMANCE GOAL 4.2.1.1: Risk-reduction strategies and methods transferred to the Nation's agricultural industry.

Indicators:

During FY 2001, *ARS will begin integrating remotely sensed data with crop growth models. This information will be used to increase the accuracy of decision support tools for crop production and profitability.*

In FY 2001, *ARS is requesting an increase of*

***$550,000** to conduct integrated ecosystems risk assessments.*

STRATEGY 4.2.2: Weather and environmental risks: Develop concepts and technologies for predicting and reducing the socio-economic costs and resource damages associated with extreme weather variability.

PERFORMANCE GOAL 4.2.2.1: Improve strategies and technologies that reduce the effects of extreme weather variability.

Indicators:

During FY 2000, *ARS will demonstrate a technology to provide geographically site-specific radar-based precipitation estimates for public and private lands that lack on-site precipitation measurements, enabling producers and resource managers to better cope with extreme weather variability in scheduling vegetation management and cropping and grazinglands operations.*

OBJECTIVE 4.3: Safe production and processing: "Improve the safe production and processing of, and adding of value to, United States food and fiber resources using methods that maintain the balance between yield and environmental soundness."

STRATEGY 4.3.1: Environmentally safe pest management: Develop environmentally safe methods to prevent or control pests (insects, weeds, pathogens, etc.) in plants, animals, and ecosystems.

PERFORMANCE GOAL 4.3.1.1: Deliver integrated pest management strategies that are cost effective and protect natural resources, human health, and the environment.

Indicators:

During FY 2000, *ARS will*

develop new methods to mass produce beneficial insects such as parasites and predators of insect and weed pests. develop new artificial diets, automate processing and harvesting equipment, and improve methods of distributing and releasing mass produced beneficial biological control agents.

identify new sampling and control procedures for the Asian longhorned beetle, a newly introduced pest that is damaging many species of hardwood trees in New York City and Chicago. This may include the identification of chemical attractants that are produced by either the beetle or by its preferred host plants.

develop new biological control agents for several major target weed species including kudzu, tropical soda apple and saltcedar. Methods are currently being developed to mass produce parasitized caterpillars that can be released on kudzu. ARS scientists believe that these beneficial agents will not only eat the kudzu, but the resulting parasites are expected to attack and kill crop damaging caterpillars in nearby agricultural fields.

develop new biochemical methods to identify the feeding preferences of several beneficial insects under natural field conditions. Using ELISA and biochemical markers, and/or rare elements the feeding patterns and impact of natural occurring beneficial insects will be assessed and the information used to help cotton and grain farmers avoid making unnecessary pesticide applications to their crops.

collect parasitic insects from native apple orchards in Kazakstan and China where apples and apple pests originate, then introduce them into U.S. areas to control exotic pests such as the codling moth and apple leafrollers.

develop new remote sensing technology to identify pest attacks on important crop production and natural areas where exotic insects and diseases threaten to cause economic and/or environmental losses. Aerial photography surveys linked with geographic information systems to organize and display complex pest and weather data will assist scientists, extension agents, and farmers in making pest control decisions.

continue to provide critical identifications of unknown pest species, provide taxonomic revisions of critical groups of insects, identify new biological control agents, and produce updated keys to agriculturally important insect groups.

continue to collect and ship many new exotic biological control agents to ARS quarantine laboratories in Albany, California; Stoneville, Mississippi; Newark, Delaware; and Temple, Texas. The agents will be tested for their host specificity and appropriateness for release into the U.S. environment to control introduced pest insects and weeds.

release and evaluate new biological agents to control insect pests such as the silverleaf whitefly and the pink hibiscus mealybug. Both of these pests attack a large number of crop plants and cause extensive economic losses in areas where infestations occur. Scientists will attempt to control similar pests in the Caribbean Basin before they can invade the Continental U.S.

complete the shift of internal resources of the weed science program so that two-thirds of the resources are directed to biologically-based integrated weed management in line with the USDA Strategic Plan for "Invasive and Noxious Weeds" and the ARS Strategy on "Noxious and Invasive Weeds."

begin to change how biological weed control programs are planned and conducted in ARS. Scientists will prepare a long-term management plan for each targeted weed. This plan will concentrate on measuring the long-term impact of released biological control agents on the target weed and on closely related nontarget plants, incorporate cultural control/revegetation as an integral part of the biologically-based weed management program, and emphasize developing partnerships.

During FY 2001, *ARS will*

continue to provide critical identifications of presently unknown pest species, provide urgently needed taxonomic revisions of critical groups of insects, identify new natural control agents, and produce updated keys to agriculturally important insect groups.

use classical biocontrol approaches to suppress invasive insect and weed pests such as the Asian longhorn beetle, gypsy moth, fire ant, cereal aphid, leafy spurge, or saltcedar. Permanent ecosystems are targets.

continue to collect and ship many new exotic biological control agents to ARS quarantine laboratories. The geographic base for collections of natural enemies will be overseas laboratories in Montpellier, France; Thessaloniki, Greece; Beijing, China; Hurlingham, Argentina; and Brisbane, Australia. Control agents will be tested in overseas laboratories or quarantine facilities for their host specificity and appropriateness for release into the U.S. for control of introduced or native pests of insects and weeds and if suitable, they will be released and evaluated.

use augmentative biocontrol approaches to suppress native or invasive insect and weed pests, such as tarnished plant bug, boll weevil, or kudzu. Greenhouse and high value crops are targeted beneficiaries.

develop new microbial agents for insect biocontrol, including native and genetically engineered strains. This includes determining the factors responsible for pathogen persistence, the use of protectants to lengthen activity, and new methods to deliver the agents.

develop new methods to mass produce and deliver beneficial insects such as parasites, predators, and pathogens of insect and weed pests, which includes formulation of artificial diets and fermentation (or cell culture) systems for mass production, invention of automated processing, and harvesting equipment, and improving release systems for distribution.

develop new detection tools for assisting APHIS in interdicting invasive species.

develop remote sensing systems for monitoring insect distribution, density, and damage, along with development of economic thresholds, and relate the information to biocontrol prospects. Increased knowledge of the biology, and behavior of pests and their natural enemies will be part of this effort. Climate matching models will be used as decision aids to guide biocontrol success.

determine movement of insects related to the presence and persistence (microbes) or behavior (parasites and predators) of natural enemies. The latter includes determining the role of refugia in conservation of natural enemies or protecting nontargets, particularly along the borders of transgenic crops.

develop new means for determining host preferences and impacts of natural enemies, such as predatory spiders, lacewings, and beetles, using techniques such as ELISA and molecular markers.

determine how the signaling strategies of plants interface with the feeding behavior of pests and the foraging behavior of natural enemies of those pests.

develop methods for transferring genes into insect cells in vitro and in vivo. These methods will be used to identify vulnerabilities in pest insect physiology, improve control efforts such as the sterile male technique, and improve natural enemies as biocontrol agents.

continue implementation of changes in how biological weed control programs are planned and conducted in ARS. Scientists will prepare a long-term management plan for each target weed. This plan will concentrate on measuring the long-term impact of released biological control agents on the target weed and on closely related nontarget plants, incorporate cultural control/revegetation as an integral part of the biologically-based weed management program, and emphasize developing partnerships.

develop environmentally-benign, biologically- and ecologically-based, highly integrated areawide control strategies for fire ants (e.g., phorid flies and microsporidia) and continue to transfer the technology and information to regulatory agencies, such as APHIS-PPQ and State agencies through the Southern Legislative Council on how to use the strategies and monitor biologically-based management of fire ant populations. This technology transfer will reduce the use of insecticides.

continue to develop and field test biologically-based management methods to control biting and filth breeding insects, e.g., mosquitoes, using bacteria, viruses, and microsporidia biocontrol agents as replacements for conventional chemical control methods.

discover and begin development of attractants for trapping and monitoring biting and filth-breeding arthropod pests, and repellents for personal protection from them.

complete the technology transfer of diagnostic tests for tick-vectored equine babesiosis. This will facilitate the international movement of horses and make equine events in the United States less restrictive.

continue development and technology transfer of new and improved vaccines and immunomodulators for protection of animals against arthropod-borne pathogens such as the protection of calves from cryptosporidiosis. The results will reduce the impact of disease on animal populations.

continue to screen, breed, and select honeybee stocks that are resistant to Varroa and/or tracheal mite parasites. The result will aid crop production and the beekeeping industry by reducing the cost and difficulties in maintaining honeybee stocks.

continue developing precision targeting techniques to reduce pesticide use for the control of Lyme disease ticks on an areawide basis in Connecticut, New Jersey, New York, Maryland, and Rhode Island.

continue development of precision targeting for control of the cattle fever tick using medicated corn technology in the quarantine area along the United States and Mexican border.

continue to provide competitive genetic strains of screwworm to supply the eradication program in Central America.

continue areawide integrated pest management strategies for the control of the Formosan subterranean termite in Louisiana, Texas, Hawaii, and other infested States.

continue field testing and demonstration of Pharaoh's ant and cockroach control on DoD facilities using spatial mapping to facilitate precision targeting and reduction of pesticide use.

STRATEGY 4.3.2: Integrated agricultural production systems: Develop knowledge and integrated technologies for promoting use of environmentally sustainable agricultural production systems.

PERFORMANCE GOAL 4.3.2.1: Demonstrate the effectiveness of integrated agricultural production systems in the improvement of natural resources and protection of the environment.

Indicators:

During FY 2000, *ARS will combine the most appropriate attributes of the SPUR (Simulation of Production and Utilization of Rangelands) and WEPP (Water Erosion Prediction Program) models to produce an advanced simulation model SPUR-2000 that range management specialists can use to assist ranchers, and improve resource conservation and management at ranch and watershed scales in cooperation with NRCS.*

During FY 2001, *ARS will expand efforts in developing sustainable agricultural systems that emphasize the use of renewable resources. The substitution of renewable resources for nonrenewable resources will preserve natural resources.*

PERFORMANCE GOAL 4.3.2.2: Provide computer-based models and decision-support systems to farmers, public agencies, and private organizations.

Indicators:

During FY 2000, *ARS will*

field test the performance of decision support systems for water quality protection with NRCS. The field tests will assess how decision support systems, which include an embedded simulation model and a multi-objective

decision-making component, can improve NRCS conservation planning and help farmers select improved farm management systems.

release the Kineros2 rainfall-runoff-erosion model on an Internet accessible website. This model will provide improved estimates of runoff flood peaks and soil erosion rates for designing efficient flood control structures and evaluating erosion control strategies.

field test decision support tools for the assessment of soil quality in cooperation with NRCS. The tools will range from brochures to computer programs. They are intended for use by farmers and other land managers to enable them to select management systems to enhance soil and environmental quality.

During FY 2001, *ARS will*

assist NRCS in final testing, modification, and preparation of WEPS1 and RUSLE2 under MOSES so that field offices may apply the models in FY 2002.

formally deliver MOSES, with RUSLE2 and WEPS1 incorporated to NRCS.

STRATEGY 4.3.3: Waste management and utilization: Develop and transfer cost-effective technologies and systems to use agricultural, urban, and industrial wastes for production of food, fiber, and other products.

PERFORMANCE GOAL 4.3.3.1: Demonstrate technologies to store, mix, compost, inoculate, incubate, and apply wastes to obtain consistent economic benefits while at the same time minimizing environmental degradation, nutrient loss, and noxious odors.

Indicators:

During FY 2000, *ARS will*

demonstrate that specially designed municipal biosolid composts can be used to remediate metal contaminated sites at a fraction of the cost of soil removal and replacement techniques.

conduct research to link the manure management model with the beef production system model for use in raising beef cattle.

develop new technologies for managing livestock waste and reducing odor production and emissions.

evaluate near-infrared spectroscopy as a technique for quick analysis of nutrients in manure.

develop strategies to reduce emission of volatile organic compounds including ammonia from manure.

evaluate urease inhibitors, antimicrobial agents, and odor-masking agents in combination for controlling ammonia and odor emissions.

evaluate microbial cultures for seeding biofilters and biocovers for reducing odor from manure.

During FY 2001, *ARS will*

develop treatment technologies to reduce ammonia emissions from animal facilities and manure storage areas.

develop improved tools to determine nutrient concentrations in manure and predict nutrient release from manure.

develop methods or techniques to reduce or eliminate pathogens in manure.

develop methods to measure emission rates of gases from animal production and manure storage facilities.

investigate composting technologies that will conserve more nutrients (e.g., nitrogen) and reduce odors and destroy pathogens.

In FY 2001, *ARS is requesting an increase of*

$900,000 *to improve livestock manure management systems to protect environmental quality.*

PERFORMANCE GOAL 4.3.3.2: Demonstrate the conversion of agricultural waste into liquid fuels and industrial feedstocks.

Indicators:

During FY 2000, *ARS will*

develop bioprocess and metabolic engineering technologies that expand biofuel feedstocks and add value to agricultural wastes.

develop technology to remove and concentrate nutrients from liquid animal waste and waste water. This process will protect environmental quality and create a source of concentrated, high-value, low-volume fertilizer.

During FY 2001, *ARS will*

continue to develop novel bacteria that efficiently ferment a mixture of sugars that are genetically stable, selectively produce ethanol, have reasonable ethanol productivity, high ethanol tolerance, and tolerate inhibitors found in biomass-derived hydrolysates.

expand the microbial diversity of available microorganisms by metabolically engineering other organisms for selective fuel and chemical production.

identify the bacteria present in swine manure and waste holding facilities (primarily pits) to establish the primary bacterial populations present in the swine intestinal tract and waste holding facilities. The bacteria can then be isolated and studied for production of known odorous compounds. This information will be employed to develop diagnostic methods aimed at determining the effectiveness of abatement strategies to control the microbiological agents responsible for odor.

convert agricultural byproducts, such as nut shells, soybean hulls, and sugarcane bagasse into high value absorbents of metals and organics to clean up wastewater from industrial processes.

evaluate the use of manure fiber in composite materials.

advance recently developed laboratory procedures to the pilot plant stage with interested industrial partners to demonstrate the production of alternative fuels (bio-diesel) from soap stocks, an underutilized byproduct of edible oil processing. This innovative technology has the potential to not only reduce the cost of biodiesel but also to abate a serious pollution problem in edible oil refining.

establish methods for setting quality standards and enhancing the properties of biodiesel fuels in collaboration with farm cooperatives, industry trades groups, government and university partners.

conduct research with an industrial partner, through a CRADA, to complete research necessary for commercialization of a lipid-based nutraceutical with beneficial pharmacological activity.

transfer technology for a new downstream ethanol recovery unit operation, potentially saving three cents per gallon.

In FY 2001, *ARS is requesting an increase of*

***$3,000,000** to develop new technologies for improving and expanding biomass for energy.*

GOAL V: Empower People and Communities, Through Research-Based Information and Education, to Address the Economic and Social Challenges of Our Youth, Families, and Communities.

Funding by Program Activity ($000's)	FY 1998	FY 1999	FY 2000	FY 2001
Soil, Water & Air Sciences	3,920	3,945	3,896	3,786
Plant Sciences	86,713	91,204	93,945	89,053
Animal Sciences	37,221	40,013	40,630	37,231
Commodity Conversion & Delivery	2,662	1,527	2,304	2,180
Human Nutrition	813	733	0	0
Integration of Agricultural Systems	4,926	5,820	5,775	5,670
Total	$136,255	$143,242	$146,550	$137,920
FTEs	1,446	1,429	1,446	1,349

Means and Strategies: To successfully accomplish the research activities under this goal, ARS will need the level of human, fiscal, physical, and information resources portrayed in the budget estimates for fiscal years 1999 to 2003.

Verification and Validation: ARS currently conducts a series of review processes designed to ensure the relevance and quality of its research work and to maintain the highest possible standards for its scientists. A more detailed description of the evaluation plans can be found in the introduction to this plan.

OBJECTIVE 5.1: Economic opportunity and technology transfer: "Conduct agricultural research to promote economic opportunity in rural communities and meet the increasing demand for information and technology transfer throughout the United States agriculture industry."

STRATEGY 5.1.1: Rural development opportunities: Develop farming systems tailored to diverse agricultural production enterprises to enhance profits, sustainability, and environmental quality.

PERFORMANCE GOAL 5.1.1.1: Experimentally demonstrate the successful operation of small-scale production and processing systems, evaluate small scale animal production systems, and enhance high value agricultural products.

Indicators:

During FY 2000, *ARS will determine whether high value nut trees and specialty crops, such as ginseng and mushrooms can be established in agroforestry systems being developed for Appalachia and the Ozarks. Establishment of such crops will lessen U.S. dependency on imports and provide higher income to these economically-depressed rural areas.*

STRATEGY 5.1.2: Information access and delivery: Provide improved access to and dissemination of information to increase public knowledge and awareness of agricultural research, to aid technology transfer, and to speed up sharing of new knowledge.

PERFORMANCE GOAL 5.1.2.1: Make information on ARS research results and inventions available electronically via the Internet and similar resources.

Indicators:

During FY 2000, *ARS will*

develop an interactive Internet website to display and exchange information developed by the Semi-Arid-Land-Surface-Atmosphere (SALSA) global change research programs on global change and water resource management in the San Pedro Basin. Government agencies, organizations, and private citizens will be able to access SALSA research findings and other public information. SALSA collaborators will be able to interactively retrieve data from and deposit in a common database. This research and information tool will facilitate transfer of SALSA science products to user communities in the U.S. and abroad.

use the Internet to expand license and development opportunities of low phytate corn to reduce phosphate in the environment, and corn fiber oil to reduce the level of blood cholesterol. ARS will also expand electronic methods to increase the adoption of biocompetitive agents in poultry and swine to increase food safety.

During FY 2001, *ARS will enhance online options from the OTT Home Page to maximize the transfer of ARS technologies to the private sector by adding a searchable database for CRADA opportunities.*

PERFORMANCE GOAL 5.1.2.2: Provide more cost-effective and efficient public information and technology transfer.

Indicators:

During FY 2000, *ARS will*

continue to develop partnerships with States, the Minority Business Technology Transfer Consortium, and Rural Conservation and Development Councils to enhance small businesses in rural communities.

submit 70 new patent applications.

participate in 90 new CRADAs.

license 30 new products.

develop 70 new plant varieties for release to industry for further development and marketing.

During FY 2001, *ARS will*

increase outreach activities with proactive participation at selected industry trade shows and increase activity with venture capital groups to highlight technology transfer opportunities and services.

submit 80 new patent applications.

participate in 92 new CRADAs.

license 32 new products.

develop 70 new plant varieties for release to industry for further development and marketing.

PERFORMANCE GOAL 5.1.2.3: Research programs include information and technology transfer considerations.

Indicators:

During FY 2000, *ARS will participate in National Program Reviews and Area Leadership Conferences to enhance technology transfer education and information.*

During FY 2001, *ARS will expand efforts to work with NPS to develop policies for transfer of technologies and make such considerations early in the research planning process. New training programs will be developed to inform research leaders and new scientists of technology transfer procedures and concerns.*

STRATEGY 5.1.3: Commercialize research results: Develop technology transfer systems that lead to commercialization of research results by industry.

PERFORMANCE GOAL 5.1.3.1: Provide small businesses with contacts and information on the programs available from public and private sources.

Indicators:

During FY 2000, *ARS will expand efforts to identify groups that will enhance the probability of identifying partners for commercialization of ARS technologies. ARS will give particular emphasis to organizations concerned with minority businesses and rural development.*

During FY 2001, *ARS will provide the International Trade Division of the Commerce Department with ARS-linked companies for incorporation in its international industry promotion program and continue to develop partnerships with States, the Minority Business Technology Transfer Consortium, and Rural Conservation and Development Councils to enhance small businesses in rural communities.*

PERFORMANCE GOAL 5.1.3.2: Expand the types of agreements used by ARS and delegate signatory authority to the lowest feasible level.

Indicators:

During FY 2000, *ARS will expand negotiation of licenses for ARS technology by training the Technology Transfer Coordinators in procedures. This will enhance customer service and facilitate the licensing process. OTT will provide oversight to ensure consistent implementation of Federal Regulations.*

During FY 2001, *ARS will expand license monitoring to ensure compliance with terms and shorten the time period required to provide a final draft to licensees.*

ADMINISTRATIVE, PROGRAMMATIC, AND MANAGEMENT INITIATIVES

Initiative 1: Support Education: "Support Higher Education in Agriculture to Give the Next Generation of Americans the Knowledge, Technology, and Applications Necessary to Enhance the Competitiveness of United States Agriculture."

All of the activities relating to this initiative are cross-cutting in nature and are reflected in the strategies and performance measures under the five ARS Goals and Initiatives 2 and 3.

Initiative 2: National Agricultural Library: "Ensure and Enhance Worldwide Access to Agricultural Information through the Programs of the National Agricultural Library (NAL)."

Funding by Program Activity ($000's)	FY 1998	FY 1999	FY 2000	FY 2001
AG Information & Library Services	18,308	19,048	19,150	21,352
Total	$18,308	$19,048	$19,150	$21,352
FTEs	174	171	174	180

Means and Strategies: To successfully accomplish the activities under this initiative, ARS will need the level of human, fiscal, physical, and information resources portrayed in the budget estimates for fiscal years 1999 to 2003.

The proposed funding for FY 2001 includes $2,000,000 in program increases. Funding increases include enhanced support of ARS research and information programs.

Verification and Validation: ARS currently conducts a series of review processes designed to ensure the relevance and quality of its work. A more detailed description of the evaluation plans can be found in the introduction to this plan.

STRATEGY 2.1: Access to information: Collect, organize, and provide access to information that supports agricultural programs and responds to information needs.

PERFORMANCE GOAL 2.1.1: Implemented selection guidelines for the electronic resources to be acquired and used by NAL.

Task completed in FY 1997.

PERFORMANCE GOAL 2.1.2: Expanded representation of electronic formats such as Internet resources, online databases, and digital documents in AGRICOLA and NAL's online catalog.

Indicators:

During FY 2000, *NAL will*

continue the transition from print to electronic collections.

begin using publisher supplied citation and abstract data in electronic form in the creation of indexing records.

make articles from indexed journals available immediately upon receipt by adding descriptive citation data to AGRICOLA in advance of subject indexing.

PERFORMANCE GOAL 2.1.3: A gateway is provided to a large body of electronic information on agriculture over a network such as the Internet.

Indicators:

During FY 2000, *NAL will continue to work with its land grant university partners to select and implement an infrastructure system which facilitates distributed searching for enhanced resource discovery using recently developed metadata and subject classification structure.*

During FY 2001, *NAL will, in collaboration with land grant and international institutions, investigate alternatives and development of database structures which facilitate searching across multiple databases, and the development of algorithms and software related to the retrieval and analysis of agricultural information.*

PERFORMANCE GOAL 2.1.4: Demonstrate increased use of agricultural information by institutions of higher education.

Indicators:

During FY 2000, *NAL will*

as part of the Reference Reinvention Initiative, continue to transition to nonmediated services for users. Data will be collected to document the usage of more readily available electronic reference materials.

collect and analyze tracking information to determine customer needs. This information will be valuable in restructuring and enhancing the information and services offered to institutions of higher education.

STRATEGY 2.2: Meet customer needs for information: Anticipate and provide information products and services, including educational programs, that enable NAL's diverse customers to identify, locate, and obtain desired information on agricultural topics.

PERFORMANCE GOAL 2.2.1: The time for processing requests for services and delivering the information requested is further reduced.

Indicators:

During FY 2000, *NAL will*

expand electronic methods of document delivery to increase accuracy and efficiency of requested items. Implementation of an electronic request system for walk-in reader request patrons will begin. Patrons will request items on site for copy or loan through the online catalog ISIS. Requests will be sent from this subsystem electronically to the stacks for fulfillment and delivery of items.

continue to expand electronic services and identify emerging technologies to enhance program delivery.

PERFORMANCE GOAL 2.2.2: The gap between the time that information is published and made available in NAL-produced databases is further reduced.

Indicators:

During FY 2000, *NAL will*

decrease the elapsed time for indexing from receipt of the journal issues to release of articles to AGRICOLA.

begin addition of machine-readable records to the online catalog for older serial publications.

In FY 2001, *NAL is requesting an increase of*

***$600,000** to update and improve technology infrastructure.*

***$1,200,000** to provide access to research information.*

PERFORMANCE GOAL 2.2.3: Expanded provision of Internet and other technology-related training programs for NAL customers.

Indicators:

During FY 2000, *NAL will develop web-based training to provide the ARS staff to better utilize electronic resources that have been obtained as a result of improved acquisition approaches for group access to expanded resources.*

STRATEGY 2.3: Preservation of significant materials: Preserve significant and important works in agriculture and the fields related to agriculture to ensure availability of NAL's collections to current and future generations.

PERFORMANCE GOAL 2.3.1: Establishment of a national archive for agricultural literature that serves as a centralized storage facility for archival copies prepared by cooperators in the program.

Indicators:

During FY 2000, *NAL will obtain the master microfilm negatives from phase two of the U.S. Agricultural Information Network (USAIN) preservation microfilming project for transfer to NUS.*

PERFORMANCE GOAL 2.3.2: Development of a program for monitoring quality of electronically archived materials to ensure that the data remain accessible.

Indicators:

During FY 2000, *NAL will work with the steering committee to produce a conference on metadata for the USDA and to develop further actions for preserving USDA digital publications.*

In FY 2001, *NAL is requesting an increase of*

$200,000 *to preserve USDA digital publications.*

Initiative 3: Creative Leadership: Promote Excellence, Relevance, and Recognition of Agricultural Research through Creative Leadership in Management and Development of Resources, Communications Systems, and Partnerships with Our Customers and Stakeholders.

STRATEGY 3.1: Develop research agenda: Identify ARS program priorities and core research capabilities and use them to provide leadership in development of the coordinated REE and national research agendas.

PERFORMANCE GOAL 3.1.1: The annual performance plan is delivered on time.

Indicators:

During FY 2000, *ARS will meet all REE and Departmental deadlines for submissions required by the strategic plan.*

PERFORMANCE GOAL 3.1.2: Meet REE deadlines for submission of material for inclusion in the Coordinated Research Agenda.

Indicators:

During FY 2000, *ARS will meet REE deadlines for submission of materials related to the Coordinated Research Agenda.*

PERFORMANCE GOAL 3.1.3: Annual conferences of public and private individuals are convened to discuss major researchable issues in agriculture and to articulate approaches to addressing these problems.

Indicators:

During FY 2000, *ARS will*

select the researchable aspects of a high priority national issue that will benefit from a broad public/private, Federal/State/local dialogue and convene an appropriate conference.

continue an annual conference of Federal, State, and industry representatives for the purpose of reviewing the progress of the new five year research, action and technology transfer plan, as well as to make control recommendations for the silverleaf whitefly that has caused $200-500 million in losses across the Southern tier of the U.S.

PERFORMANCE GOAL 3.1.4: Rapid responses to crises.

Indicators:

During FY 2000, *ARS will respond to threats to the security of American agriculture and the safety of the Nation's food supply.*

STRATEGY 3.2: Civil Rights: ARS is committed to the principal of Civil Rights and the implementation of the Civil Rights Action Team Report. The ARS Civil Rights Staff (CRS) recognizes that systematic communication is important as a means of ensuring that its services meet the expectations and needs of its customers/stakeholders, including managers, supervisors, and employees.

PERFORMANCE GOAL 3.2.1: Written policies and guidance to facilitate implementation of the Civil Rights program.

Indicators:

During FY 2000, *ARS will continue to develop policies, brochures, and fact sheets to facilitate implementation of the Civil Rights Program.*

PERFORMANCE GOAL 3.2.2: Improve all aspects of the Title VII program which includes EEO training, data collection, and monitoring and evaluation.

Indicators:

During FY 2000, *ARS will conduct on site EEO program evaluations to determine the extent to which ARS is complying with Equal Employment Opportunity requirements.*

STRATEGY 3.3: Additional funding: Encourage acquisition of additional funding to improve ARS programs and priorities.

PERFORMANCE GOAL 3.3.1: Partnerships are established.

PERFORMANCE GOAL 3.3.2: Procedures are implemented.

PERFORMANCE GOAL 3.3.3: Outside support increases.

Indicators:

During FY 2000, *ARS will meet or exceed the targets for securing additional funding.*

STRATEGY 3.4: Customer service: Improve customer service.

PERFORMANCE GOAL 3.4.1: Improved customer satisfaction.

PERFORMANCE GOAL 3.4.2: Customer needs are identified.

STRATEGY 3.5: Management of facilities: Provide appropriately equipped Federal facilities required to support the research and information activities of ARS into the next century.

PERFORMANCE GOAL 3.5.1: Criteria and priorities identified.

Indicators:

During FY 2000, *ARS will update annually the ARS facilities modernization plan which identifies ongoing repair and maintenance needs of existing Agency laboratory and support facilities.*

During FY 2001, *ARS will continue its construction, modernization, and repair and maintenance program.*

In FY 2001, *ARS is requesting an increase of*

$39,300,000 *for replacement and modernization of selected laboratories.*

STRATEGY 3.6: Maintenance of core research capabilities: Develop and implement comprehensive human resource systems and policies to support and enhance ARS' core research capabilities while maintaining the flexibility to shift research and form interdisciplinary teams to address emerging problems.

PERFORMANCE GOAL 3.6.1: Identify core capability requirements and develop a scientific staff to meet long-term research needs.

Indicators:

During FY 2000, *ARS will*

increase its core capability by significantly increasing the number of research scientist positions (SYs).

conduct three consolidated scientist recruitment cycles.

develop a core curriculum for new scientist orientation for use at field offices and laboratories.

implement a new Research Leader Training Program. A formal leadership training program will also be established, including orientation within Headquarters and the Areas.

During FY 2001, *ARS will continue to conduct consolidated scientist recruitment and provide orientation and training for new scientists and research leaders.*

PERFORMANCE GOAL 3.6.2: Establish a database of ARS experts by discipline and research areas of expertise.

ARS decided not to develop this database.

PERFORMANCE GOAL 3.6.3: Train 1,300 postdoctoral students, and competitively select 10 percent of them to fill full-time positions.

Indicators:

During FY 2000, *ARS will continue its Research Associate Program as a source of qualified candidates for its permanent research positions.*

During FY 2001, *ARS will continue its Research Associate Program as a source of qualified candidates for its permanent research positions.*

STRATEGY 3.7: Provide administrative support to REE: Serve as the lead agency in providing administrative and financial management services for Research, Education, and Economics.

PERFORMANCE GOAL 3.7.1: Customer participation in planning processes.

Indicators:

During FY 2000, *ARS will continue to monitor customer needs consistent with the AFM Strategic Plan and develop an AFM-wide customer survey to obtain feedback on customer satisfaction.*

During FY 2001, *ARS will review the need for revisions to the AFM Strategic Plan and seek customer, employee, and stakeholder input to the planning process.*

PERFORMANCE GOAL 3.7.2: Strategic Plan is developed and communicated to REE customers.

Indicators:

During FY 2000, *ARS will collect customer feedback to identify changing priorities and begin refinement of its Strategic Plan.*

During FY 2001, *ARS will implement a revised Strategic Plan reflecting the priorities of REE customers.*

STRATEGY 3.8: Program excellence and relevance: Ensure excellence and relevance of ARS programs through a variety of comprehensive reviews.

PERFORMANCE GOAL 3.8.1: Internal and external peer reviews are conducted on all research projects before implementation.

Reporting will begin in FY 2000.

PERFORMANCE GOAL 3.8.2: Review of the productivity, quality, and impact of individual scientists as scheduled in the Research Position Evaluation System (RPES).

Indicators:

During FY 2000, *ARS will conduct RPES reviews of approximately 350 Agency scientists.*

During FY 2001, *ARS will conduct RPES reviews of approximately 350 Agency scientists.*

PERFORMANCE GOAL 3.8.3: Program reviews are conducted periodically, and programs are sustained or redirected as appropriate.

Reporting will begin in FY 2000.

STRATEGY 3.9: Improve financial management: ARS/Administrative and Financial Management will support Departmental efforts to improve financial management.

PERFORMANCE GOAL 3.9.1: Implement integrated management systems in USDA.

Indicators:

Reporting will begin upon issuance of Departmental evidence on the Foundation for Financial Information System (FFIS) for mandatory use by USDA agencies.

During FY 2000, *ARS will*

continue to work with the Office of Chief Financial Officer (OCFO) on the design and modification of the FFIS for use by REE.

continue to work with the NFC on implementing new and modernized financial systems for the REE agencies.

During FY 2001, *ARS will*

continue to work with the OCFO on the design and modification of the FFIS for use by REE.

continue to work with the NFC on implementing new and modernized financial systems, for the REE agencies.

PERFORMANCE GOAL 3.9.2: Correct in a timely manner internal control deficiencies.

Indicators:

Reporting will begin upon issuance of Departmental evidence on the FFIS for mandatory use by USDA agencies.

During FY 2000, *ARS will continue compliance with the FMFIA, including the timely completion of audit report recommendations and the timely correction of any FMFIA weaknesses that are identified.*

During FY 2001, *ARS will continue compliance with the FMFIA, including the timely completion of audit report recommendations and the timely correction of any FMFIA weaknesses that are identified.*

PERFORMANCE GOAL 3.9.3: Make available reliable cost accounting information.

Indicators:

Reporting will begin upon issuance of Departmental evidence on the FFIS for mandatory use by USDA agencies.

During FY 2000, *AFM will*

continue to work with the OCFO and the NFC to implement USDA cost accounting standards on behalf of all REE agencies, and perform biennial reviews of user charges as required by OMB Circular A-25.

continue to review Agency operations for new potential user fee situations.

During 2001, *ARS will*

continue to work with the OCFO and the NFC to implement USDA-cost accounting standards on behalf of all REE agencies, and perform biennial reviews of user charges as required by OMB Circular A-25.

continue to review Agency operations for new potential user fee situations.

PERFORMANCE GOAL 3.9.4: Clean and timely audit opinions are provided on audited financial statements.

Indicators:

Reporting will begin upon issuance of Departmental evidence on the FFIS for mandatory use by USDA agencies.

During FY 2000, *ARS will prepare, review, and certify the yearly consolidated financial statements of the REE agencies as required under the Chief Financial Officer's Act.*

During FY 2001, *ARS will prepare, review, and certify the yearly consolidated financial statements of the REE agencies as required under the Chief Financial Officer's Act.*

AGRICULTURAL RESEARCH SERVICE

Summary of Agency Resources for FY 2000
(In Thousands of Dollars)

	Goal I	Goal II	Goal III	Goal IV	Goal V	Mgmt. Init.	TOTAL
Soil, Water, and Air Sciences	692	8,947	------	75,107	3,896	------	$88,642
Plant Sciences	23,214	151,050	72	27,594	93,945	------	$295,875
Animal Sciences	3,733	86,625	-------	2,076	40,630	------	$133,064
Commodity Conversion and Delivery	92,548	73,796	239	3,227	2,304	------	$172,114
Human Nutrition	------	------	72,420	-------	------	------	$72,420
Integration of Agricultural Systems	1,140	6,298	------	17,644	5,775	------	$30,857
Agricultural Information and Library Services	------	------	------	------	------	19,150	$19,150
TOTAL	$121,327	$326,716	$72,731	$125,648	$146,550	$19,150	$812,122
FTEs	1,293	3,226	286	1,337	1,446	174	7,762

Note: Table does not include repair and maintenance of facilities, and contingencies.

AGRICULTURAL RESEARCH SERVICE
Summary of Agency Resources for FY 2001
(In Thousands of Dollars)

	Goal I	Goal II	Goal III	Goal IV	Goal V	Mgmt. Init.	TOTAL
Soil, Water, and Air Sciences	670	8,787	------	96,669	3,786	------	$109,912
Plant Sciences	21,991	162,344	36	26,462	89,053	------	$299,886
Animal Sciences	3,382	98,737	------	1,912	37,231	------	$141,262
Commodity Conversion and Delivery	102,469	75,353	420	3,167	2,180	------	$183,589
Human Nutrition	------	------	89,773	------	------	------	$89,773
Integration of Agricultural Systems	1,122	6,145	------	17,285	5,670	------	$30,222
Agricultural Information and Library Services	------	------	------	------	------	21,352	$21,352
TOTAL	$129,634	$351,366	$90,229	$145,495	$137,920	$21,352	$875,996
FTEs	1,289	3,240	324	1,380	1,349	180	7,762

Note: Table does not include repair and maintenance of facilities, and contingencies.