Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

aSB599
.A2U532

United States
Department of
Agriculture

Agricultural
Research
Service

Crop Production Research

1982 Annual Report

U.S. DEPT. OF AGRICULTURE
NATL. AGRIC. LIBRARY
RECEIVED
DEC 14 '84
PROCUREMENT SECTION

This publication reports research involving agricultural chemicals. It does not contain recommendations for their use, or does it imply that the uses discussed here have been registered. All uses of pesticides must be registered by appropriate State and/or Federal agencies before they can be recommended.

CAUTION: Pesticides can be injurious to humans, domestic animals, beneficial insects, desirable plants, and fish or other wildlife--if they are not handled or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and pesticide containers.

Any trade or company names used in this publication are used solely to provide specific information. Mention of a trade name does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture of an endorsement by the Department over other products not mentioned.

FOREWORD

Crop Production

Research under Program Element 677, Crop Production Efficiency Research, includes research under 13 National Research Programs (NRP) in Crop Production.

Research is conducted to improve plan roductivity through improved varieties of food, feed, fiber, forage, florist nd nursery crops, and turf; to develop new crop resources; and to develop improved crop production practices. Current yields and quality of crops, improve mechanization and crop production practices, and to alleviate the effects of adverse environmental conditions through hardier plants.

New multidisciplinary concepts for increasing our productive capacity have been initiated. Special emphasis has been placed on improving basic photosynthetic processes in plants, natural nitrogen-fixing processes in soils and plants, innovative cellular genetic research, better use efficiency of both renewable and nonrenewable energy resources, and control of plant growth and development.

The research workers in the plant sciences publish the results of their investigations in the open literature as quickly as sound judgment warrants. This report provides a brief overview of the scope of the activities and examples of recent findings to those interested in the results of this work. Some of these still have not been released by publication. No attempt is made at completeness.

This report outlines crop production research and provides a brief description of recent accomplishments at the various locations throughout the United States. The report is organized by National Research Programs, each of which describes a separate subject matter area. These ARS National Research Programs are subdivided into Technological Objectives which more specifically describe the objective of each area of research.

Readers who have comments or inquiries are invited to contact either the National Program Staff or, more appropriately, scientists at the locations where the research is conducted.

Edward B. Knipling

EDWARD B. KNIPLING
Associate Deputy Administrator
Plant and Natural Resource Sciences Staff

TABLE OF CONTENTS

Issued January 1983

SUMMARY

Crop production research is an integral part of the total research program conducted by the Agricultural Research Service. Research is conducted to improve plant productivity through improved varieties of food, feed, fiber, forage, florist, and nursery crops; to develop new crop resources; to better understand biological processes; and to develop improved crop production practices. Current emphasis is on research to preserve germplasm resources, to develop new genetic stocks and varieties, increase yields and quality of crops, improve crop production practices, and to alleviate the effects of adverse environmental conditions. There also is a new awareness of the need and opportunity to better understand the basic physiology of growth. New technology and recent advances in the use of plant growth regulators have opened new vistas for the more perceptive scientists. Such research will be particularly important as plants are recognized for the potential they have as one of the few renewable resources available to humans.

The research is described under 13 National Research Programs (NRP).

A brief summary of each NRP is provided in the front of this volume. More detailed reports for each NRP follow with selected examples of progress and publication.

NRP 20010 Breeding and Production - Fruits, Nuts, and Specialty Crops

The objectives of this National Research Program are to develop new and improved germplasm and varieties of fruits, nuts, and specialty crops and to develop new and improved cultural and management practices for those crops. This research is presently being conducted at 17 locations by 65 scientists in several disciplines and serves many small and diverse horticultural industries. Research reported in this annual summary is also reported in 107 scientific publications. This report on current research includes highlights on (1) introduction of new, improved pest-resistant scion varieties with increased yields, quality, consumer acceptance, and geographic adaptation; (2) use of intergeneric and interspecific hybridization in Citrus to introduce increased cold hardiness and pest resistance; (3) genetic studies on the inheritance and transmission of horticulturally important fruit and plant characteristics; (4) use of embryo and tissue culture; (5) discovery of mode of transmission of walnut blackline disease; (6) discovery of new viruses and testing for varietal susceptibility to viruses; (7) plant physiology studies on cold hardiness; (8) use of bioregulators to influence growth, flowering, and fruiting; and (9) cultural studies to increase yields and reduce the cost of production. In the future, more emphasis will be given to germplasm enhancement, host-plant resistance studies, use of bioregulators, and basic studies on aspects of plant growth and reproduction that influence production of fruits, nuts, and specialty crops.

NRP 20020 Breeding and Production - Vegetables

This program emphasizes research in genetic improvement and production of vegetables to develop new and improved genetic populations and

cultural methods. This research will result in lower costs to consumers and increased efficiency of crop production by commercial growers, small acreage farmers, and homeowners.

Good progress has been made toward the achievement of program goals through cooperative research efforts. A total of 90 journal articles was published by research scientists in this program area. These publications, other reports, and releases of new cultivars and improved germplasm document the results of research conducted by 39 scientists at 15 locations in 12 States. A major program workshop was conducted in the Southern Region. The program was judged to be productive and strongly interactive with other program areas within USDA-ARS and with the States and industry. New projects were initiated at Mayaguez, Puerto Rico on germplasm enhancement of sweet potatoes and tomatoes, with special emphasis on adaptation to hot-humid, tropical conditions.

Fundamental genetic research has led to the development and release of nine new cultivars and 17 germplasm or breeding lines. Most releases were made jointly with cooperating State agricultural experiment stations. New cultivars include two big vein-resistant crisphead lettuce types; one multiple-disease-resistant pinto bean; one multiple-disease-resistant muskmelon (cantaloupe); four high-yielding, high-quality, multiple-pest-resistant potatoes; and one early maturing F_1 tomato processing-type hybrid. Noncommercial germplasm released includes one bacterial blight-resistant bean line; one downy mildew-resistant Fordhook-type lima bean; one carrot inbred for use in production of high-quality, market-type hybrids; one multiple-disease-resistant cucumber line that is gynoecious flowering and parthenocarpic fruiting; five big vein-resistant, crisphead-type lettuce lines; and eight pea lines resistant to Pea Seedborne Mosaic Virus (PSbMV) and representing a wide array of varietal types. A germplasm collection trip into Central Mexico resulted in 52 accessions of mostly wild bean (Phaseolus) species. New research was initiated in the Vegetable Laboratory at Beltsville to utilize protoplast isolation, fusion and regeneration, and other emerging genetic engineering technologies. These new techniques should significantly aid in the development of genetically diverse pest- and stress-resistant vegetable germplasm.

Research on improving cultural practices showed that ethephon applications to tomato transplants before transplanting increased stem and root growth and significantly improved transplant survival. Equipment was developed for rapid, large-scale field inoculation of potato plants of different sizes with bacterial wilt (Pseudomonas solanacearum) so that evaluation and selection for genetic resistance would be facilitated. A method involving gel electrophoresis was developed to detect virus infection in commercial stock cultures of cultivated mushrooms. Cultural and sanitation methods were evaluated and recommendations developed for reducing major viral and fungal pathogens of mushrooms under commercial cultural conditions. Slitted plastic tunnels to cover crops on small acreages were evaluated for their ability to extend the cropping period.

NRP 20030 Breeding and Production - Florist and Nursery Crops

The major emphasis of this program is on multidisciplinary research to develop new technology for improving productivity and increasing efficiency in the production of floral and nursery crops that can enhance urban and rural environments.

Productivity of research scientists in this national program was high, as measured by the publication of 50 journal articles. Program research, conducted by 31 scientists at seven locations in six States, includes breeding and selection of new germplasm and cultivars; genetic engineering; tissue culture propagation; basic and applied work on reaction and resistance to disease and insect attacks, and on the development of effective pest control and management systems; improved cultural and management practices that increase yield, minimize losses, and improve quality; and study of factors contributing to environmental stress of plants and enhancement of environmental quality by reducing pollution and improving human surroundings.

Specific research progress this past year includes the release of seven new ornamental cultivars. These include four camellia species hybrids -- two that are cold tolerant and fall blooming, one with tolerance to heat and high light intensity, and one with high floral fragance; a holly (Ilex crenata) with compact, globose plant habit; and two flowering pears (Pyrus calleryana) related to the Bradford pear that are suitable for planting in limited space.

Advances were made in plant virus research and in virus detection methods. Monoclonal antibodies were developed against four viruses by the new hybridoma procedure. These high-titer, highly uniform antibodies should be useful as both diagnostic and taxonomic tools. Two different methods were perfected for identifying or "fingerprinting" cultivars that are difficult to distinguish by other means. One method involves the use of scanning electron microscopy (SEM) while the other employs high-pressure liquid chromatography (HPLC) for measuring quantitative and qualitative differences in floral pigments. The volatile terpene germacrone was identified as a weevil repellent present in weevil-resistant rhododendrons, and may provide a means to control feeding damage by these pests, which occur on many horticultural species.

Dr. H. M. Cathey assumed new duties as Director of the National Arboretum. Dr. R. H. Lawson replaced Dr. Cathey as Chief of the Florist and Nursery Crops Laboratory in the Horticultural Science Institute at Beltsville. The Laboratory at Corvallis, Oregon, is undergoing a reorganization under the leadership of Dr. R. G. Linderman who serves as both Research Leader and Location Leader.

NRP 20040 Breeding and Production - Corn, Sorghum, and Millets

Research on corn, sorghum, and grain millets emphasized the development of basic principles and the improvement of plant materials. Studies included chemical, genetic, entomological, pathological, methodological, and others, as well as an integration of these approaches.

Thirty-four scientists conducted research at fourteen locations, most often in cooperation with state scientists. Their studies resulted in a better understanding of corn and sorghum plants, improved germplasm populations, and the publication of the results in seventy-six journal articles.

Major accomplishments include:

- Plasmidlike DNA's in male-sterile sorghum share molecular homology with plasmidlike DNA's in male-sterile corn and with normal cytoplasm of corn. These similarities suggest some shared characteristics in sorghum and corn.

- A bar with attached pins proved effective as a tool to infest ears of corn with Aspergillus flavus. A technique using this pinbar shows promise as a method by which to select lines resistant to infestation by this aflatoxin-producing organism. Advanced progeny of the cross of corn by Zea diploperrenis, a relative of corn from Mexico, retained the resistance of Z. diploperrenis to maize chlorotic dwarf virus. The transfer of this resistance to corn would provide resistance not now available.

- An applicator was developed that can be used to apply NH_3 and other chemicals simultaneously without prior mixing. Substances unstable when mixed with NH_3 can now be applied at the same time as NH_3.

- Rapid and inexpensive methods were developed for screening sorghum plants for tolerance to mineral-element deficiencies and toxicities in nutrient solution. These procedures should enable the selection of types that will be more productive in areas where deficiencies and toxicities are problems.

These and other accomplishments improved the understanding of how these plants develop, the nature of the control of physiological processes, and the composition of grain. Stress tolerance and water and mineral-use efficiencies continued to be strong components. Pests, both insect and disease, were the subjects of research in many projects. A major effort was devoted to an understanding of infection of corn by Aspergillus flavus.

In addition to improved understanding and techniques, the research resulted in the release of new germplasm lines. Five corn lines with improved characteristics were released for use of public and private breeders.

Future plans include a greater emphasis on identifying improved germplasm and on developing more efficient means to use it to improve corn and sorghum.

NRP 20050 Breeding and Production - Small Grains

Primary emphasis is placed on basic and applied research directed toward improvement of germplasm and varieties of wheat, oats, barley, and rice so that new breeding material and varieties will produce more grain per acre, will have more effective protection from diseases and insects, will be better able to withstand environmental adversities, and will produce high quality and more nutritious grain for food and feed.

In 1981, wheat was harvested on 80,948,000 acres, oats on 9,411 acres, barley on 9,151 acres, and rice on 3,804,000 acres. Rye was harvested from an additional 697,000 acres and very small acreages of triticale, wild rice, and buckwheat were produced. All are included in NRP 20050.

During 1981, 5 wheat, 6 barley, 2 oat, and 4 rice varieties were released cooperatively by ARS and State Agricultural Experiment Stations. In addition, 10 wheat, 2 barley, and 1 rice germplasm populations or lines were released for

use by breeders. Research was conducted at 27 locations, and 62 scientist years (SY's) were involved. Publications numbered 58.

The four Wheat Quality Laboratories located at Manhattan, KS, Fargo, ND, Wooster, OH, and Pullman, WA; the Barley and Malt Laboratory at Madison, WI; the Rice Quality Laboratory at Beaumont, TX; and the Oat Quality Laboratory at Madison, WI, all played a vital role in maintaining and protecting our domestic and export grain markets. Increased attention was given wild species related to the small grain cereals as sources of new genes for resistance to diseases, insects, and desirable agronomic traits. Triticum dicoccoides, a tetraploid wheat which grows wild in Israel and other Mediterranean countries, has proved to be a good source of resistance to powdery mildew and stripe rust of wheat. It is also under study because of its high grain protein. One area of potential progress through basic research is our effort to extend the area of winter cereal crops over that of spring type varieties. The smuts that are parasitic on small grains continue to have an adverse effect on market quality. China (PRC) continues to maintain a zero tolerance for smut spores on wheat imported from the U.S. Pacific Northwest, for fear of introducing dwarf smut (TCK) into their country. This has virtually shut off the export of wheat from the Northwestern U.S. ports to China. New races of common smut obtained by hybridizing existing races present new combinations of virulence genes which will be used to identify new wheat breeding lines that carry adequate resistance to dwarf smut. Extensive studies to measure the effect of volcanic dust from the 1980 eruption of Mount St. Helens indicate there is no adverse effect on wheat milling and baking quality except for loss in test weight. Lines of Avena species related to our common oats were identified which initiated regenerable tissue cultures. Hybrids involving that material with common oats also produced regenerable tissue culture. Such hybrid tissue cultures may have potential use in interspecific gene transfer. These are but a few highlights of research conducted on small grains during 1981. The future holds both promise and excitement for improvement of these food and feed crops. More emphasis will be placed on germplasm development and less on variety release in the future, however, ARS must retain an active role in varietal development of some small grain cereal crops. Disease and insect resistance, improved grain quality, better lodging resistance, and higher yield will remain as worthy goals in small grain improvement.

NRP 20060 Breeding and Production - Cotton

The mission is to develop new knowledge which will increase cotton production efficiency, expand exports, and provide consumers with a stable supply of fiber and food at a reasonable cost. Research approaches emphasize the enhancement of germplasm and the development of basic principles to improve cultural and management practices that conserve energy, soil, and water. The research is conducted at 13 locations and involves about 39 scientists.

Accomplishments this past year include:

- Broadened germplasm base through conversion of 56 nonflowering exotic race stocks to types which flower in the Cotton Belt. This wild race germplasm is a valuable source of pest resistance and tolerance to climatic stress.

° Identification of germplasm which has a higher rate of fiber elongation under high temperature stress. This will make it possible to develop earlier maturing cottons with the desired long fibers.

° Development of basic principles to culture haploid pollen cells. This is an essential first step to the utilization of emerging genetic engineering technology to enhance cotton germplasm.

° Collection of new accessions of seed of ten wild species of cotton from Australia, including the first seed collected of two new species.

° Development of principles to use a biological agent (Gliocladium virens) to control seedling diseases in cotton. The fungus is grown on a peat moss - broth culture to form spores which can be added dry to the seed at planting time to suppress damping-off diseases.

° Development of more efficient water management procedures for growing short season cotton. During 3 years of testing, water deficits before flowering had little effect on earliness or yield. Deficits after flowering started, however, were very detrimental and decreased early season yield. Maximum short season yields can be obtained by avoiding water stress during the early portion of the flowering period.

Detailed research results were reported in 60 separate scientific articles.

NRP 20080 Breeding and Production - Soybeans, Peanuts, and Other Oilseed Crops

Primary emphasis in this program is on the germplasm improvement of oilseed crops. Germplasm improvement is achieved by intraspecific and interspecific hybridization programs, cytogenetical and genetical analyses of the crosses, and screening and selection for desired agronomical and chemical characteristics and for disease, nematode, and insect resistances. Basic physiological and biochemical studies are conducted on the biosynthesis and regulation of fatty acids and proteins. Approximately 31, 7, 9, and 3 SY's are assigned to soybean, peanut, sunflower, and other oilseeds, respectively. Soybean, peanut, sunflower, and other oilseeds germplasm improvement research is conducted at 11, 3, 4, and 4 locations, respectively, and the total number of locations for this research is 16. Most of the research is highly cooperative with State Agricultural Experiment Stations. The 50 scientists in this program published 94 scientific papers in 1981.

The highlights of 1981 include: 1) The identification of a new race of downy mildew disease of soybean, two mosaic virus diseases of safflower, bacterial tan spot disease of soybean, fast growing Rhizobium from Chinese soybean root nodules, and three major genes in soybean for resistance to soybean rust. 2) The identification of appropriate oilseed germplasm exhibiting tolerance to brownspot disease of soybean, resistance to leafspot diseases of peanuts, resistance to Phytophthora root and stalk rots and Sclerotinia stalk rot of sunflower, resistance to the new race 3 of downy mildew of sunflower, and tolerance to aluminum toxicity in soybeans. 3) The development of a new nondestructive method for screening soybean germplasm for N-fixation. 4) The increase in oil content of soybean seed by a plant growth regulator. 5) The clarification of an enzyme responsible for oil synthesis in soybeans, the role

of enzymes responsible for oxygenated fatty acids in sunflower, and the role of two enzymes responsible for partitioning glycolytic carbon in soybean seed. 6) The development and release of five soybean lines resistant to Mexican bean beetle and one soybean line high in protein content of seed, 20 peanut lines resistant to rust or Cylindrocladium black rot, four sunflower germplasm pools, and 14 safflower germplasm lines resistant to all four known races of Fusarium wilt. 7) The development and release of six improved soybean, three peanut, and one flax varieties and five sunflower lines.

Future plans for the research in this program include a greater emphasis on germplasm improvement and basic research, with decreasing emphasis on variety development and release. The guar program at Vernon, Texas, was reestablished on January 21, 1982.

NRP 20090 Breeding and Production - Sugar Crops

Primary emphasis in the program is on the improvement of sugar crops through breeding of superior cultivars of sugarcane and sweet sorghum and development of improved sugarbeet breeding lines. Secondary emphasis is on developing cultural and management practices to increase sucrose and sirup yields, minimize production losses, improve quality attributes, and efficiently conserve scarce resources in production systems involving the three crops. The research is conducted by 49 scientists located at 10 locations. Research described in this annual report is reported in 50 separate scientific publications. Sugarcane is grown on about 275,000 hectares in 4 States and sugarbeets are grown on about 480,000 hectares in 14 States. During the period 1977-81, domestic production of sucrose provided an average of about 40 percent of U. S. consumption of caloric sweeteners on a per capita basis.

The highlights of 1981 include: (1) release of sugarbeet germplasm resistant to nematodes; (2) release of a male sterile sugarbeet resistant to rhizoctonia; (3) development of a method to screen for southern root rot resistance; (4) development of sugarbeet germplasm resistant to the sugarbeet root maggot; (5) development of a method to detect curly top virus in the insect vector; (6) development of sugarcane germplasm that increases yield by 20 percent over existing commercial varieties; (7) development of sugarcane germplasm with field resistance to mosaic virus strain H; and (8) successful production of haploid sugarcane cell lines and plants by anther culture. Emphasis will continue on the development of improved germplasm, basic research on major diseases and the nature of host plant resistance, and basic research on aspects of plant growth and photosynthate partitioning that affect sucrose production and storage in commercial sugar crops.

NRP 20100 Breeding and Production--Forage Crops for Hay, Pastures, and Other Uses, Including Turf

Research is conducted by 64 scientists at 28 locations. Primary emphasis is placed on developing improved germplasm and management practices. The objectives are approached by understanding and using basic biological processes to improve forage crop production and utilization.

Significant progress is being made in the use of interspecific hybridization as a means to increase the availability of desirable genes. This approach holds considerable potential for increasing the availability of germplasm with resistance to disease, insects, and environmental stresses.

Improving forage quality is also of major importance because of its impact on livestock performance. Selection for improved digestibility has been successful in a number of grass species. Anti-quality factors are also important, and two new grass varieties have been developed that have decreased amounts of alkaloids that reduce livestock performance.

New scientific methodology is increasing the effectiveness and efficiency of research. Near-infrared reflectance spectroscopy is widely used for estimating forage quality by plant breeders and forage and livestock researchers. This and other technology based on modern electronics will continue to expand research capabilities in several areas. The need for interdisciplinary research will continue, and teams of scientists will be assembled or expanded for investigating the interactions among the basic metabolic processes of plants.

NRP 20110 Improved Vegetation and Management Practices for Range

Research is conducted by 38 scientists at 16 locations. Primary emphasis is placed on developing improved germplasm and range management practices. The objective is approached by understanding and by using basic biological and physical processes to improve range productivity and utilization.

Significant progress is being made in the use of interspecific hybridization as a means to increase the availability of desirable genes. This approach holds considerable potential for increasing the availability of germplasm with resistance to disease and insects and with adaptability to environmental extremes.

Improving forage quality is also important because it affects livestock performance. Selection for improved digestibility has been successful in a number of grasses and will continue in a number of introduced range species.

The development of a comprehensive range model will greatly enhance rancher's ability to make management decisions that are environmentally sound and have long-term benefits. The model will also aid in the identification of research gaps and improve communications among scientists. It will be necessary to understand, measure, and alter basic biological and physological processes in the development of improved range management practices that are consistent with the use of the range for wildlife, recreation, as a source of water, and conservation of soil.

The need for interdisciplinary research will continue, and teams of scientists will be maintained and expanded for investigation of several interacting and basic plant, animal, and soil processes.

NRP 20160 Introduction, Classification, Maintenance, Evaluation, and Documentation of Plant Germplasm

This is a three-pronged program: plant germplasm, new crops, and control of narcotics crops. The grouping is a natural one; all three programs draw heavily upon the botanical disciplines of taxonomy, ecology, and plant geography because they all deal with the occurrence and distribution of diversity among plants on a systematic, ecological, and geographical basis. The plants under study are mostly non-cultivated, or are being evaluated for their potential of useful diversity to establish crops.

People that several years ago did not know what germplasm was, or did not care, are, across the land in universities, professional societies, back-to-nature movements, and in Congress, speaking out in concerned tones that this renewable but irreplaceable, resource be given the national priority that it merits. In 1981 the Director, Science and Education, was apprised of the National Plant Germplasm System's needs and commissioned a review of it for the purpose of defining its strengths and weaknesses in organization, management, policy development and implementation, planning functions, and utilization of resources. The study has been completed as has one by the General Accounting Office. These have brought forth a strong commitment within ARS to provide support needed to give this country the National Plant Germplasm System it must have to assure continuing high productivity of its crops.

Studies are underway to determine opportunities and methods for manipulating the biosynthesis mechanisms in narcotic plants leading to the elaboration of morphine and other phenanthrine alkaloids, cannabinoids, and cocaine. Through bioinduction these biosynthetic processes may be blocked or altered without killing the target plants or having adverse impact on other elements of the environment where such illicit crops are being produced.

The research under this NRP is being conducted at 26 locations in the United States and abroad, involves about 55 SY's and is supported by approximately $9.0 million.

NRP 20170 Physiological and Biochemical Technology to Improve Crop Production

This National Research Program coordinates and manages research elucidating the basic function of plants at the physiological and biochemical level. New data resulting from this research are used to establish advanced agricultural technology with emphasis on field and horticultural crops.

Major fields of consequences within this National Research Program are: (1) improvement of photosynthetic capability, photosynthetic efficiency; translocation, metabolism, and biological converison of solar energy of plants; (2) development of improved efficiency of nitrogen fixation and the absorption, translocation, and utilization of nutrients; (3) improvement of crop production under environmental stress and reduction of stress damage to plants; and (4) improvement of technologies for understanding water relations, seed germination, growth regulation, flowering, fruiting, and photoperiod as a base for using molecular biology to increase crop production efficiency.

There are 16 locations represented by 68 SY's engaged in research under this National Research Program. Research teams comprised of not only these scientists and their colleagues but scientists with expertise crossing many and varied National Research Programs working together, focusing on the optimal transfer of basic information to field application.

The highlights of the 1981 research include: divalent cation effects on Photosystem II reaction elucidated; potential reduction in photorespiration; site of chilling injury identified; discovery of a new N_2-fixing system; identification of nonnodulating genotypes of alfalfa; development of molecular probes for plant viroids; characterization of iron reduction mechanism; promotion of plant growth by brassinosteroids; cryostorage of crop germplasm; new plant growth inhibitors of unique chemical structure; reduction of tomato yields with mixtures of sulfur dioxide and ozone.

NRP 20180 Crop Pollination and Honey Production

About 210,000 people keep more than 4.3 million honey bee colonies in the United States. Each year these beekeepers produce around 200 million pounds of honey, worth about $123 million and 3.9 million pounds of beeswax valued at $7 million. The management of our leafcutter bees adds another viable multimillion dollar agribusiness devoted to alfalfa seed production. More than 90 agricultural crops valued at $20 billion, in the United States depend upon bees for pollination or are benefited to some extent by bee pollination. Achievement of the goals of this NRP may help provide an adequate supply of agricultural products at reasonable prices, improve the nutrition and way of life of all Americans, and benefit the Nation's balance of payments by identifying and solving problems associated with the maintenance and use of honey bee and other pollinators of important U.S. crops.

The research in this NRP is conducted at 6 locations and involves 30 scientists. The scientists in this NRP have published 70 papers in 1981 reporting the results of scientific research in various scientific journals.

Photoperiod plays an important role in the life of the honey bee and the life span may be modified by varying the photoperiod. Dietary studies have shown that bees actively prefer a balanced mixture of pollen in their diet therefore, the presence of nearby weeds or second crops may be important to the well being and efficiency of crop pollinating colonies of bees. Future research in this area needs to address problems associated with substitute diets for bees, chemical control of bee behavior, mechanization of colony management, movement, and specialized management techniques.

Although progress is being made to develop fungicides to control chalkbrood disease of leafcutting bees, additional studies are needed. Research will continue to develop fungicides and other treatments for control of diseases.

The timing of insecticide applications to sweet corn may be adjusted so that they are not made during the dehiscence of the pollen. This would greatly reduce the potential for bee insecticide kills on sweet corn. Bee pesticide poisonings remain the most important problem to the bee keeping industry and future research areas will be directed toward the development of evaluation of bee management practices that may reduce the hazard to bees. The use of repellents, pesticide residues, reformulation of insecticides and adjustment in the use patterns of insecticides to reduce or minimize bee pesticide poisonings will also be explored.

Electrostatic interactions may play important roles in pollen collection, pollen shedding, stigmatic capture, and possibly as a marker delimiting flowers which are devoid of nectar and pollen. This helps us better understand the relationships between bee, pollen, and bee behavior in relation to pollination. Work is continuing on further definition of honey bee/crop pollination requirements on hybrid cotton, cucumber, and soybeans.

ARS has jointly participated with APHIS in a National Bee Mite Survey and has received about 2,600 apiary samples from 41 states. Two important mite pests not now in the United States, Acarapis woodi and Varroa jacobsoni represent a potential threat to the beekeeping industry. Neither species was found in any samples examined. The samples will represent about 5% of the apiaries in the country when completed. These mites may reach the U.S. border by the end of this decade.

The Africanized honey bee has now been found in Panama. Research shows that it is inferior in honey production to the commercial honey bees now found in North America. Africanized-European bee hybrids were nearly as objectionable for commercial use as their Africanized parents. There is a continued need for research on Africanized bees to find ways to make these bees compatible and nondisruptive to the beekeeping industry and honey production.

National Research Program 20010
BREEDING AND PRODUCTION - FRUITS, NUTS, AND SPECIALTY CROPS

This National Research Program involves research on breeding and production of fruits, nuts, and specialty crops that will result in increased production efficiency for commercial growers, part-time farmers, and homeowners and increased availability, variety, and quality of fruits and nuts for consumers. When possible, this research is conducted by multidisciplinary teams comprised of horticulturists, geneticists, physiologists, and pathologists in association with entomologists, nematologists, agricultural engineers, and marketing specialists. The research is national or regional in scope and concentrates on long-range projects not easily initiated or justified by individual State agricultural experiment stations.

Technological Objective 1: Develop new and improved varieties of fruits, nuts, and specialty crops that combine improved yield potentials; quality characteristics; better resistance to pests; tolerance to environmental stress; and adaptation for mechanical culture, harvesting, and handling.

NPS Contact; Howard J. Brooks

Research Locations:

Fresno, California
Indio, California
Orlando, Florida
Byron, Georgia
Beltsville, Maryland
Poplarville, Mississippi
Chatsworth, New Jersey
Wooster, Ohio
Corvallis, Oregon
Brownwood, Texas
Kearneysville, West Virginia

Examples of Recent Progress:

Improved grape germplasm selected - Fresno, California. A total of 7242 seedlings from 1980 crosses were planted in the field. This year, 220,032 emasculations resulted in 22,516 seeds from 120 controlled crosses. Forty-five new selections were made in 1981. The earliest-maturing seedless selection had 17 percent soluble solids on June 31 and a berry size of 11/16 inch. This result indicated that the potential exists for developing early-maturing grapes with good berry size. Nine seedless and three seeded selections are being evaluated in grower trials. Three seedless selections were saved for trial as raisins.

Embryo culturing found useful in stone-fruit breeding program - Fresno, California. A total of 9157 peach and nectarine embryos were cultured on defined media. From those embryos 3194 plants are now growing and will be transplanted to the field. Forty-nine peach, 22 nectarine, 17 plum, and 22 apricot seedlings were selected for the first time and saved for further evaluation. The earliest-maturing selection was P10-58, a nectarine developed from embryo culturing. It was mature May 4, 1 week ahead of commercially available nectarine varieties. Fourteen peach plants and two nectarine plants were developed by embryo culturing and are very early maturing. Sunfre nectarine, tested as C73-40, was released jointly with the Florida Agricultural Experiment Station, Monticello, Florida.

Tissue culturing technique developed for propagation of date trees - Indio, California. Asexual propagation of date trees is exceedingly slow by established procedures - often requiring 6 to 8 years for one new propagation. A new tissue-culturing technique has been developed and vegetative tissue of important varieties has been sent to Twyford Laboratories, England, and to Microviv, Institute National de Recherche Agronomique, Gerdat, France. This cooperation will lead to increased production of asexual plant material and greatly increase date-production efficiency worldwide.

Progress made in transferring deciduous-leaf characteristic in citrus - Orlando, Florida. Poncirus trifoliata is a citrus relative with deciduous leaves. F_1 hybrids of P. trifoliata and Changsha mandarin X English Small, English Large, and trifoliate X (Sunki mandarin X Benecke trifoliate) were evaluated for deciduousness in mild 50°-70° temperatures. Some mandarin X trifoliate hybrids had deciduous leaf characteristics similar to those of P. trifoliata. F_1 hybrids of P. trifoliata and sweet orange, grapefruit lemon, and sour orange did not have deciduous leaf characteristics similar to those of P. trifoliata. A total of 2205 seed resulted from additional crosses made to transfer this deciduous-leaf characteristic to Citrus.

Breeding commercial citrus varieties with virus resistance now possible - Orlando, Florida. Seventy-nine F_1, backcross, and potential parental scion selections were propagated and evaluated for tristeza resistance. Many of those hybrids had some Poncirus trifoliata in their parentage. Poncirus is a source of resistance to tristeza virus but it has very poor fruit quality. Forty-three advanced generation hybrids produced from two crosses made for testing tristeza-resistance transmission beyond a single, original genetic-resistance source were evaluated. Tristeza resistant selections were recovered from those hybrids in the third generation and with only one-eighth Poncirus inheritance. These results indicate that it should now be feasible to breed edible, commercial-quality citrus varieties that are resistant to the tristeza virus.

Severe Florida freeze beneficial to citrus breeders - Orlando, Florida. A severe freeze in January 1981 afforded an opportunity to compare the cold stress reactions of many hybrid seedlings to both the 1977 freeze and 1981 freeze and to evaluate several hundred hybrid seedlings planted after the 1977 freeze for cold stress reactions. Many cold-tolerant seedlings were identified. Twenty-four intergeneric hybrid seedlings that were derived from Citrus, Eremocitrus, Fortunella, and Poncirus and that were selected for use in the scion cold-hardiness part of the breeding program were planted in a severe

cold-stress area 300 miles north of Orlando for cold-stress evaluation. Crosses that were made to increase the genetic diversity of the citrus industry by transferring cold hardiness and other desirable traits from other genera and species to commercial scion varieties yielded 7045 seeds during 1982.

Sources of resistance to Phytophthora fungi found in citrus relatives - Orlando, Florida. Citrus relatives were in the Orlando citrus-breeding program. Fourteen bigeneric and five trigeneric crosses were made to broaden the genetic base of the citrus-rootstock improvement program. The hybrids will eventually be evaluated for disease resistance, drought tolerance, tree-size-control traits, and rest-period stability. Ten selections were found to be resistant to the citrus tristeza virus and two selections were found to be susceptible. Of 220 hybrid selections, 92 were moderately resistant to Phytophthora parasitica feeder root inoculations; and, of 129 hybrid selections, 9 were resistant to P. phytophthora stem inoculations.

Sunprince peach cultivar introduced - Byron, Georgia. Sunprince is a yellow-fleshed freestone peach that was released for commercial use because of its superiority over standard cultivars in its season. In long-term tests in Georgia and North Carolina, it has had better color and shape than Redskin and better bacterial spot resistance than Blake. Sunprince is expected to be widely grown in the Southeast.

Discovery of "rough skin" mutation of peach epidermis - Byron, Georgia. This unique "rough skin" character appears to be intermediate between the soft fuzz of a peach and the smooth skin of a nectarine. Although studies proving its genetic basis are not complete, this type of peach epidermis may be useful in reducing the need for brushing during peach packing operations. Since the surface is not smooth and waxy like that of a nectarine, problems with pesticide spray retention and insect and disease injury to the fruit should be reduced. This epidermal character will be incorporated into the germplasm used for the peach-breeding program.

Progress made in plum breeding - Byron, Georgia. In 1981 the plum-breeding program produced approximately 5000 hand-pollinated and open-pollinated seeds that should provide 2500 to 3000 additional seedlings for the program. Eleven new selections were added to the testing program. Advanced testing with selection BY 68-971 is continuing. Selections BY 69-399 and BY 7401-5 were added to the advanced-testing program. The 1980 plum releases, Explorer and Robusto, have been propagated for sale by at least five nurserymen. All seedlings, selections, and cultivars were inoculated at least twice with Xanthomonas pruni and rated later for leaf spot, fruit spot, and twig canker.

Germplasm found for tolerance to peach tree gummosis - Byron, Georgia. The geographical distribution of fungal gummosis in the Southeastern United States was determined by extensive on-site surveys. Botryosphaeria dothidea, the causal organism, was isolated from orchards diagnosed as having gummosis disease. Approximately 270 commercial varieties, selections, and exotic varieties of Prunus persica were rated for gummosis susceptibility. Some apparently resistant material was identified through observations of natural infection and through artificial inoculation. An artificial inoculation technique was developed for study of pathogenicity and virulence of B. dothidea isolates on peach trees. This technique will be used to screen seedlings of the Byron stone-fruit breeding program.

Potential sources found for resistance to gummosis disease in peaches - Byron, Georgia. Professional workers and the peach industry have been alerted to gummosis as a major disease problem of peach in the Southeastern United States. Control methods have been tentatively recommended. If effective, they will reduce orchard losses caused by gummosis and increase yields of peaches in the Southeast. Potential sources of resistance that may allow the development of resistant varieties have been identified in the germplasm collection.

Three new strawberry varieties introduced - Beltsville, Maryland. New strawberry varieties released to nurserymen for propagation this year include Allstar, Junebearer, Tristar, and Tribute everbearers. Allstar is consistently higher yielding than the standard cultivar Guardian in matted rows and its fruit size is superior to that of Guardian in unthinned rows. Tribute and Tristar can be grown either by home gardeners or commercial growers. In 1981, 54 new strawberry crosses were made. More than 5900 seedlings from 27 progenies were planted at Wye Institute, Wye, Maryland. Seedlings from 20 of those progenies were entered into a randomized complete block design. At Beltsville, 2240 seedlings were also planted.

Intergeneric hybrids made in strawberry - Beltsville, Maryland. Thirty successful strawberry crosses were made in Raleigh, North Carolina, including intergeneric crosses between Fragaria ananassa and Duchesnea indicia for immunity to anthracnose. Sixteen of the Raleigh progenies and an additional ten made in Beltsville attempted to recombine red stele root rot resistance with anthracnose resistance. Replicated trials with strawberries, including 134 elite selections and cultivars, were established at Clinton and Fletcher, North Carolina.

Strawberry and thornless blackberries propagated in tissue culture - Beltsville, Maryland. Strawberry and thornless blackberry varieties were propagated in tissue culture. In the first year, tissue-cultured strawberry plants had more runners, flowers, berries, and total fruit weight than did screenhouse runner plants of the same varieties, whereas runner plants had larger fruit size than did the tissue-cultured plants on first and second picking. In the second year, the tissue-cultured and runner plants had fruit of the same size, but there was no difference in fruit size and the tissue culture plants had much larger yields than the runner plants. Tissue-cultured thornless blackberries grew as well as, or better than, plants of the same cultivar grown from one-node cuttings. Tissue-cultured plants were as fruitful as those produced from cuttings, although first-year fruit size was reduced in one cultivar. No variant plants were observed in the field.

New thornless blackberry variety introduced - Beltsville, Maryland. Hull thornless blackberry (SI-US-68-6-6) was named and released to nurserymen as a more adaptive, firmer, and tougher-fruited selection than Black Satin. Plantings of new thornless blackberry selections were established at Ripley and Jackson, Ohio, and at Beltsville, Maryland. Ratings of selections planted in Beltsville indicated that different cultivars reacted differently to fungus diseases and had different mechanical harvesting potentials. Over 100 bramble crosses were made in 1981 of which the majority were from intercrossings of partially hardy thornless types; intercrossings of thornless blackberry and raspberry; and intercrossings of thornless and hardy, thorny types. Fourteen blackberry crosses, totaling 284 seedlings, were sent to Wooster, Ohio, for planting this year.

Blueberry germplasm widely tested and new variety introduced - Beltsville, Maryland. In North Carolina, blueberry selection NC 1688 was established in tissue culture for rapid propagation to produce plants for advanced testing and possible release. North Carolina selections 1376, 1440, 1514, 1522, 1523, 1525, 1836, and 1837 were increased and planted in replicated trials for advanced testing. In Georgia, rabbiteye blueberry selections T-99 and T-139 were increased for release. After the 1981 fruit evaluations, T-99 was named Brightwell and released to nurserymen for propagation. Parent clones were rooted and seedling progenies were produced for a proposed breeding study in Mississippi. About 60 new selections were evaluated and propagated for further testing in New Jersey. Blueberry selections G-130, G-138, G-139, and G-144 are being propagated for possible release.

Blueberry relatives hybridized - Beltsville, Maryland. Approximately 183 crosses of Vaccinium were made in Raleigh, North Carolina, including crosses at the 2n, 4n, and 6n levels and intersectional crosses between Cyanococcus and Polycodium species, between Cyanococcus and Herpothamnus species, and between Herpothamnus and Pyxothamnus species. More than 2300 seedlings, representing 31 crosses of blueberries at the 4n and 6n levels, were sent to North Carolina for planting and evaluation. New selections included 55 June-bearing strawberries and 79 blueberry selections (39 tetraploids, 27 hexaploids, and 13 ornamental diploids). Thirty-seven germplasm accessions were collected from Eastern North Carolina. Two replicated prevarietal ornamental blueberry trials, including 11 elite clones of V. crassifolium and V. sempervirens, were established at Pleasant Garden and Bailey, North Carolina.

Four States involved in developing strawberries with resistance to anthracnose - Poplarville, Mississippi. Seed from 60 crosses were germinated at Poplarville and 20,000 seedlings were grown in the greenhouse under controlled conditions. The seedlings were inoculated with five strains of Colletotrichum fragariae isolated for anthracnose resistance. Resistant seedlings were shipped to cooperating scientists (4000 to North Carolina, 1000 to Florida, and 2500 to Louisiana). Thirty-two clones from the 1979 strawberry seedling field at Poplarville were selected for further evaluation. The selections were based on their high resistance to anthracnose, fruit flavor, size, color, firmness, yield, plant growth habit, and vigor.

Self-pollination found to reduce fruit size in highbush blueberries - Poplarville, Mississippi. In studies of six tetraploid highbush blueberry genotypes allowed to self-propagate the number of seeds produced per pollination was drastically reduced. The percentge of viable seeds produced was reduced correspondingly as indicated by the percentage of seed that produced seedlings. The mean weight of berries was also reduced by self-pollination. One genotype appeared only partially fertile.

High-quality disease-resistant pear selections propagated for trial - Wooster, Ohio. This program is closely integrated with the USDA pear-breeding program at Kearneysville, West Virginia. More than 1200 seedlings were planted at Wooster and more than 3000 seedlings were planted in a nursery at Kearneysville, More than 20,500 pollinations were made at Beltsville. From those pollinations, 4373 seeds were obtained. About 1850 fruit samples were evaluated at Wooster.

Eleven selections were made at Wooster for high quality, good size, and fire-blight resistance. Fire blight and Fabraea leaf spot incidences were recorded for all trees. Giant Seckel showed extreme susceptibility to leaf spot. Fourteen high-quality, disease-resistant selections have been propagated for trial.

Once-over mechanically harvested strawberry selections - Corvallis, Oregon. OR-US strawberry selections 4688 and 4695 both exceeded 9000 kg/ha of ripe fruit when harvested with a once-over mechanical harvester. Seven additional selections also exceeded this production. Mechanical capping of the calyx was 70 percent successful for selection OR-US 4688.

New filbert variety found to be greatly superior to leading variety - Corvallis, Oregon. The new filbert variety Ennis produced 40 percent greater nut yield than the standard Barcelona variety during the first 5 producing years of the trees. In one sample, Ennis had 90 percent of its nuts in the two largest grades whereas Barcelona had only 15 percent in those grades. Ennis nut samples had 1 to 4 percent blank nuts and 45 percent kernel, and Barcelona had 10 to 25 percent blank nuts and 38 percent kernel. In addition, Ennis nuts and kernels were superior to those of Barcelona in quality and appearance.

New improved hop selection widely tested - Corvallis, Oregon. The experimental hop cultivar USDA 21193 was harvested in both Oregon and Washington. Oregon yields ranged from 1572 to 1797 kg/ha at the 2 locations and had an alpha acid content (dry weight basis) of 13.4 percent and 11.2 percent, respectively. In Washington, cone yield averaged 1348 kg/ha and had an alpha acid content of 12.3 percent. An 8.1 ha experimental planting of USDA 21193 in Oregon and in four 2-ha plots in Washington were established in 1981 to provide additional hops for large-scale testing. Planting stock of USDA 21192 was increased from virus-free plants to provide additional material for off-station testing of hops free of all known hop viruses.

Hop pollen stored at -196°C. found to be viable after 2 years - Corvallis, Oregon. Two-year-old hop pollen that had been stored at refrigerator temperatures (+3°D) at -18°C. in a freezer, and in liquid nitrogen (-196°C.) was used to pollinate a receptive female in the summer of 1981. Pollen from the 2-year -196°C. storage was nearly comparable in fertility to fresh pollen while pollen at -18°C. had only small residual fertility. Pollen stored at refrigerator temperatures was non-functional.

Research initiated to study effect of pollen on size of pecan kernels - Brownwood, Texas. An experiment has been established to evaluate xenia and metaxenia effects of pecan pollen. Five staminate parents were used on each of 5 pistillate parents. A total of 1603 bagged clusters produced 832 nuts which will be evaluated individually for size and quality. Isolated trees at 2 locations were pollinated with 5 pollen sources and nuts were collected for quality analysis. This data should establish the presence or absence of xenia or metaxenia on pecans. If present, selection of pollinizers might be an added consideration for the commercial grower.

Limited inbreeding in pears found to be a possible aid in breeding for improved quality - Kearneysville, West Virginia. A trend toward small but significant improvements in flavor, flesh texture, and grit of pear fruit was found to be associated with increases in the level in inbreeding of pear progenies while a consistent but small reduction in seedling vigor was observed. If limited, intermating of related pear germplasm does not adversely affect seedling vigor and appears to be of benefit in selecting favorable genes for improved fruit quality. This finding will influence selection of parents in the USDA pear breeding program.

Addition of thiamine to medium found to increase growth and spore production of Fabraea leaf-spot fungus - Kearneysville, West Virginia. In basic studies with Fabraea maculata in the laboratory, the addition of thiamine to a basal glucose-casein hydrolysate medium considerably increased the growth rate and conidial production of the fungus. This finding enhances the possibility for development of an inoculation method whereby pear seedlings can be screened in the greenhouse for leaf-spot resistance. Fabraea resistance is a major objective in the USDA pear-breeding program.

New technique developed for screening peach seedlings for disease resistance - Kearneysville, West Virginia. A new technique was developed that shows promise as a rapid, reliable method for determining the resistance of young peach plants to the cytospora disease. Techniques currently used are generally cumbersome or unreliable. This new system will enable breeders and pathologists to study the genetic and physiological bases of resistance and susceptibility.

Two additional Phytophthora species found to be involved in apple crown rot disease complex - Kearneysville, West Virginia. In addition to the involvement of Phytophthora cactorum, studies confirmed that P. cambivora and P. megasperma are also involved in the crown-rot-disease complex that affects apple rootstocks. The addition of these species to the inoculum used in the apple rootstock breeding program will allow selection of potential rootstocks with broader resistance to this disease. This research was done under a cooperative project with the New York Agricultural Experiment Station, Geneva, New York.

Technological Objective 2: Develop new and improved cultural and management practices for fruits, nuts, and specialty crops that will increase yield, minimize production losses, improve quality, and conserve use of natural resources.

Research Locations:

Booneville, Arkansas
Davis, California
Indio, California
Orlando, Florida
Byron, Georgia
Beltsville, Maryland
Poplarville, Mississippi
Stoneville, Mississippi
Chatsworth, New Jersey
Corvallis, Oregon
Brownwood, Texas
Weslaco, Texas
Prosser, Washington
Wenatchee, Washington
Kearneysville, West Virginia

Research on small fruit culture initiated at new South Central Family Farms Research Center - Booneville, Arkansas. Experiments were established to test the performance of blueberry varieties and selections, the effect of water management on performance of blueberries, and the effect of cultural modification on the performance of raspberries at Booneville. Small fruit research conducted at this new South Central Family Farms Research Center will serve the entire South Central section of the country where there are small land holdings and opportunities for increased production of small fruits.

Serological tests developed for measuring grape losses caused by grape fanleaf virus - Davis, California. We have known that infectious degeneration caused by grape fanleaf virus is the cause of losses to grape producers but we have not previously had a technique for measuring this loss. Sensitive serological tests were developed with which scientists can now establish quickly that vines are either healthy or infected with grape fanleaf virus. We are thus able to locate healthy and diseased vines in close proximity in the same test vineyard and obtain a valid statistical estimate of their production. Using this test method and measuring the vine yields, we found that healthy vines in a Napa Valley vineyard produced at the rate of 9000 kg/ha whereas adjacent infected vines produced only 1780 kg/ha.

Tolerance to nematode-transmitted fanleaf virus in grapes apparently found - Davis, California. ARS scientists have selected a *Vitis rufotomentosa* x *V. vinifera* hybrid that did not become infected after 5 years when it was planted in soil infested with viruliferous nematodes. They also could not establish infections into cuttings of it by grafting with buds infected by the fanleaf virus. Preliminary study indicates that fanleaf-virus tolerance might come about with two very different mechanisms. One is tolerance in certain *Vitis* species

to feeding by the vector, the other is tolerance to movement of virus into tissues of certain selections of V. vinifera. We have made or planned several controlled crosses to further evaluate the mechanisms of grape-fanleaf-virus tolerance. We are increasing stocks of selections that exhibit the best fanleaf-virus tolerance to plant in infected sites for further evaluation.

New indexing procedures developed that help keep grapes free of known viruses - Davis, California. A total of 354 selections of heat-treated explant lines from 177 varieties or Vitis species were established for index testing and observation. Fifty-nine clean selections were released at the end of the 1981 indexing season. All registered mother vines that were entered into the grape clean-stock program before 1976 were reindexed for stem pitting. A new sensitive indicator for mild strains of grape leafroll was used to reindex 125 selections from the 20 most important scion varieties and the 11 most important rootstocks that are used in California.

Research suggests quick method for testing sensitivity of grape varieties to Pierce's disease virus - Davis, California. By vacuum infiltration with standard doses of Pierce's disease bacteria, we inoculated cuttings of 44 grape varieties with Pierce's disease. All developed symptoms. From intensity of the symptoms and from survival data, it appears that Semillon is the most tolerant of the varieties tested, and table grapes, as a group, the least tolerant. Detached grape leaves developed marginal burning when their petioles were immersed in a solution of crude cultural filtrate from cultures of Pierce's disease bacteria. Differences in the time needed for different varieties to develop burning may be an indicator of variety sensitivity.

Desert insects found to carry bacteria that cause Pierce's disease in grapes - Davis, California. ARS scientists discovered that Pierce's disease bacteria are present in the insects that feed on Joshua trees in the Mohave Desert, far removed from cultivation. That finding is strong circumstantial evidence that Pierce's disease is endemic over much of the Pacific Southwest, as it must also be in the Southeastern States. Pierce's disease became a problem only when grapes were planted in "hot spot" areas where the disease agent and its insect vectors were already present.

Pollen now found to transmit blackline disease in walnuts - Davis, California. Research indicated that pollen effectively spread blackline disease from infected to healthy walnut trees in commercial orchards. In the past, pollen has been collected indiscriminately, often from blackline-affected trees and used for pollenization of approximately 20,000 acres by aircraft. The role of pollen in transmission of blackline was not known previously. This discovery concerning its role is very important for preventing further rapid and uncontrolled spread of the disease for preventing its introduction into healthy commercial orchards and walnut-producing areas. Blackline is one of the most serious diseases of walnuts and causes a loss of approximately $7 million annually to the walnut industry in California

New procedure developed for rapidly detecting blackline virus in walnuts - Davis, California. An enzyme-linked immunosorbent assay procedure was developed for rapid and reliable detection of blackline virus in walnut trees in commercial orchards. With this technique, detection of early infection is now possible. Two hundred trees can be reliably indexed by one person within 2 days at a cost of approximately $300, whereas the same task without the new procedure would require 1000 nursery trees at an approximate cost of $10,000. The infection in walnut trees cannot be visually recognized for several years after initial infection and, during that time, infected trees shed pollen that infects healthy orchard trees.

Relative susceptibility of almond varieties to leaf scorch disease determined - Davis, California. The relative susceptibility of 16 important almond varieties to almond leaf scorch disease was determined by artificial inoculation in field experiments. Nonpariel, Long IXL, Milo Peerless, and Davey, which account for about 65 percent of almonds in California, are highly susceptible, whereas Thompson, Price, Mission, Merced, Carmel, Carrion, Drake, Harvey, Fritz, and Ruby varieties are tolerant to the disease. These findings will permit growers to use tolerant varieties in areas where almond leaf scorch disease is inflicting serious economic losses or in areas that are threatened by the disease.

Progress made in tissue culturing of walnuts - Davis, California. The *in vitro* propagation of Paradox walnut rootstock was accomplished on an analytical level through organogenesis. The process from explant to established plantlet was completed in 18 weeks. During that time, five shoots per axillary bud were induced. Those shoots can be maintained as a source for further shoot multiplication for at least four subcultures. The maximum degree of shoot multiplication has not yet been determined and the ability of the shoots to respond uniformly to the rooting stimulus needs to be explored. Preliminary results indicate that natural dormancy can be broken by either cold or ascorbic acid treatment. These treatments allow the application of these established procedures throughout the year. Scaling this process to an efficient commercial application is currently being studied.

Biochemical changes associated with cold hardening of citrus - Orlando, Florida. Results of citrus studies indicated that winter cold hardening increased unsaturated fatty acids and polyunsaturated fatty acids (triglycerides) in citrus leaves and increased carbohydrates and the amino acid proline in fruit rinds. The biochemical changes in the leaves may be involved in the development of tree cold hardiness, and those in the fruit rinds may be involved in the resistance of fruit and fruit resistance to chilling injury.

Zinc accumulation in citrus tissues associated with blight disorder - Orlando, Florida. At spring flush, citrus trees with blight had fewer and shorter twigs with fewer and smaller leaves and fruit than did healthy trees. Trunk growth was slower on blighted trees. Rickettsialike bacteria injected into healthy trees has not induced blight symptoms. Lower sulfate and chloride levels were found in soils under blighted trees than in those under healthy trees. Grapefruit air layers from blighted and healthy trees had few differences in 14 elements in leaves, wood, bark, and roots. Zinc accumulation may occur up to 36

months before visual blight symptoms but often during the same 12-month period. Ammonium hydroxide induced wilt, xylem plugging, and reduced water uptake but no zinc accumulation. Leaf mold and bentonite clay added to soils under blight trees did not improve tree health.

Disease resistance found in citrus hybrid clones - Orlando, Florida. Of 220 hybrid citrus clones evaluated, 9 were found to be resistant to stem inoculation of Phytophthora and 92 were resistant to root inoculation of Phytophthora of a total of 220 evaluated. Clones normally resistant to Phytophthora stem infection are susceptible if the suberized bark cells on the trunk are removed. Citrus seedling lines inoculated with Glomus etunicatus and G. mosseae grew better than uninoculated plants. Seedling growth was reduced and root rot increased in situ by anaerobic conditions and high water tables. Ridomil, when applied to mature grapefruit trees with P. parasitica feeder root rot, reduced P. parasitica in the soil and increased feeder-root weight per tree. Ridomil at 150 ppm reduced soil P. parasitica but did not eliminate it.

Damage from citrus canker reduced with chemical sprays - Orlando, Florida. Early season applications of copper bactericides were highly effective in reducing damage in grapefruit from canker, Xanthomonas citri. This research is being conducted in Argentina. The disease is not found in the United States. An application at bloom and when fruit was 0.5 cm in diameter reduced infection to 15 percent of that in the control. An additional spray applied later in the season resulted in 84 percent marketable fruit. Canker infection was reduced by diquat defoliation but it may be difficult to eradicate X. citri without destroying infected trees. A medium containing purified agar has been developed for culturing the "B" pathotype of X. citri. Physiological and pathological distinctions can now be made between the severe "A" type and the less important "B" type.

Carbohydrate reserves implicated in irregular bearing problem in pecans - Byron, Georgia. Research on the irregular bearing of pecans resulted in the characterization of carbohydrates and fatty acid composition and their correlation with the dynamics of shoot and fruit developmental processes. This research provided information necessary for an understanding of the dynamics of energy stress which is associated with pistillate flowers and, consequently, with irregular bearing. Gibberellin-like substances were identified in the developing fruit and may be associated with flower primordia initiation and irregular bearing. Brief infestations by one of several pecan aphid species can greatly reduce carbohydrate reserves, growth, and kernel weight of pecan trees, and thus can contribute to irregularity of bearing.

Polyethylene glycol treatments found to cause stress in apple trees - Beltsville, Maryland. Research on the effect of water stress on apple tree-physiology and nutrition indicated that stress induced by polyethylene glycol decreased water consumption, stomatal conductance, and net photosynthesis rate. Potassium sulfate sprays applied to stressed trees further lowered water consumption, photosynthesis, and stomatal conductance. A potassium pretreatment did not alleviate the detrimental effects of polyethylene-glycol-induced water stress.

Progress made in tissue-culturing research with apples - Beltsville, Maryland. Research on the tissue culturing of fruit trees indicated that apple-shoot proliferation rates varied with cultivar, medium, agar, and medium on which the stock cultures had grown. Sustainable proliferation rates of 4:1 in 3 weeks were achieved with Redspur but cultures of Jonathan were less productive. Considerable difficulty with vitreous growth in shoot proliferation cultures may have been linked to change in cytokinin source and stock solution preparation. Growing the proliferating cultures in the dark for 4 weeks improved subsequent rooting of several varieties. When proliferating cultures were grown on medium containing phloroglucinol, subsequent rooting was sometimes improved but the effect was inconsistent. Use of naphthaleneacetic acid in the rooting medium showed no advantage over the use of indolebutyric acid. Some progress on direct rooting of tissue cultured shoots under high humidity was made with up to 80 percent rooting of Jonathan in some treatments.

Strawberry yields related to plant density - Beltsville, Maryland. The results from a five-factor culture and management experiment with strawberries indicated the beneficial effects of fumigation and narrow rows. Yield from two narrow matted rows was 65 percent higher than from a single wide-matted row. The analysis of yield components indicated that productivity per plant was highly sensitive to plant density. As plant densities increased in matted rows, the number of trusses per plant, the percentage of fruit set, and the weight of fruit decreased. In a 1981 study on loamy soil, peak yield was 43 plants/square meter.

Marketing studies initiated for small fruits in the Gulf Coast States - Poplarville, Mississippi. A 3-year extramural cooperative research program on the marketing of small fruit for the Gulf Coast States was established in FY 1979. A survey to determine present or planned acreage of blueberries grown in Mississippi and other Gulf Coast States showed increased planted and planned blueberry acreage with the majority of acreage in pick-your-own plantings. An analysis of the cost and returns for small-acreage rabbiteye blueberry production in the Gulf Coast States indicated that such production is economically feasible for small-acreage land owners. Studies will be conducted on the feasibility of marketing areas in the Gulf Coast States, other areas in the United States, and overseas for small fruit grown in the Gulf Coast States.

Rabbiteye blueberries compared - Poplarville, Mississippi. Fruit ripening periods and their duration were determined on six rabbiteye blueberry varieties. Flowering dates of those varieties overlap sufficiently to ensure the cross-pollination required for good fruit set. Yields and time of fruit ripening are such that they can be interplanted to meet the needs of individual growers. Cold hardiness studies indicated that the Delite and Woodard varieties are the most susceptible to freeze damage. On those varieties, floral buds with individual flowers were killed by 9°C temperatures. Fruit development of the six rabbiteye blueberry varieties was characterized by three divisions of growth. Fruit size in all varieties was largest at the first harvest and smallest at the last harvest.

Disease losses from cranberry harvesters compared - Chatsworth, New Jersey. The condition and diseases of Early Black variety of cranberries--after 6 weeks of storage--that had been harvested, on three harvest dates, with a Felton cranberry picker and with a water-reel harvester were compared. For the first harvest, the fruit had less fungal rot and physiological breakdown after 6 weeks of storage when they had been harvested with the Felton picker than when they had been harvested with the water reel harvester. For the third harvest, the water-reel harvester caused less breakdown of the fruit in storage than did the picker. These findings will help reduce storage losses now common in northeast production areas.

Red ringspot virus found to have different effects on yields of two commercial blueberry varieties. - Chatsworth, New Jersey. The effect of red ringspot virus (RRSV) on growth and yield of the blueberry varieties Blue Ray and Burlington was evaluated. The fresh weight of stems produced by Blue Ray infected with RRSV was less than that of stems produced by healthy plants, but fruit production was greater on the diseased plants. The fresh weight of stems produced by Burlington with RRSV was significantly less than that of stems produced by healthy plants, and the infected plants produced less fruit than did healthy plants.

New device developed for grafting fruit and nut trees - Corvallis, Oregon. A new device to aid the healing of graft unions of fruit and nut trees was developed. The device directs thermostatically controlled warm air exclusively to the graft union, leaving scion buds and root systems at ambient outdoor temperatures. Success in filbert tree grafting was improved from 7 to 100 percent by use of this device. Improved grafting of apple, pear, prune, peach, and Douglas fir was also obtained with the new device.

Fourteen-year study reveals significant information on filbert yields - Corvallis, Oregon. Filbert trees spaced 1.8, 2.4, 3.0, and 3.7 meters apart in rows 5.5 meters apart all produced their highest yields at 14 years of age. Per hectare yields of 5014, 4738, 4840, and 4360 kilograms, respectively, were averaged for each of the 4 spacings. While close-spaced trees continue to yield the most nuts at this age and density, yields are no longer statistically different. This 14-year research data will be used by growers as the filbert industry continues to expand.

Indexing method devised to identify sterile blackberry plants - Corvallis, Oregon. Graft-transmissible sterility disease in certain blackberry cultivars in the Eastern United States caused distinctive leaf symptoms on Alpine strawberry leaves within 6 weeks of grafting. Commercial interest has been expressed in this Alpine indicator procedure for detecting blackberry sterility disease.

Infection of pecans with scab disease directly related to nut drop Brownwood, Texas. The fate of scab-infected pecan nuts has been poorly defined in the past--presumably severely infected nuts either did not mature or remained on the tree. In a study during the 1981 season, pecans of the Western variety infected with scab dropped prematurely in late summer and the number of nuts that dropped was directly related to the severity of infection. Data from the 1981 season were used to successfully predict the percentages of nut drop in sprayed and unsprayed trees in a spray test conducted in 1979. Thus, the data from 1981 appear to reflect a general relationship that would be valid in any year. This relationship between severity of infection and nut drop will enable more accurate assessment of the efficacy of fungicide treatments and of losses caused by the scab disease.

Cold tolerance of citrus seedlings increased by use of ionic compounds - Weslaco, Texas.The cold tolerance of citrus seedlings was increased with sprays of 3 ionic compounds of 1,1-dimethylpiperidinium without a surfactant. Seedlings treated with one of the compounds and cold hardened 45 days later for 2 weeks tolerated 20°F for 4 hours with only slight twig injury.

Hop trials established in the Pacific Northwest - Prosser, Washington. Agronomic data, small plot yield estimates, and brewing values were obtained from 235 experimental hop lines and 25 U.S. and foreign hop varieties. Several hop lines grown in four small-plot trials under commercial conditions in the Yakima Valley were evaluated to examine their responses to various environmental conditions. Three hop lines, W412-018, W416-002, and W421-038, were grown in commercial plots to provide hops for full-scale, pilot brewing trials, as well as for evaluation of their agronomic qualities. The cultivar USDA 21193 grown in four 5-acre commercial trials and in one 18-acre commercial trial was evaluated on first-year growth characteristics. A new U.S. hop selection, BOR704, was established on a 2-acre commercial plot to provide hops for full-scale brewing trials by interested breweries. This hop has chemical characteristics that are similar to European aroma hops.

Additional evidence gathered on causes of alfalfa greening in pears - Wenatchee, Washington. Additional evidence was gathered during 1981 on some of the causes of alfalfa greening in pears. The evidence indicates that the alfalfa greening and related disorders are caused by a deficiency in levels of calcium, especially in the peel of the affected fruit and by excessive irrigation, high rates of nitrogen fertilizer, and severe pruning. Study results also suggested that a virus might be implicated.

Alfalfa greening disorder of d'Anjou pears conrolled by calcium chloride sprays - Wenatchee, Washington. Foliar sprays of calcium chloride consistently reduced the incidence and severity of alfalfa greening and cork spot of

d'Anjou pears during the past 3 years. Lowering the rate of calcium chloride from 1.4 kg/400 liters to .07 kg/400 liters controlled the disorders and reduced the number of spray marks on leaves and fruit Addition of a surfactant to the calcium chloride sprays further reduced the leaf and fruit marking. For control of cork spot and alfalfa greening, calcium chloride sprays must be applied throughout the growing season. Early application of the sprays in May and June is especially important.

Mode of action of chemical thinning sprays related to ethylene production in fruiting spurs - Wenatchee, Washington. Aminoethoxyvinylglycine (AVD) was used to study the mode of action of NAA, Sevin, and Ethrel. The AVG sprays applied after the thinning sprays completely counteracted the effect of NAA and Sevin but had no affect on Ethrel. The conclusions from these trials were that AVG counteracts the endogenous production of ethylene which is normally increased when NAA or Sevin is applied to apple trees, AVG has no control over fruit abscission when exogenous ethylene in the form of Ethrel is applied to apple trees, AVG reduces seed abortion by reducing endogenous levels of ethylene, and excessive ethylene production in the spur and fruit triggers fruit abscission which is the ultimate result of physiological stress in the tissues.

Timing of fertilizer application and tree misting found to influence cold hardiness of apple trees - Wenatchee, Washington. Cold-hardiness tests in mid-January 1981 on 20-year-old d'Anjou pear trees indicated that summer sprays of calcium chloride slightly increased cold hardiness. Applications of ammonium nitrate in March or in September at two rates were tested for possible effects on cold hardiness of Anjou pear trees. Freeze tests in late October and early December 1980 indicated that trees with the high rate of nitrogen applied in March were the least hardy, whereas trees with the low rate applied in September were slightly more hardy. Freeze tests in mid-January 1981 indicated that the latter treatment resulted in the least hardy trees. Cold hardiness and carbohydrates of Delicious and Golden Delicious were monitored at biweekly intervals from September 1980 to March 1981, and those tests indicated that hardiness increased as the temperature decreased. Over-tree misting of Delicious apple trees in mid-September to mid-October 1980 induced cold hardiness in the fall and affected tree growth, fruit quality, and mineral content of fruit and leaves.

New diagnostic test developed for stone fruit viruses - Wenatchee, Washington. The ELISA technique detected prunus necrotic ringspot virus of stone fruits earlier than the method currently used. Two infected trees were detectd that were not found using the standard indexing method. With ELISA, one infected tree can be readily detected in a 100-tree sample. In tests to study the relationship of almond calico virus to the severe rugose, cherry trees were inoculated with both viruses. Four of five strains of rugose and all four almond calico isolates exhibited symptoms of varying intensity on the foliage. Tests were conducted on normal and infected trees in peach short life orchards in Georgia and on normal trees from unaffected orchards to determine whether a relationship existed with prunus necrotic ringspot or sour cherry yellows viruses.

Computer system developed for study of freezing in tissues of fruit tree - Kearneysville, West Virginia. A computer-interfaced method of thermal analysis was developed to evaluate the cold hardiness of apricot and peach buds. Bud temperature was monitored and the data sent directly to a computer. The computer analyzed the data and determined the temperature at which freezing was initiated. Through the use of differential thermal analysis (DTA), water in dormant peach and apricot buds was observed to freeze as two separate components. Water in the bud axis and scales froze at a temperature between -5° and -7°C. The freezing of supercooled water within the bud primordia became lethal at a temperature between -15° and -25°C.

Summer pruning studied in fruit trees - Kearneysville, West Virginia. Studies to develop tree training systems adaptable to mechanical harvesting were initiated. Pruning method had little or no effect on canopy size after one season. After two consective seasons, summer pruning has reduced average canopy size by 13 percent. Fruit size was significantly reduced by summer pruning in either June or August. Summer pruning in 1980 had no effect on blossom density or fruit set in 1981.

Disease and insect resistance observed in pears collected in Yugoslavia - Kearneysville, West Virginia. In 1981, 30 percent of the trees in the Pyrus species collection at Beltsville, Maryland, were found to be seriously infected with fire blight. At the Plant Introduction Station, Glenn Dale, Maryland, 22 accessions collected in Yugoslavia in 1978 were found to be severely blighted in 1981. However, 17 accessions from that country were found to have a high degree of resistance to leaf spot and pear psylla. Cultural and morphological studies of Fabraea maculata in vitro have revealed that thiamine is a requirement in a basal glucose-casein hydrolysate medium; its inclusion increased cultural growth rate and sporulation. Initial attempts to infect young seedlings in a greenhouse moist chamber with conidia from defoliated leaves were successful.

Screening procedures improved for disease and insect resistance in apples - Kearnsyville, West Virginia. Under a cooperative agreement with the New York State Agricultural Experiment Station, apple seedlings were tested in the greenhouse for response to inoculations with the incitants of crown rot (Phytophthora cactorum), fire blight (Erwinia amylovora), and for response to the wooly apple aphid (Eriosoma lanigerum). It was determined from field studies that Phytophthora cambivora and P. megasperma are also involved in the crown rot complex in New York, and those species were added to the inoculum used in the first-stage screening. Resistance to wooly apple aphid was confirmed in Malus flexilis and M. micromalus. A new highly virulent biotype of Erwinia amylovora, inoculated into advanced rootstock selections resistant to previously used biotypes, produced a susceptible reaction in 75 percent of the clones.

P U B L I C A T I O N S

Davis, California

Goheen, A. C. 1981. Grape virus diseases. In D. L. Flaherty, F. L. Jensen, A. N. Kasimatis, H. Kido, and W. J. Moller, (eds.), Grape Pest Management. pp. 84-92 Division of Agricultural Sciences, University of California, Berkeley, CA.

Lear, Bert, A. C. Goheen, and D. J. Raski. 1981. Effectiveness of soil fumigation for control of fanleaf-nematode complex in grapevines. Am. Jour. Enol. Vitic. 32:208-211.

Mircetich, S. M., G. A. deZoeten, and J. A. Lauritis. 1980. Etiology and natural spread of blackline disease of English walnuts. Acta Phytopathologica Academiae Scientarum Hungarica 15:147-151.

Mircetich, S. M., and J. W. Hoy. 1981. Brownline of prune trees, a disease associated with tomato ringspot virus infection of myrobalan and peach rootstock. Phytopathology 71:30-35.

Mircetich, S. M. John, and A. Rowhani. 1981. Blackline: research advances on etiology, epidemiology, and control. pp. 22-23 In Proc. of the XIII Ann. Walnut Res. Conference, Univ. of Calif., Davis, CA, Jan. 29-30, 1981.

Fresno, California

Ramming, D. W. 1981. Plum and prune cultivar situation in the West Coast of North America. Fruit Var. J. 35:48-52.

Ramming, D. W., and O. Tanner. 1981. Blackamber plum. HortSci. 16:232.

Indio, California

Carpenter, J. B., R. M. Burns, and R. F. Sedlacek. 1981. Phytophthora resistant rootstocks for Lisbon lemons in California. 1981. Citrograph 66:287-288, 291-292.

Carpenter, J. B. 1981. Improvement of traditional date culture. Date Palm J. (Baghdad) 1:1-16.

Orlando, Florida

Baker, R. A., J. H. Tatum, and S. Nemec. 1981. Toxin production by Fusarium solani from fibrous roots of blight-diseased citrus. Phytopathology 71:951-954.

Bar-Joseph, M., and S. M. Garnsey. 1981. Enzyme-linked immunosorbent assay (ELISA): Principles and applications for diagnosis of plant viruses. pp. 35-59. In K. Maramorosch and K. F. Harris, (eds.), Plant Diseases and Vectors: Ecology and Epidemiology. Academic Press, New York.

Evensen, K. B., M. G. Bausher, and R. H. Biggs. 1981. Ethylene production by Valencia peel explants treated with abscission-accelerating compounds. J. Amer. Soc. Hort. Sci. 106:57-60.

Evensen, K. B., M. G. Bausher, and R. H. Biggs. 1981. Wound-induced ethylene production in peel explants of Valencia orange fruit. HortSci. 16:43-44.

Garnsey, S. M., R. F. Lee, C. O. Youtsey, R. H. Brlansky, and H. C. Burnett. 1980. A survey for citrus tristeza virus in registered budwood sources commercially propagated on sour orange rootstocks in Florida. Proc. Fla. State Hort. Soc. 93:7-9.

Grimm, G. R., and L. W. Timmer. 1981. Control of phytophthora foot rot and root rot. Citrus Ind. 62(10):34-39.

Guy, C. L., G. Yelenosky, and H. C. Sweet. 1981. Distribution of ^{14}C photosynthetic assimilates in Valencia orange seedlings at 10°C. and 25°C. J. Amer. Soc. Hort. Sci. 106:433-437.

Levy, Y., J. P. Syvertsen, and S. Nemec. 1981. Effect of VA mycorrhiza on citrus leaf water relations and root conductivity. Plant Physiol. 67(4)121.

Nemec, S. 1981. Histochemical characteristics of Glomus etunicatus infection of Citrus limon fibrous roots. Can. J. Bot 59:609-717.

Nemec, S., J. A. Menge, R. G. Platt, and E. L. V. Johnson. 1981. Vesicular-arbuscular mycorrhizal fungi associated with citrus in Florida and California and notes on their distribution and ecology. Mycologia 73:112-127.

Nemec, S., and F. I. Meredith. 1981. Amino acid content of leaves in mycorrhizal and nonmycorrhizal citrus rootstocks. Ann. Bot. 47:351-358.

Rasmussen, G. K. 1981. Gibberellin and cell-wall hydrolases as related to the low response of Valencia oranges to abscission chemicals. HortSci. 16:497-498.

Wheaton, T. Adair and R. Young. 1981. Cytex not effective in research trials. Citrus Ind. 62(8)31-34.

Wutscher, H. K. 1981. Seasonal changes in zinc and water-soluble phenolics in the outer trunk wood of healthy and blight-affected sweet orange trees. HortSci. 16(2):157-158.

Wutscher, H. K. 1981. Swingle in Texas and Florida. Citrograph 66(8):197.

Wutscher, H. K. 1981. Seasonal levels of water-extractable cations and anions in soil under blight-affected and healthy citrus trees. Comm. in Soil Sci. and Plant Analysis 12(7):719-731.

Wutscher, H. K. 1981. Declinamiento de citrus por causas desconocidas. Proc. 11. National Citrus Congr., Concordia, Argentina 2:249-263.

Yelenosky, G. 1981. A new insulator wrap to protect young citrus trees during freezes. HortSci. 16:44-45.

Yelenosky, G., and R. Young. 1981. Freezing temperatures and injury to citrus during the 1981 freeze in Florida. HortSci. 15:420.

Yelenosky, G., and R. Young. 1981. The freeze problem in Florida. Citrus Ind. 62:7-11.

Young, R. 1981. Effects of subfreezing temperatures. Citrus Ind. 62:(7):7-9.

Byron, Georgia

Bertrand, P. F., R. H. Littrell, and T. R. Gottwald. 1981. The effect of foliar applied sulphur on pecan production. Proc. SE Pecan Growers Assoc. 74:187-191.

Edwards, J. H., and B. D. Horton. 1981. Influence of magnesium concentration in nutrient solution on growth tissue concentration and nutrient uptake of peach seedlings. J. Amer. Soc. Hort. Sci. 106:401-405.

Gottwald, T. R., and P. F. Bertrand. 1981. Diurnal and seasonal discharge patterns of Fusicladium effusum and its impact on an epidemic. Proc. SE Pecan Growers Assoc. 74:137-142.

Norton, B. D., E. J. Wehunt, J. H. Edwards, R. R. Bruce, and J. L. Chesness. 1981. The interaction of drip irrigation and soil fumigation during moisture stress increases Redglobe peach yields. J. Amer. Soc. Hort. Sci. 106:438-443.

Prince, V. E., and W. R. Okie. 1981. Sunland Peach. HortSci. 16:(4)570.

Prince, V. E., and W. R. Okie. 1981. Durbin Nectarine. HortSci. 16(3)348.

Prince, V. E., and W. R. Okie. 1981. Starlite Peach. HortSci. 16(5)684.

Tedders, W. L., and J. M. Thompson. 1981. Histological investigation of stylet penetration and feeding damage to pecan foliage by three aphids [Hemiptera (Homoptera): Aphididae]. ESA Misc. Pub. Vol. 12(2):69-83.

Thompson, J. M. 1981. The plum industry in the Southeastern United States. Fruit Var. 35(2):53-54.

Thompson, J. M., and V. E. Prince. 1981. Explorer - a new full-season Japanese-type plum for the Southeastern United States. Fruit Var. Jour. 35(3):104-106.

Wells, J. M., B. C. Raju, and G. Nyland. 1981. A medium for isolation and growth of the bacteria associated with plum leaf scald and phony peach diseases. Appl. Environ. Microbiol. 42:357-363.

Wells, J. M., B. C. Raju, J. M. Thompson, and J. K. Lowe. 1981. Etiology of phony peach and plum leaf scald diseases. Phytopathology 71(11):1156-1161.

Wood, B. W. 1981. Effect of ethrel and CGA 15281 on nut thinning and ethrel, CGA 15281, and ethrel plus calcium on shuck split of peach. HortSci. 16:283.

Wood, B. W., and J. L. McMeans. 1981. Carbohydrate changes in various organs of bearing and nonbearing pecan trees. J. Amer. Soc. Hort. Sci. 106(9):798-760.

Wood, B. W., and J. L. McMeans. 1981. Carbohydrates and fatty acids in developing pecan fruit. J. Amer. Soc. Hort. Sci. 107-47-50.

Beltsville, Maryland

Barrat, R. E., J. L. Maas, H. J. Retzer, and R. E. Adams. 1981. Comparison of spray droplet size, pesticide deposition, and drift with ultralow-volume, low-volume, and dilute pesticide application on apple. Plant Dis. 65:872-875.

Bell, R. L., J. Janick, R. H. Zimmerman, T. van der Zwet, and R. C. Blake. 1981. Response of pear to inbreeding. J. Amer. Soc. Hort. Sci. 106:584-589.

Faust, Miklos. 1981. Multiplying fruits and berries. Yearbook of Agriculture 1981:90-91.

Galletta, G. J., A. Draper, and R. J. Hill, Jr. 1980. Recent progress in bramble breeding at Beltsville, Maryland. Acta Hort. 112:95-102.

Galletta, G. J., A. D. Draper, H. D. Stiles, and H. J. Swartz. 1980. Scott strawberry. HortSci. 15:541-542.

Melville, A. H., G. J. Galletta, A. D. Draper, and T. J. Ng. 1980. Seed germination and early seedling vigor in progenies of inbred strawberry selections. HortSci. 15:749-750.

Swartz, H. J., G. J. Galletta, and R. H. Zimmerman. 1981. Field performance and phenotypic stability of tissue culture-propagated strawberries. J. Amer. Soc. Hort. Sci. 106:667-673.

Swietlik, Dariusz, F. R. Korcak, and Miklos Faust. 1981. Effect of mineral nutrient sprays on photosynthesis and stomatal opening of water stressed and unstressed apple seedlings. 11. Potassium sulfate sprays. J. Amer. Soc. Hort. Sci. 107.

Swietlik, Dariusz, R. F. Korcak, and Miklos Faust. 1981. Physiological and nutritive effects of K-pretreatment and KCl sprays on water stressed and unstressed apple seedlings. J. Amer. Soc. Hort. Sci. 107.

Zimmerman, R. H. 1981. Micropropagation of fruit plants. Acta Hort. 120:217-222.

Zimmerman, R. H., and O. C. Broome. 1981. Phloroglucinol and in vitro rooting of apple cultivar cuttings. J. Amer. Soc. Hort. Sci. 106:648-652.

Poplarville, Mississippi

Spiers, J. M. 1981. Freeze damage in six rabbiteye blueberry cultivars. Fruit Var. 35(2):68-70.

Spiers, J. M. 1981. Fruit development in rabbiteye blueberry cultivars. HortSci. 16(2)175-176.

Spiers, J. M. 1981. Freeze damage in six rabbiteye blueberry cultivars. HortSci. 16(3)280.

Spiers, J. M., and Creighton L. Gupton. 1981. Harvest intervals of six rabbiteye blueberry varieties. HortSci. 16(3)280.

Spiers, J. M., and Creighton L. Gupton. 1981. Seasonal trends in nutrient composition of Tifblue rabbiteye blueberry leaves. HortScience 16(3)51.

Chatsworth, New Jersey

Ceponis, M. J., and A. W. Stretch. 1981. The influence of water immersion times at harvest on physiological breakdown of Early Black cranberries in storage. HortScience 16(1):60-61.

Stretch, A. W. 1981. Incidence of stem canker on blueberry in New Jersey. Phytopathology 71:564.

Wooster, Ohio

Bell, R. L., J. Janick, R. H. Zimmerman, T. van der Zwet, and R. C. Blake 1981. Response of pear to inbreeding. J. Amer. Soc. Hort. Sci. 106(5):584-599.

van der Zwet, T., R. L. Bell, and R. C. Blake. 1981. Some factors affecting selection for fire blight resistance in pear. Acta Hort. 117:55-61.

Corvallis, Oregon

Converse, R. H. 1981. A proposed list of common names for diseases of caneberry. Plant Dis. 65:284-285.

Converse, R. H. 1981. An overview of the 1980 International Rubus Symposium. Proc. Oregon Hort. Soc. 94:100-102.

Converse, R. H. 1981. Infection of cultivated strawberries by tomato ringspot virus. Phytopathology 71:1149-1152.

Converse, R. H. 1981. Relationship of prior heat treatment to growth and fruiting of Thornless Oregon Evergreen blackberry. HortSci. 16:312-313.

Converse, R. H. 1981. The Israeli strawberry industry. HortSci. 16:19-22.

Converse, R. H. 1981. Virus-tested Rubus cultivars in the USDA collection. Fruit Var. Jour. 35:141-145.

Converse, R. H., W. C. Denison, and F. J. Lawrence. 1981. Reaction of some Pacific Coast strawberry cultivars to leaf scorch disease. Plant Dis. 65:254-255.

Converse, R. H., and K. L. Kowalczyk. 1980. Graft transmission of calico from three blackberry cultivars. Acta Hort. 112:47-52.

Haunold, Alfred. 1981. Hop production, breeding, and variety development in various countries. J. Am. Soc. Brew. Chemists 39:27-34.

Lagerstedt, H. B. 1980. Ennis and Butler filberts. HortSci. 15:833-835.

Lagerstedt, H. B. 1981. Ennis - a large filbert. Fruit Var. 35:107-109.

Lagerstedt, H. B. 1981. Butler - a filbert pollinizer. Fruit. Var. 35:109-111.

Lagerstedt, H. B. 1981. A new device for hot-callusing graft unions. Hort Sci. 16:529-530.

Lawrence, F. J. 1980. Breeding primocane fruiting red raspberries at Oregon State University. Acta. Hort. 112:145-149.

Lawrence, F. J. 1980. Characteristics and performance of the Linn strawberry in 1979, pp. 38-39. In L. W. Martin and J. R. Morris (eds.), Strawberry Mechanization, Ore. State Agric. Expt. Sta. Bul 645.

Parish, C. L., and R. H. Converse. 1980. Tomato ringspot virus associated with apple union necrosis and decline in Western United States. Plant Dis. 65:261-263.

Peacock, V. E., Max L. Deinzer, S. T. Likens, G. B. Nickerson, and L. A. McGill. 1981. Floral hop aroma in beer. J. Agric. Food Chem. 29:1265-1269.

Pyott, J. L., and R. H. Converse. 1981. In vitro propagation of heat treated red raspberry clones. HortSci. 16:308-309.

Brownwood, Texas

Brown, E. J., T. E. Thompson, and R. E. Hunter. 1981. Characteristics of pecan cultivars and USDA advanced selections. Texas Pecan Orchard Management Handbook: 28-30.

Hunter, R. E. 1981. USDA pecan research. Texas Pecan Orchard Management Handbook. 1981:250-253.

Thompson, T. E. 1981. Pecan breeding prospects. Pecan Quarterly 15:(1)4-11.

Thompson, T. E., and E. J. Brown. 1981. Increased production and nut quality due to the xenia effect in pecan. Pecan South 8(3)23-25.

Thompson, T. E., R. E. Hunter, G. D. Madden, and E. J. Brown. 1981. Performance of varieties and selections in a high-density orchard establishment test. Pecan Quarterly 15(2):14-19.

White, A. W., Jr., and R. E. Hunter. 1981. Differences in leaf nutrient concentration from mature Stuart and Schley trees. Pecan South 8(2):22-23.

Weslaco, Texas

Peynado, A., H. W. Gausman, and F. R. Rittig. 1981. Effect of mepiquat chloride on citrus freezing resistance. Proc. 8th Plant Growth Regulator Working Group, St. Petersburg Beach, Florida. pp. 240-246.

Wenatchee, Washington

Chen, P. M., R. A. Spotts, and W. M. Mellenthin. 1981. Stem-end decay and quality of low oxygen stored d'Anjou pears. J. Amer. Soc. Hort. Sci. 106:695-698.

Parish, C. L. 1981. Graft-transmission of blister bark and internal bark necrosis in Delicious apples. HortSci. 16:52-54.

Parish, C. L., and R. H. Converse. 1981. Tomato ringspot virus associated with apple union necrosis and decline in Western United States. Plant Dis. 65:261-263.

Parish, C. L., M. W. Williams, and J. C. Misley. 1981. A survey of dead spur of Delicious apple and evidence of possible transmission. J. Amer. Soc. Hort. Sci. 106(5):622-624.

Raese, J. T., and E. A. Stahly. 1981. Calcium sprays to control physiological disorders of d'Anjou pears. Proc. of the Third International Symposium on Pear Growing. Acta Hort. Vol. 124.

Raese, J. T. 1981. Increasing cold hardiness of apple trees by over-tree misting in early autumn. HortSci. 16(5):649-650.

Spotts, R. A. 1981. Common names for diseases of pear - a proposed list. Plant Disease 65:166, 198.

Spotts, R. A. 1981. Powdery mildew - biology and control. Proc. Oreg. Hort. Soc. 72:10-12.

Stahly, E. A., and D. A. Buchanan. 1981. High pressure liquid chromatographic procedure for separation and quantification of zeatin and zeatin riboside from pears, peaches, and apples. J. Chromatogr. 235(2):453-459.

Kearneysville, West Virginia

Ashworth, E. N., M. N. Christiansen, J. B. St. John, and G. W. Patterson. 1981. Effect of temperature and BASF 12228 on the lipid composition and respiration of wheat roots. Plant Physiol. 67:711-715.

Ashworth, E. N., J. B. St. John, M. N. Christiansen, and G. W. Patterson. 1981. Characterization of the phospholipid composition of wheat roots using high performance liquid chromatography. J. Agric. Food Chem. 29:879-881.

Bell, R. L., Jules Janick. R. H. Zimmerman, T. van der Zwet, and R. C. Blake. 1981. Response of pear to inbreeding. J. Amer. Soc. Hort. Sci. 106:584-589

French, R. C., and C. L. Wilson. 1981. The effect of nicotine and related compounds on germination and vacuolation in several species of rust uredospores. Physiol. Plant Path. 19:201-207.

Scorza, Ralph, and H. Miramendy. 1981. Introduction and evaluation of low-chilling peach and nectarine cultivars in the Bolivian highlands. Fruit Var. J. 35:122-125.

Seliskar, C. E., and C. L. Wilson. 1981. Yellows diseases of trees. In Mycoplasma diseases of trees and shrubs. Maramorosch and Raychaudhuri (eds.), pp. 35-96. Academic Press, Inc.

Timmer, L. W., Ralph Scorza, and R. F. Lee. 1981. Incidence of tristeza and other citrus diseases in Bolivia. Plant Disease 65:515-517.

Wilson, C. L., P. L. Pusey, and B. E. Otto. 1981. Plant epidermal sections and imprints using cyanoacrylate adhesives. Can. J. Plant Sci. 61:781-782.

van der Zwet, T., R. L. Bell, and R. C. Blake. 1981. Some factors affecting selection for fire blight resistance in pear. Acta Hort. 117:55-61.

BOONEVILLE, AR 72927

Mr. James R. Gifford
Director, South Central Family Farms Research Center
Route 2, Box 144-A
(501) 675-3834

DAVIS, CA 9561

Dr. Austin C. Goheen
Department of Plant Pathology
University of California
FTS: 453-6896

FRESNO, CA 93747

Dr. David W. Ramming
2021 S. Peach Avenue
FTS: 467-5334

INDIO, CA 92201

Dr. J. B. Carpenter
U. S. Date & Citrus Station
44-455 Clinton Street
714) 347-3414

ORLANDO, FL 32803

Dr. Roger H. Young
Director, U. S. Horticultural Laboratory
2120 Camden Road
FTS: 820-6051

BYRON, GA 20705

Dr. J. Wendell Snow
Director, USDA Southeastern Fruit & Tree Nut Research Laboratory
FTS: 238-0421

BELTSVILLE, MD 20705

Dr. Miklos Faust
Chief, Fruit Laboraory
Bg-004 ARC-W
FTS: 344-3567

POPLARVILLE, MS 39470

Dr. James M. Spiers
USDA Agricultural Research Station
P. O. Box 287
(601) 795-8751

WOOSTER, OH 44691

Dr. Roland C. Blake
Ohio Agricultural Research and Development Center
(216) 264-1021

CORVALLIS, OR 97331

Dr. Richard H. Converse
Oregon State University
FTS: 420-4819

Dr. Harry B. Lagerstedt
Oregon State University
(503) 754-4583

Dr. Alfred Haunold
Oregon State University
(503) 754-2964

BROWNWOOD, TX 76801

Dr. Richard E. Hunter
W. R. Poage Pecan Field Station
(915) 646-0593

WENATCHEE, WA 98801

Dr. Max W. Williams
Fruit Research Laboratory
104 N. Western Avenue
FTS: 390-0317

KEARNEYSVILLE, WV 25430

Mr. Bill A. Butt
Director, Appalachian Fruit Research Station
Route 2, Box 45
(304) 725-3451

National Research Program 20020

BREEDING AND PRODUCTION - VEGETABLES

This National Research Program involves research in breeding and production of vegetables to develop new and improved genetic and cultural methods that will result in lowered costs of vegetables and potatoes to consumers and in increased efficiency of their production by growers, small acreage farmers, and homeowners. Geneticists, plant pathologists, entomologists, plant physiologists, and horticulturists (both Federal and State) work in a team approach to evaluate and improve vegetables and vegetable cultural methods.

The research is conducted at 15 locations in 12 States in both Federal and State stations, where USDA/ARS scientists usually work as a team with State scientists.

In 1981, over 39 million tons of 30 kinds of vegetables and potatoes (including dry beans and peas) were harvested from 6.7 M acres with an aggregate value of over $6.6 billion.

Technological Objective 1: Develop new and improved genetic populations, breeding lines, and cultivars of vegetables that combine improved yield potentials and favored quality characters, including reduced contents of undesirable constituents with better resistance to pests, tolerance to environmental stress, and adaptation for mechanized culture, harvesting, and handling.

NPS Contact: A. E. Thompson

Research Locations:

Brawley, California
Salinas, California
Tifton, Georgia
Aberdeen, Idaho
Orono, Maine
Presque Isle, Maine
Beltsville, Maryland
East Lansing, Michigan
Corvallis, Oregon
Mayaguez, Puerto Rico
Charleston, South Carolina
Weslaco, Texas
Prosser, Washington
Pullman, Washington
Madison, Wisconsin

Examples of Recent Progress:

Big vein-resistant lettuce cultivars and germplasm released - Salinas, California. 'Sea Green' and 'Thompson' are new lettuce cultivars resistant to big vein, a virus-like disorder that occurs under cool growing conditions. Earliness, yield, and appearance are all improved with the use of these cultivars as compared to susceptible standard cultivars. In addition, five big vein-resistant, advanced germplasm lines were released to lettuce breeders in State agricultural experiment stations and industry.

Weakness detected in method of testing potatoes for resistance to storage rot by use of only one causative agent - Aberdeen, Idaho. Storage rots caused by Fusarium spp. (tuber dry rot) and Erwinia carotovora var. atroseptica (bacterial soft rot of tubers) cause large economic loss in stored potatoes. Inoculation of potato clones showing differential levels of resistance to Fusarium spp. with combinations of Fusarium and Erwinia resulted in a much higher incidence of rot than that due to either pathogen alone. This demonstrates a serious weakness in the general approach of testing for resistance to storage rots by controlled inoculations with either Fusarium or Erwinia alone.

Downy mildew-resistant, green-seeded Fordhook-type lima bean germplasm developed and released to breeders - Beltsville, Maryland. The released breeding line (MRF 79) is resistant to races A, B, C, and D of downy mildew (Phytophthora phaseoli); has a green seed coat and green cotyledons, which enable it to maintain high quality for several days; and has shown little injury from air pollution.

Safe levels of natural toxicants found in insect-resistant wild potato species - Beltsville, Maryland. A wild potato species (Solanum berthaultii) resistant to leafhoppers, aphids, and flea beetles, was found to have safe levels of natural toxicants. Most previously identified resistant species have excessive levels of glycoalkaloids. Use of S. berthaultii as a resistant source-plant in breeding should greatly accelerate progress in developing safe and high-quality, insect-resistant potatoes.

Hybrids with potato leafhopper resistance developed and found to be promising - Beltsville, Maryland. Selections from F_1 and F_2 hybrids of Solanum tuberosum x S. berthaultii which were highly resistant to potato leafhopper produced moderate tuber yields. These hybrids are significant for two reasons: (1) resistance primarily results from glandular trichomes and should be stable; and (2) tuber yields are larger than usual when other wild species are hybridized with S. tuberosum.

Three new potato cultivars released - Beltsville, Maryland. The Eastern cooperative potato breeding research program recently released three new cultivars. 'Chipbelle' is widely adapted, with high quality and excellent chipping characteristics. It is resistant to the golden nematode and a wide array of diseases. 'Oceania' is an early, high-yielding, widely adapted, multipest-resistant, smooth, white type for the fresh market. 'Pennrose' is a medium maturing, high-yielding, red-skinned type for the fresh market.

New research on protoplast isolation and fusion initiated - Beltsville, Maryland. New research was initiated in the Vegetable Laboratory and involves protoplast isolation, fusion and regeneration, and other emerging genetic engineering technologies. An efficient procedure was developed for achieving high frequency fusion of potato protoplasts, and conditions for optimum fusion efficiency with minimum loss of protoplast viability were defined. These new techniques should significantly aid in the development of genetically diverse past- and stress-resistant germplasm of potatoes, tomatoes, asparagus, and other vegetables.

Evidence found that inheritance of tomato anthracose resistance is quantitative - Beltsville, Maryland. Quantitative inheritance of tomato anthracnose resistance is of significance to seed companies that want to produce F_1 hybrids. Both parental inbreds would need to carry genetic factors for resistance if the F_1 hybrid is to maintain a good level of resistance.

Asparagus germplasm enhancement - Beltsville, Maryland. Successful crosses were made between diploid and tetraploid garden asparagus, Asparagus officinalis, and a related wild tetraploid, A. officinalis subsp. prostratus, native to sandy beaches of England and France. The success represents one piece of information in the study of fertility relationships among asparagus species and the use of wild relatives in cultivar improvement.

New sources of cytoplasmic male sterility found in the cole crops - Beltsville, Maryland. Maintainer genotypes for radish-derived, cytoplasmic, male-sterile Brassica oleracea were found in cabbage, kale, and Chinese broccoli. Such genotypes are a prerequisite in the establishment of stable male-sterile breeding lines for efficiently producing seed of hybrid cultivars commercially.

Onion germplasm enhanced - Beltsville, Maryland. Tetraploid lines of the green onion cultivars 'Evergreen Bunching' and 'Tokyo Long White Bunching' of the Japanese bunching onion, Allium fistulosum, were established by colchicine treatment. These lines represent one step in the synthesis of new Beltsville Bunching type amphidiploid species hybrids between A. fistulosum and the bulb onion A. cepa, a combination known for its superior vigor and hardiness. Sterile hybrids between A. fistulosum and the wild Himalayan species A. roylei were converted to fertile amphidiploids by colchicine treatment. The performance of these hybrids expands our knowledge of the sterility relationships among onion species as well as the germplasm base available to onion breeders.

Four new dry bean cultivars developed - East Lansing, Michigan. The cultivars -- 'Swan Valley' and 'Neptune' (both navy types), and 'Domino' and 'Black Magic' (black types) -- were cooperatively developed with the Michigan Agricultural Experiment Station, and approved for release in 1982. The cultivars represent a unique concept in plant architecture: They are of narrow, erect, growth habit. All are resistant to several strains of anthracnose, prevalent strains of rust in Michigan, a type strain of bean common mosaic virus and its New York 15 variant, and oxidant air pollution injury.

Pea germplasm successfully reclaimed from virus infection - Corvallis, Oregon. Pea (Pisum) germplasm was successfully reclaimed from 100 Plant Inventory lines previously found to be infected with pea seedborne mosaic virus (PSbMV). This was accomplished by growing out plants in the greenhouse for two generations, eliminating plants with PSbMV symptoms, selecting potential seed-source mother plants, subjecting selected plants to assays for PSbMV by ELISA serology, and harvesting seeds from plants proven to be free of detectable virus. Proof of success consisted of a zero level of detectable virus in the second generation plants. This method has been made available for eliminating PSbMV from some 2,000 PI lines of Pisum.

Bean germplasm tested for seedborne cucumber mosaic virus - Corvallis, Oregon. Plants from principal bean breeding lines in Idaho, Washington, and Oregon were tested and found to be free of seedborne cucumber mosaic virus, as determined by enzyme-linked immunosorbent assay, bioassay, or serology. By the same methods, the virus was detected in one of 32 plant inventory bean accessions of international origin. Future monitoring for the virus may be desirable in view of current international exchanges of bean germplasm.

Novel relationships of a newly identified strain of pea seedborne mosaic virus (PSbMV) discovered - Corvallis, Oregon. A virus previously found to be seedborne in lentil (Lens culinaris) germplasm, but unable to infect pea (Pisum) cultivars tested, has been shown to be a strain of PSbMV. A PSbMV strain was found in New Zealand that was unable to attack pea cultivars with the genotype mo mo, which confers resistance to bean yellow mosaic virus. The pathogenicity of the lentil-infecting strain (PSbMV-L) was shown to be the same as that of the New Zealand strain. This demonstration brings to light the fact that the Pisum genotype mo mo protects against three distinct members of the potyvirus group: bean yellow mosaic virus, a strain of pea seedborne mosaic virus, and even watermelon mosaic virus (a pathogen of peas in New York). This phenomenon is unprecedented and suggests nucleotide homology in the respective viral RNA segments conferring pathogenicity to Pisum. Another novel aspect is the discovery that the lentil (Lens) gene sbv confers immunity to PSbMV-L. Such unexpected information provides some challenge to the current definition of a virus strain.

New bean germplasm collected - Mayaguez, Puerto Rico. Fifty-two collections of Phaseolus, mostly of wild species, were obtained from plant explorations in Central Mexico. Of the 36 presumably valid species of the genus from the area north of Panama, 23 are now in hand. Some of the collections clearly demonstrate that interspecific introgression occurred among wild species, and suggest a possible pathway for the domestication of the bean.

Unique, high-quality, green-fleshed muskmelon developed - Charleston, South Carolina. The new muskmelon has superb culinary qualities and disease resistance, and is adapted to the growing conditions of the southeastern United States. The new melon is being released in 1982 under the name 'Green Ice'; the first such melon of this type to be made available as an improved, disease-resistant cultivar.

A high-yielding, multipest-resistant, cream-type southernpea developed - Charleston, South Carolina. A new high-yielding, disease- and insect-resistant, cream-type southernpea has been developed, and is presently being tested under the designation V-306. It is highly resistant to Cercospora leaf spot and cowpea rust, and moderately resistant to the cowpea curculio. V-306 is a prolific pod setter with a yield potential that is quite superior to most currently recommended cream-type cultivars. The mild-flavored cream-type southernpeas have gained considerable popularity in recent years with both home gardeners and commercial processors, and this new line represents a major contribution to that industry.

Attractive tomato germplasm with improved vitamin content developed - Charleston, South Carolina. A new genotype in tomato was synthesized by combining the dark green (dg) gene with the crimson (og^c) gene. The dg og^c tomatoes are highly attractive with excellent qualities, containing 2 to 3 times as much beta-carotene (provitamin A) as normal tomatoes and approximately twice as much vitamin C. The fruit has a very firm flesh and ripens to a blood-red color on the vine. However, pigment development is somewhat impaired if fruits are harvested at the mature-green stage and ripened indoors at 68 °F. The dg og^c genotype should be highly desirable for home or market garden usage.

Male sterility character found in beans - Charleston, South Carolina. The male sterile character found in beans is associated with indehiscent anthers. Fertility appears to be dominant to sterility since the F_1 between normally fertile lines and the male sterile line is fully fertile. A field planting was made in 1981 to determine the extent of natural crossing between the male sterile line and adjacent fertile lines. Of 553 seedlings grown from seed harvested on the male sterile line, 94 percent were hybrids. These results indicate that production of F_1 hybrid beans may be possible. This trait also has possibilities for facilitating cross pollination in breeding schemes to broaden the genetic base of Phaseolus vulgaris, and to establish a mass or recurrent selection program in beans.

Sweet potato germplasm found to have potential for biomass production - Charleston, South Carolina. A sweet potato with high potential for biomass production has been developed in cooperation with Clemson University. In 2 years of testing, the new line (W-190) yielded about 75 percent as much as the leading U.S. cultivar, 'Jewel', but, because of a very high dry matter content it produces 25 to 30 percent more dry matter per acre. On a fresh-weight basis, W-190 had 31 percent fermentable carbohydrate as compared with 15 percent in 'Jewel'. W-190 is therefore much more efficient for biomass production because of its high yield of fermentable carbohydrate and much more efficient for harvesting and handling because of its low gross weight.

'Cinco', a multiple-disease-resistant muskmelon cultivar released - Weslaco, Texas. This muskmelon (cantaloupe), is highly resistant to watermelon mosaic virus 1 (WMV-1); downy mildew; races 1, 2, and 3 of powdery mildew; and Alternaria leaf-blight. The keeping qualities of the fruit make them quite suitable for long-distance shipping. The large fruit size would indicate greater preference by local market and home garden growers than by shippers. The high level of multiple disease resistance should make 'Cinco' especially desirable for production on small farms and home gardens, where fungicide application equipment is at a minimum and production economy and safety must be maximized.

Improved pinto bean released for production in the North Central region - Prosser, Washington. 'Pindak' a unique multiple-disease-resistant pinto bean developed at Prosser, Washington, was released jointly by ARS and the North Dakota Agricultural Experiment Station in 1981. This new bean is earlier maturing, shorter vined and, during 3 years of testing in several irrigated and dryland locations throughout the extensive bean-growing areas of North Dakota was 10 percent higher yielding than the popular Pinto UI-114. 'Pindak' is resistant to the prevalent virus diseases, root rot, and races of rust destructive to other beans grown in North Dakota in 1980 and 1981.

Resistance of new breeding lines to many potato diseases confirmed - Prosser, Washington. Resistance was confirmed in potato breeding lines for Verticillium and Sclerotinia wilts, early blight, common and deep-pitted scab, common and Columbia root-knot nematodes, Colorado potato beetle, leafroll, Potato Virus X, and Potato Virus Y. Mass intercrosses were made within and between resistant lines to accumulate genes for multiple resistances.

Endosperm Balance Numbers (EBN) of more tuber-bearing Solanum species determined - Madison, Wisconsin. The Mexican species 4x Solanum fendleri, 4x S. hjertingii, and 4x S. polytrichon as well as 4x S. stoloniferum have been assigned an Endosperm Balance Number (EBN) of 2. The diploid species S. cardiophyllum and S. michoacanum have been assigned an EBN of 1. This means that the 4x 2EBN species will cross with 2x 2EBN species, and that the 2x 1EBN species can only be crossed with other diploids (2x 2EBN) if their chromosomes are doubled with or through the functioning of 2n gametes. This research suggests possible ways to incorporate this germplasm into more useful forms for potato improvement. These species are noted for their high levels of resistance to various fungal and viral pathogens and insects.

Cryogenic storage procedure developed for cultivars of potato - Madison, Wisconsin. A cryogenic exposure procedure originally developed for Solanum etuberosum as a model system was successfully modified and applied to S. tuberosum materials, particularly cultivars from S. tuberosum Gp. Tuberosum. The procedure allows better regeneration and use of nodal sections for isolating shoot-tips. It also allows evaluation of the effects of long-term cryogenic storage on a diverse array of important germplasm materials.

Long-term cryogenic storage found to be applicable to potato pollen - Madison, Wisconsin. Results from viability studies suggest that potato pollen can be stored cryogenically (-196°C) for long periods without losing its seed setting ability. Short- and long-term cryogenic storage of pollen should facilitate crossing of diverse potato germplasm sources.

Multiple disease resistance incorporated into cucumber breeding line with good horticultural quality - Madison, Wisconsin. The cucumber breeding line WI 2757 combines many important plant and fruit characteristics, including bitter-free fruit, white spine, tender skin, uniform green color, parthenocarpic (seedless) fruits, gynoecious (female) flowering, and resistance to all major cucumber diseases except watermelon mosaic. The diseases to which it has shown a high level of resistance in greenhouse and field tests are: scab, mosaic (CMV), powdery mildew, angular leaf spot, anthracnose, downy mildew, bacterial wilt, target leaf spot, and fusarium wilt. WI 2757 provides breeders and seedsmen with a rare combination of characteristics for use in developing improved inbred parents as well as a female parent for producing new hybrid cultivars.

High quality carrot inbred and hybrid released - Madison, Wisconsin. Carrot line F524 released in cooperation with the Florida Agricultural Experiment Station provides seedsmen and breeders with a genetic stock for breeding purposes as well as for use in producing improved hybrids. F524 has a total carotene content 50 percent higher than that of the widely grown market cultivar, Imperator 58. It combines well and produces good seed crops on a variety of female parents. One hybrid, B3640 BC_1 x F524, performed very well

in large scale commercial trials and will be released in 1982 as 'Orlando Gold'. The release will provide the fresh market carrot industry with a high quality cultivar of high vitamin A content and improved field performance. Extensive field tests demonstrated that 'Orlando Gold' will stand mechanized harvesting and packing operations.

Relative importance of environmental and genetic influences on carrot quality determined - Madison, Wisconsin. The discovery that genotype is much more important than environment in determining flavor and other quality factors gives the breeder a sound basis for developing genotypes that will produce good eating quality under a wide range of environments. The discovery of specific genotypes that confer reliable quality and transmit good flavor to their hybrids will enable breeders to rapidly improve the quality and nutritive value of commercial cultivars.

Technological Objective 2: Develop new and improved cultural and management practices that increase vegetable yields, minimize production losses, improve quality attributes, and conserve and use scarce resources efficiently.

Research Locations:

Salinas, California
Tifton, Georgia
Orono, Maine
Beltsville, Maryland
East Lansing, Michigan
Corvallis, Oregon
Mayaguez, Puerto Rico
Charleston, South Carolina
Prosser, Washington
Pullman, Washington
Madison, Wisconsin

Examples of Recent Progress:

Use of synthetic sex lure effective in artichoke plume moth control - Salinas, California. Using not only insecticide but also traps baited with synthetic sex pheromone were found to be highly cost effective in controlling the artichoke plume moth. Large numbers of moths were trapped, insecticide use was decreased, and bud damage remained low. The pheromone was also effective in reducing mating during peak flights, thus reducing bud infestation to a level lower than that due to use of insecticides alone.

Ethephon treatment of tomato found to improve transplanting survival and freeze resistance - Tifton, Georgia. Ethephon applied at 300 ppm improved transplanting survival by 0.5 percent for every day between ethephon application and transplant harvest. Average transplanting survival for 19 tomato cultivars under freezing conditions was increased by 17 percent with ethephon treatment in Georgia.

Field equipment developed for rapidly and reliably inoculating potato and related species with bacterial wilt - Tifton, Georgia. The equipment enables inoculation of potato plants of different sizes with Pseudomonas solanacearum, which incites bacterial wilt disease. The inoculation consists of wounding by sand blasting and then spraying with the bacterial suspension. This device and system are used for field screening large numbers of plants for bacterial wilt resistance, and is very likely applicable to field screening for many other diseases.

Dinoseb tested as soil sterilant - Orono, Maine. Soils treated with the herbicide dinoseb showed very little microbial activity in the top one inch. Moreover, the herbicide prevented growth of the major fungal soilborne pathogens of potato. This treatment may be both harmful and beneficial, but preliminary tests show that it tends to be more harmful than beneficial because of the long lasting effects of dinoseb.

Protecting vegetables on small farms with slitted plastic tunnels found to extend their cropping period - Beltsville, Maryland. Tests indicated that cabbage and broccoli covered with plastic tunnels were harvestable up to 3 weeks earlier in the spring than those not covered. Harvesting of late planted crops could be extended well into December and January by the use of slitted plastic

tunnels. The primary problem encountered was the buildup of insects in the tunnels.

Maintenance of potato late blight inoculum improved - Beltsville, Maryland. An efficient, effective, and reliable method, using sterilized corn grains, was developed for storing and maintaining virulent isolates of Phytophthora infestans, the organism causing late blight of potato. Many P. infestans isolates lost their virulence within 1 year when routine storage methods were used, and most were avirulent after 3 years. This new method prevented this problem, and all seven isolates tested maintained their virulence for 5 years. Currently, this method is being used throughout the world to maintain isolates of P. infestans and other Phytophthora spp. Because this method uses only sterilized corn seeds, it can be used in areas where laboratory facilities are restricted.

Mushroom virus detection method developed - Beltsville, Maryland. Polyacrylamide gel electrophoresis was used to detect virus infection in a large number of commercial stock cultures of cultivated mushrooms used in the mushroom industry. Although several strains were in stock culture collections for 15 years and stored in liquid nitrogen for more than 10 years, 42 percent of the strains contained viral nucleic acids. The results indicate that electrophoretic analysis at the spawnmaking stage may be useful in detecting virus-associated degenerative diseases.

Natural sources of virus infection in commercial mushrooms evaluated - Beltsville, Maryland. Several sources of virus infection were tested for their natural potential to transmit LaFrance's disease of mushrooms. Compost, casing soils and peat, and several competitor organisms were tested as natural reservoirs for the virus. The virus was transmitted by contaminated casing soil. Not only was the virus transmitted to Agaricus bisporus, but the A. bisporus virus was also transmitted to A. bitorquis via this method. This is the first successful intraspecific transfer of virus between two Agaricus species.

Mushroom cultural methods evaluated to determine techniques for reducing major fungal pathogens - Beltsville, Maryland. Strict sanitary measures were found to limit disease transmission in mushroom cultivation, including disinfection of the culture trays, baskets, and corridors, and use of spore filters. A consistent steaming program, even in the apparent absence of disease problems, is necessary for controlling both viral and fungal diseases.

Bacteria capable of providing in vitro control of bean bacterial blight pathogens found - East Lansing, Michigan. Three Bacillus-like bacteria isolated from bean seed showed excellent in vitro antagonism to all Xanthomonas phaseoli strains tested. One of the isolates, 143A, also showed in vitro inhibition of Colletotrichum lindemuthianum, Fusarium solani f. sp. phaseoli, Rhizoctonia solani, Sclerotinia sclerotiorum and Thielaviopsis basicola (all pathogens of beans). Research is in progress to determine the efficacy of in vivo biocontrol of disease in bean plants.

Advances made in potato virology and eradication of viruses from potato seed stocks - Prosser, Washington. Viruses were eradicated from 50 important potato clones, and procedures were developed to preserve clones as meristem cultures and to propagate them rapidly from meristems to field plants. A Solanaceous virus isolate repository with host range and serological classifications of 800 virus sources was established. Superior methods to renew tuber sources of virus isolates were also developed. These methods and resources were made available to other research programs, a public ELISA laboratory, and potato seed certification programs.

Properties of tomato yellow top virus, a potentially important new virus, determined - Prosser, Washington. The host range, symptomatology, and transmission characteristics of the virus were investigated and found to be distinctive. Also, this virus, which causes a devastating disease of tomato and which is new to this country, proved to be an independent luteovirus with a weak serological relationship to potato leafroll virus.

Effects of Mt. St. Helens ash on vegetable production studied - Prosser, Washington. Applications of one inch of ash on the soil surface reduced soil temperature during the critical early growth of plants. Such an application made after planting and before plant emergence significantly reduced plant stands and yields of peas, dry beans, and snap beans. Ash deposition tended to increase the severity of root rot disease. Incorporation of ash into the soil before emergence or surface application of one inch after emergence was only slightly detrimental to emergence, plant weight, and yield. Heavy ash deposition (3-4 inches) smothered young tomato seedlings in direct-seeded plots, resulting in poor stands and delayed maturation. Large transplants were not noticeably damaged. One to two inches of ash delayed maturation slightly, but did not reduce yields or affect quality of tomatoes. Long-term effects of ash fallout are likely to be negligible.

Cause of "chalky spot" damage in lentils found to be Lygus bugs - Pullman, Washington. "Chalky spot," a chronic but unexplained problem in lentil crops in the Palouse, was shown to be caused by Lygus bug feeding on immature pods and seeds. Lygus bugs caused chalky spot in 20 to 40 percent of the seeds, and also caused pod and seed abortion. Seed quality and economic yield were adversely affected by the bugs. A diverse program of field experiments to evaluate methods of insect control has been initiated.

CULTIVARS RELEASED

Name or Designation	Release Agencies	Reason for Release
Beans		
Pindak	ARS and ND AES	Multiple-disease resistant, early pinto type for North Central area.
Lettuce		
Sea Green	ARS and CA AES	Big vein-resistant crisphead with potential for wide adaptability.
Thompson	ARS and CA AES	Big vein resistant, adapted to early spring production.
Muskmelon (cantaloupe)		
Cinco	ARS	Multiple-disease resistant.
Potato		
Alasclear	ARS and AK AES	Scab-resistant, white-skinned, high-quality general-purpose potato adapted to Alaskan conditions.
Chipbelle	ARS, FL, ME, MI, NJ, NY, and VA AES	Golden nematode-resistant, multiple-disease resistant, high quality with excellent chipping characteristics, and widely adapted.
Oceania	ARS, FL, VA, NJ, and ME AES	Smooth white for fresh market, early, high yielding, high quality, multipest resistant with wide adaptability.
Pennrose	ARS and PA AES	Red skinned, medium maturity, high yielding for fresh market.

Tomato		
US 68	ARS	Determinate-vined, early maturing F_1 hybrid for mechanical harvesting adapted to the Eastern and Midwestern areas.

NONCOMMERCIAL GERMPLASM RELEASED

Name or Designation	Release Agencies	Reason for Release
Beans		
XR-235-1-1	ARS, PR, and FL AES	Bacterial blight (Xanthomonas spp.) resistant.
MRF 79	ARS	Fordhook-type lima bean with green cotyledons and seedcoat, and downy mildew resistant.
Carrot		
Florida 524 (F524)	ARS and FL AES	Inbred line for use in production of high quality market-type hybrid carrots.
Cucumber		
WI 2757	ARS and WI AES	Resistant to nine major diseases, gynoecious flowering, parthenocarpic fruiting.
Lettuce		
70-612	ARS and CA AES	Big vein resistant, crisphead type.
71-28	ARS and CA AES	Big vein resistant, crisphead type.
71-31	"	"
72-119	"	"
72-142	"	"
Peas		
X78006	ARS and WA AES	Pea Seedborne Mosaic Virus (PSbMV) resistant.
X78122	"	"
X78123	"	"
X78124	"	"
X78125	"	"
X78126	"	"
X78127	"	"
X78128	"	"

PUBLICATIONS

Salinas, California

Bari, M. A. and W. H. Lange. 1980. Influence of temperature on the development, fecundity and longevity of the artichoke plume moth. Environ. Entomol. 9:673-676.

Ryder, E. J. 1981. 'Sea Green' lettuce. HortScience 16:571-572.

Ryder, E. J. 1981. 'Thompson' lettuce. HortScience 16:687-688.

Tifton, Georgia

Ghate, S. R., S. C. Phatak, and C. A. Jaworski. 1981. Seeding pre-germinated vegetable seeds in plots. Trans. Amer. Soc. Agr. Eng. 24:1099-1102, 1107.

Ghate, S. R., S. C. Phatak, and C. A. Jaworski. 1981. Design of equipment for sowing pre-germinated vegetable seeds. Trans. Amer. Soc. Agr. Eng. Paper No. 81-020, 20 pp.

Jaworski, C. A., S. C. Phatak, and R. E. Hanneman. 1981. Field screening potatoes and wild Solanum species for bacterial wilt resistance. International Symposium for Potatoes in Hot Climates, Israel, A/L4, 2 pp.

Jaworski, C. A., S. C. Phatak, A. W. Johnson, and S. M. McCarter. 1981. Tomato production and soil pest control in relation to width of fumigated and mulched bed and soil fumigation rate. HortScience 16:667-669.

Johnson, A. W., C. A. Jaworski, N. C. Glaze, D. R. Sumner, and R. B. Chalfant. 1981. Effects of film mulch and soil pesticides on nematodes, weeds, and yields of vegetable crops. J. Nematology 13:141-148.

Liptay, A., C. A. Jaworski, and S. C. Phatak. 1981. Effect of tomato transplant stem diameter and ethephon treatment on tomato yield, fruit size, and number. Canadian J. Plant Sci. 61:413-415.

Phatak, S. C., C. A. Jaworski, and A. Liptay. 1981. Flowering and adventitious root growth of tomato cultivars as influenced by ethephon. HortScience 16:181-182.

Aberdeen, Idaho

Davis, J. R., J. J. Pavek, and D. L. Corsini. 1981. Stability of field resistance to Verticillium dahliae in potato cultivars and relationship to soilborne inoculum. Summaries of Third International Symposium on Verticillium, Instituto di Patologia Vegetale, University of Bari, Italy, August 24-28, 1981. 24 pp.

Dwelle, R. B., G. E. Kleinkopf, R. K. Steinhorst, J. J. Pavek, and P. J. Hurley. 1981. The influence of physiological processes on tuber yield of potato genotypes (Solanum tuberosum L.) stomatal diffusive resistance, stomatal conductance, gross photosynthetic rate, leaf canopy, tissue nutrient levels, and tuber enzyme activities. Potato Res. 24:33-47.

Dwelle, R. B., G. E. Kleinkopf, and J. J. Pavek. 1981. Stomatal conductance and gross photosynthesis of potato (Solanum tuberosum L.) as influenced by irradiance, temperature, and growth stage. Potato Res. 24:49-59.

Pavek, J. J., D. L. Corsini, J. G. Garner, Sheri Michener, W. C. Sparks, G. F. Carnahan, C. E. Stanger, A. R. Mosely, M. J. Johnson, G. E. Carter, R. E. Voss, M. W. Martin, and R. H. Johansen. 1981. Lemhi Russet: A new high yielding potato variety with wide adaptation, attractive tubers, and high internal quality. Amer. Potato J. 58:619-625.

Orono, Maine

Leach, S. S. and R. E. Webb. 1981. Resistance of selected potato cultivars and clones to Fusarium dry rot. Phytopathology 71:623-629.

Beltsville, Maryland

Barksdale, T. H. and A. K. Stoner. 1981. Levels of tomato anthracnose resistance measured by reduction of fungicide use. Plant Dis. 65:71-72.

Dudley, R. F., A. K. Stoner, and F. Smith. 1980. Aphid counts, soil temperature, and yields of muskmelons grown on four synthetic mulches. In M. H. Jensen and N. F. Oebker (eds.) Proc. 15th National Agr. Plastics Congr., Tucson, AZ. pp. 107-110.

Goth, R. W. 1981. An efficient technique for prolonged storage of Phytophthora infestans. Amer. Potato J. 58:257-260.

Goth, R. W. and S. A. Johnston. 1981. Induction of Macroconidium formation in Fusarium moniliforme. Mycologia 73:282-287.

Goth, R. W., P. Semeniuk, and R. E. Webb. 1981. Effect of ultraviolet (UV-B) irradiation on Chenopodium quinoa inoculated with potato virus S. Amer. Potato J. 58:502.

Goth, R. W. and R. E. Webb. 1981. Source and genetics of host resistance in vegetable crops. p. 337-410. In M. E. Mace, A. A. Bell, C. H. Beckman (eds.), Fungal Wilt Diseases of Plants. Academic Press, New York.

Gregory, P., S. L. Sinden, S. F. Osman, W. M. Tingey, and D. A. Chessen. 1981. Glycoalkaloids of wild, tuber-bearing Solanum species. J. Agr. Food Chem. 29:1212-1215.

McCollum, G. D. 1981. Induction of an alloplasmic male-sterile Brassica oleracea by substituting cytoplasm from 'Early Scarlet Globe' radish (Raphanus sativus). Euphytica 30:855-859.

San Antonio, J. P. 1981. Cultivation of the shiitake mushroom. HortScience 16:151-156.

Sinden, S. L. and L. L. Sanford. 1981. Origin and inheritance of solamarine glycoalkaloids in commercial potato cultivars. Amer. Potato J. 58:305-325.

Stavely, J. R. and J. P. Meiners. 1981. The current bean rust situation in the United States. Ann. Rept. Bean Improvement Coop. 24:71-72.

Webb, R. E. and Collaborators. 1981. National Potato Breeding Report, 1980. Fifty-first Annual Report by Cooperators. R. E. Webb (ed.) USDA/SEA. May, 1981. pp. 230.

Webb, R. E., D. R. Wilson, J. A. Frank, J. R. Shumaker, B. Graves, and M. R. Henninger. 1981. BelRus: A new russet skin potato variety, combining high quality, pest resistance, and adaptation to the northeastern United States and Florida. Amer. Potato J. 58:111-116.

East Lansing, Michigan

Agbo, N. G., M. A. Uebersax, and G. L. Hosfield. 1981. Genetic and physiochemical parameters affecting texture of processed dry beans. In 1980 Michigan Dry Bean Production Res. Advisory Board Ann. Rept. pp. 85-89.

Guri, A. Z. 1981. Genetics and the mechanism of ozone tolerance in selected cultivars of Phaseolus vulgaris L. Ph.D. Thesis, Michigan State Univ., E. Lansing, MI. 84 pp.

Hart. L. P. and A. W. Saettler. 1981. Bacterial blight of beans. Michigan State Univ. Ext. Bul. E-680. 4 pp.

Hart, L. P. and A. W. Saettler. 1981. White mold of beans. Michigan State Univ. Ext. Bul. E-892. 4 pp.

Hart, L. P. and A. W. Saettler. 1981. Bean rust. Michigan State Univ. Ext. Bul. E-893. 2 pp.

Hart, L. P. and A. W. Saettler. 1981. Bean common mosaic virus. Michigan State Univ. Ext. Bul. E-1561. 2 pp.

Hart, L. P. and A. W. Saettler. 1981. Air pollution injury (bronzing) in dry beans. Michigan State Univ. Ext. Bul. E-1567. 2 pp.

Hosfield, G. L., A. Ghaderi, and M. A. Uebersax. 1981. Interrelationships among yield and food quality characters: A factor analysis approach. In 1980 Michigan Dry Bean Production Res. Advisory Board Ann. Rept. pp. 75-80.

Izquierdo, J. A. 1981. The effect of accumulation and remobilization of carbon assimilate and nitrogen on abscission, seed development, and yield of common bean (Phaseolus vulgaris L.) with differing architectural forms. Ph.D Thesis, Michigan State Univ., E. Lansing, MI. 188 pp.

Izquierdo, J. A. and G. L. Hosfield. 1981. A collection receptacle for field abscission studies in common bean. Crop Sci. 21:622-625.

Izquierdo, J. A., J. D. Kelly, G. L. Hosfield, and M. A. Uebersax. 1981. Parental influence on white and off-white seed-coat color in common bean. Ann. Rept. Bean Improv. Coop. 24:44-45.

Izquierdo, J. A., J. D. Kelly, G. L. Hosfield, and M. A. Uebersax. 1981. Common bean--parental influence on white and off-white seed coat color in the common bean. Michigan Dry Bean Digest 5(4):13.

Muhalet, C. S., M. W. Adams, A. W. Saettler, and A. Ghaderi. 1981. Genetic system for the reaction of field beans to beta, gamma, and delta races of Colletotrichum lindemuthianum. J. Amer. Soc. Hort. Sci. 106:601-604.

Saettler, A. W. 1981. Yield response of navy bean treated with the antioxidant chemical ethylenediurea. Michigan State Univ., Agr. Expt. Sta. Res. Rep. No. 427. 7 pp.

Saettler, A. W. 1981. Sources of resistance to Xanthomonas bacterial blight. Ann. Rept. Bean Improv. Coop. 24:104.

Saettler, A. W. 1981. Relationship of bean halo blight bacteria to susceptible Charlevoix and tolerant Montcalm and Seafarer bean cultivars. Ann. Rept. Bean Improv. Coop. 24:105-106.

Saettler, A. W., S. J. Stadt, and L. T. Pontius. 1981. Effects of inoculation time and cultivar on internal infection of bean seed by Pseudomonas phaseolicola. J. Seed Tech. 6:22-29.

Stadt, S. J. and A. W. Saettler. 1981. Effect of host genotype on multiplication of Pseudomonas phaseolicola. Phytopathology 71:1307-1310.

Trujillo, G. E. and A. W. Saettler. 1981. Production and characterization of antisera to Xanthomonas phaseoli and X. phaseoli var. fuscans. Michigan State Univ., Agr. Expt. Sta. Res. Rep. No. 414. 8 pp.

Uebersax, M. A. 1981. Quality assessment of dry cranberry beans. Michigan Dry Bean Digest 5(4):9-10.

Uebersax, M. A., J. P. Lee, and G. L. Hosfield. 1981. Dry cranberry beans: The effect of selected soak water additives on quality. Michigan Dry Bean Digest 6(1):16-17.

Wassimi, N. N. and G. L. Hosfield. 1981. A comparative study of seed coat color, tannin content, storage conditions, nutritional quality and cookability in dry edible beans (Phaseolus vulgaris L.) and lentils (Lens culinaris L.): Their interrelationships and inheritance. In 1980 Michigan Dry Bean Production Res. Advisory Board Ann. Rept. pp. 90-94.

Wassimi, N. N., G. L. Hosfield, and M. A. Uebersax. 1981. The effect of seed coat color on soaking characteristics of dry edible beans (Phaseolus vulgaris L.). Ann. Rept. Bean Improv. Coop. 24:42-43.

Wassimi, N. N., G. L. Hosfield, and M. A. Uebersax. 1981. Dry edible beans--the effect of seed coat color on soaking characteristics. Michigan Dry Bean Digest 5(4):12.

Corvallis, Oregon

Davis, R. F., Z. Weber, H. Pospieszny, M. Silbernagel, and R. O. Hampton. 1981. Seedborne cucumber mosaic virus in selected Phaseolus vulgaris germplasm and breeding lines in Idaho, Washington, and Oregon. Plant Dis. 65:492-494.

Hampton, R. O. and G. A. Marx. 1981. Immunity to pea seedborne mosaic virus: A reassessment. The Pisum Newsletter 13:16-17.

Hampton, R. O., G. Mink, L. Bos, T. Inouye, M. Musil, and D. Hagedorn. 1981. Host differentiation and serological homology of pea seedborne mosaic virus isolates. Neth. J. Plant Path. 87:1-10.

Mayaguez, Puerto Rico

Echavez-Badel, R. and G. F. Freytag. 1981. Advanced lines of cowpea (Vigna unguiculata (L.) Walp.) developed in Puerto Rico. In XXVII Annual Meeting, Programma Cooperativa Centroamericana para el Mejoramiento de Cultivos Alimenticios (Central American Association for the Improvement of Food Crops). p. 117.

Telek, L. and G. F. Freytag. 1981. Extraction and identification of polyphenolic compounds in bean testas. In XXVII Annual Meeting, Programma Cooperativa Centroamericana para el Mejoramiento de Cultivos Alimenticios (Central American Association for the Improvement of Food Crops). p. 119.

Zapata, M., G. F. Freytag, and J. H. Lopez-Rosa. 1981. Field confirmation of resistance to bacterial blight (Xanthononas phaseoli)of bean. In XXVII Annual Meeting, Programma Cooperativa Centroamericana para el Mejoramiento de Cultivos Alimenticios (Central American Association for the Improvement of Food Crops). p. 118.

Charleston, South Carolina

Dale, J. L., Joe McFerran, E. V. Wann, and R. L. Bona. 1981. Screening sweet corn for virus resistance, yield, and quality. Arkansas Farm Res. 30(1):3.

Dale, J. R., Joe McFerran, E. V. Wann, and R. L. Bona. 1981. Field evaluation of sweet corn hybrids and inbreds with emphasis on virus disease resistance. Arkansas Agr. Expt. Sta. Rept. Series 258. 12 pp.

Fery, R. L. 1981. Cowpea production in the United States. HortScience 16:473-474.

Jones, Alfred (Chm.) 1981. Genetic resources of sweet potato. (Report of IBPGR Working Group on the Genetic Resources of Sweet Potato) AGP:IBPGR/80/63. International Board for Plant Genetic Resources, FAO, UN Secretariat, Rome. 30 pp.

Mullen, M. A., Alfred Jones, R. T. Arbogast, D. R. Paterson, and T. E. Boswell. 1981. Resistance of sweet potato lines to infestation by the sweet potato weevil Cylas formicarius elengantulus (Summers). HortScience 16:539-540.

Nugent, P. E. and J. C. Hoffman. 1981. Natural cross pollination in four andromonoecious seedling marker lines of muskmelon. HortScience 16:73-74.

Robbins, M. LeRon and P. D. Dukes. 1981. 'Footlong' polebean. HortScience 16:228.

Rolston, L. H., Thomas Barlow, Alfred Jones, and Teme Hernandez. 1981. Potential of host plant resistance in sweet potato for control of a white grub, Phyllophaga ephilida Say (Coleoptera:Scarabaeidae). J. Kansas Entomol. Soc. 54:378-380.

Wann, E. V. 1981. USDA's Southern Regional Vegetable Laboratory. HortScience 16:1-2.

Wyatt, J. E. 1981. Inheritance of a pale-green foliage mutant in beans, Phaseolus vulgaris L. J. Heredity 72:218-219.

Wyatt, J. E. 1981. Use of an automatic seed analyzer in studying electrical conductivity of imbibing bean seeds, Ann. Rept. Bean Improv. Coop. 24:65-66.

Weslaco, Texas

Thomas, C. E. and R. E. Webb. 1981. W1, W3, W4, W5, and W6 multidisease-resistant muskmelon breeding lines. HortScience. 16:96.

Prosser, Washington

Bezdicek, D. F., G. T. Vigue, and D. W. Burke. 1981. Effect of soil fumigation on N_2 fixation and yield of field bean when grown on Fusarium-infested soil. Agronomy J. 73:1062-1065.

Burke, D. W. 1981. Yield response of several bean types to a complex of cold soil, wheat crop debris, drought, and Fusarium root rot. Ann. Rept. Bean Improv. Coop. 24:48.

Drake, S. R., E. L. Proebsting, Jr., M. O. Mahan, and J. B. Thompson. 1981. Influence of trickle and sprinkle irrigation on 'Golden Delicious' apple quality. J. Amer. Soc. Hort. Sci. 106:255-258.

Fridlund, P. R. and S. R. Drake. 1981. Effect of pear vein yellows virus and a nonviral factor on the performance of pear trees. J. Amer. Soc. Hort. Sci. 106:412-414.

Hagel, G. T., D. W. Burke, and M. J. Silbernagel. 1981. Response of dry bean selections to field infestations of seedcorn maggot in central Washington. J. Econ. Entomol. 74:441-443.

Koehler, H. H. and D. W. Burke. 1981. Nutrient composition, sensory characteristics, and texture measurements of seven cultivars of dry beans. J. Amer. Soc. Hort. Sci. 106:313-318.

Kraft, J. M. 1981. Registration of 792022 and 792024 pea germplasm. Crop Sci. 21:352-353.

Kraft, J. M., D. W. Burke, and W. A. Haglund. 1981. Fusarium diseases of beans, peas, and lentils. In P. E. Nelson, et al. (ed.), Fusarium Diseases, Biology, and Taxonomy. Penn. State Univ. Press. Chapter 14, pp. 142-156.

Martin, M. W., et al. 1981. Potato varieties that can be profitably grown specifically for alcohol production. Proc. Wash. State Potato Conf. 20:105-119.

Silbernagel, M. J. 1981. Is bean Aphanomyces root rot in Oregon and/or Europe? Ann. Rept. Bean Improv. Coop. 24:106-107.

Pullman, Washington

Haddad, N. I. and F. J. Muehlbauer. 1981. Comparison of random bulk population and single-seed-descent methods for lentil breeding. Euphytica 30:643-651.

Muehlbauer, F. J., R. W. Short, R. J. Summerfield, K. J. Morrison, and D. G. Swan. 1981. Description and culture of lentils. Wash. State Univ. Ext. Bul. EB0957. pp. 1-8.

Muehlbauer, F. J., D. G. Burnell, T. P. Bogyo, and M. I. Bogyo. 1981. Simulated genetic comparisons of single seed-descent and bulk-population breeding methods. Crop Sci. 21:572-577.

Muehlbauer, F. J. and A. E. Slinkard. 1981. Genetics and breeding methodology. In G. C. Hawtin (ed.), Lentils. ICARDA. Syria. Chapter 6, pp. 69-90.

Summerfield, R. J. and F. J. Muehlbauer. 1981. Controlled environments as an adjunct to field research on lentils (Lens culinaris Med.) I. Perspective, tenets and objectives. Expl. Agric., 17:372-373.

Madison, Wisconsin

Hanneman, R. E., Jr. and S. J. Peloquin. 1981. Genetic-cytoplasmic male sterility in progeny of 4x-2x crosses in cultivated potatoes. Theor. Appl. Genet. 59:53-55.

Sanford, J. C. and R. E. Hanneman, Jr. 1981. The use of bees for the purpose of intermating in potatoes. Amer. Potato J. 58:481-485.

Simon, P. W., C. E. Peterson, and R. C. Lindsay. 1981. The improvement of flavor in a program of carrot genetics and breeding. In R. Teranishi and H. Barrera-Benitez (eds.), Quality of Selected Fruits and Vegetables of North America. Amer. Chem. Soc. Symp. Ser. #170. pp. 109-118.

Towill, L. E. 1981. Solanum etuberosum: A model for studying the cryobiology of shoot-tips in the tuber-bearing Solanum species. Plant Sci. Lett. 20:315-324.

Towill, L. E. 1981. Liquid nitrogen preservation of pollen from tuber-bearing Solanum species. HortScience 16:177-179.

SALINAS, CA 93901

E. J. Ryder
U.S. Agric. Res. Station
P.O. Box 5098
(FTS) 468-2253

TIFTON, GA 31794

C. A. Jaworski
Georgia Coastal Plain
Experiment Station
2-386-3355

ABERDEEN, ID 83210

J. J. Pavek
Aberdeen Substation
P.O. Box AA
208-397-4181

ORONO, ME 04473

S. S. Leach
N.E. Plant, Soil and
Water Laboratory
University of Maine
(FTS) 833-7475

BELTSVILLE, MD 20705

C. A. Thomas
Applied Plant Pathology Lab.
Plant Protection Institute
BARC-W (FTS) 344-3354

R. E. Webb
Vegetable Laboratory
Horticultural Science Inst.
BARC-W (FTS) 344-3380

EAST LANSING, MI 48823

A. W. Saettler
USDA-ARS, Department of
Botany & Plant Pathology
Michigan State University
517-353-3221

CORVALLIS, OR 97331

R. O. Hampton
USDA-ARS, Department of
Botany & Plant Pathology
Oregon State University
(FTS) 420-4834

MAYAGUEZ, PR 00708

G. F. Freytag
Mayaguez Institute of
Tropical Agriculture
P.O. Box 70
809-832-2435

CHARLESTON, SC 29407

E. V. Wann
U.S. Vegetable Laboratory
2875 Savannah Highway
(FTS) 677-4396

WESLACO, TX 78596

C. E. Thomas
Agric. Res. & Ext. Center
USDA-ARS
Box 267
512-968-5438

PROSSER, WA 99350

D. W. Burke
Irrigated Agr. Res. & Ext. Cen.
H. Rodgers Hamilton Laboratory
509-786-3454 (Ext. 173)

PULLMAN, WA 99164

F. J. Muehlbauer
USDA-ARS, Department of
Agronomy & Soils
Washington State University
509-335-9521

MADISON, WI 53706

C. E. Peterson
USDA-ARS, Department of
Horticulture
University of Wisconsin
(FTS) 364-5245

National Research Program 20030

BREEDING AND PRODUCTION - FLORIST AND NURSERY CROPS

This National Research Program deals with multidisciplinary research to develop new technology for improving productivity and increasing efficiency in the production of floral and nursery crops that can enhance urban and rural environments. Through research in this program, new knowledge is obtained and made available on selecting, improving, protecting, maintaining, and cultivating plants for urban and rural homes, landscape, and special purpose plantings such as windbreaks, parks, roadsides, shopping centers, and interiorscapes.

Floral and nursery crops fulfill a social as well as an agricultural need. They affect human feelings and attitudes and greatly enhance human surroundings. Green plants and flowering plants are being used increasingly in and around homes, offices, and public buildings. The "farm value" of floral and nursery plants is estimated at over $3 billion annually. The growth of the foliage and bedding plant industry in the last few years is probably unexcelled by that of any other agricultural commodity.

The USDA research on Florist and Nursery Crop Production is conducted at three primary centers: Washington, D.C.--Beltsville, Maryland; Delaware, Ohio; and Corvallis, Oregon. Significant research activities are also conducted at Tifton, Georgia; Mandan, North Dakota; and Puyallup, Washington. In Federal and State research stations at these locations, USDA-ARS scientists work together with State scientists and closely complement research activities in State programs.

Technological Objective 1: Develop new and improved genetic populations, breeding lines, and cultivars of florist and nursery crops that combine improved and favored quality characters with better resistance to pests, tolerance to environmental stress, and adaptation for mechanized culture, harvesting, and handling.

NPS Contact: A. E. Thompson

Research Locations:

Washington, D.C.
Beltsville, Maryland
Mandan, North Dakota
Delaware, Ohio

Examples of Recent Progress:

New hibiscus shrub with long flowering season released - National Arboretum, Washington, D.C. Hibiscus syriacus 'Helene' is a deciduous, multiple-stemmed, erect shrub with leathery, dark green leaves. The flowers are firm-textured, wide-spreading, ruffled, white with a red eyespot, and 10 to 15 cm. in diameter. Being a triploid with little or no seed production, the plant continues to initiate buds and will flower from June to September.

New mildew-resistant crape myrtles highly acclaimed - National Arboretum, Washington, D.C. Cultivars 'Muskogee' and 'Natchez' are the first interspecific hybrids produced by controlled hybridization of Lagerstroemia indica L. x L. fauriei Koehne. 'Muskogee' is a vigorous, multiple-stemmed, small tree with medium brown exfoliating trunk bark, dark green leaves that turn red in autumn, and long tapered inflorescences of light lavendar flowers. 'Natchez' is a multiple-stemmed, wide-spreading, small tree with distinctive dark brown trunk bark, glossy dark green leaves that turn orange and red in the autumn, and pure white flowers that are profusely borne from June to September. The unique combinations of trunk coloration and mildew resistance under field conditions have resulted in high acclaim from both nurserymen and landscape architects.

Two new Viburnums with compact growth habit introduced - National Arboretum, Washington, D.C. 'Chesapeake', a hybrid selection from the cross Viburnum x carlcephalum 'Cayuga' x V. utile, is a deciduous, compact shrub with glossy, dark green leaves, and a profusion of pink buds that open to white flowers. 'Eskimo', which has the same parentage as 'Chesapeake', is the first Viburnum cultivar that has the tubular V. carlesii - type flower in a snowball, a dwarf growth habit, and semi-evergreen foliage.

Two cold-hardy, fall-blooming camellias developed - National Arboretum, Washington, D.C. Most cultivated camellias lack cold tolerance. The species Camellia oleifera has considerable cold tolerance, but flowers of little ornamental value. Interspecific hybrids between C. oleifera and C. hiemalis have shown considerable promise for their flowers, plant form, and cold hardiness; and two have been selected and released. 'Frost Prince' has deep pink, single or semidouble flowers, and 'Frost Princess' has lavendar-pink flowers with semidouble to anemone form. Their flowering period extends from mid-October to late November in Maryland. The plants have shown little or no damage despite temperatures as cold as -20°C (-5°F).

New camellia germplasm developed to extend southern limits of culture - National Arboretum, Washington, D.C. Extending the culture of camellias south of its present limitations has been advanced by cooperator testing of a series on interspecific hybrids derived from species introduced from tropical and subtropical Asia. Reports on these hybrids from cooperators in southern Florida, Texas, and California, where existing camellia cultivars will not grow, were evaluated over a 3-year period. On the basis of these reports, the cultivar 'Two Marthas,' the first of a series of high heat and light tolerant hybrids, was named and released, and is being distributed to nurserymen for stock increase.

Series of fragrant flowered camellia hybrids released - National Arboretum, Washington, D.C. The original fragrant camellia cultivar, 'Ack-Scent,' is presently receiving favorable response from the nursery trade. A series of six additional fragrant hybrids have been selected and are being named 'Ack-Scent White,' 'Ack-Scent Red,' 'Ack-Scent Pink,' 'Ack-Scent Spice,' 'Ack-Scent Star,' and 'Ack-Scent Sno.' These new cultivars will be released in 1982 and will provide the trade with a wide array of new colors and fragrant flower types.

Two new ornamental pears released - National Arboretum, Washington, D.C. The two new cultivars, 'Capitol' and 'Whitehouse,' resemble the popular 'Bradford' ornamental pear. 'Whitehouse' differs from 'Bradford' in having a narrow columnar crown well suited for use as a street or landscape tree where space is limited. 'Capitol' has an extremely narrow crown similar to that of the Lombardy poplar, and should be very useful as a windbreak and for planting in shopping center malls and small suburban yards where space is highly restricted. Both exhibit high resistance to fire blight disease and have attractive red-purple fall foliage.

Interspecific hybridization of Impatiens made possible by ovule culture - Beltsville, Maryland. Interspecific hybrids in Impatiens were obtained for the first time by using ovule cultures of I. sultani (African) x I. niamniamensis (African), I. sultani x New Guinea Impatiens, and I. uguenensis (African) x 'Tangerine' (Celebes). From intercrosses among 13 widely separated species, 15 interspecific hybrids have been obtained thus far through ovule cultures. Repeated breeding trials by conventional in vivo methods have shown that embryos of these crosses are highly abortive and die within 2 weeks.

Protoplast fusion technique developed and should facilitate genetic engineering - Beltsville, Maryland. A technique was developed for producing a large quantity of protoplasts minus their nuclei. When these enucleated subprotoplats were used in fusions with albino recipient cells, green plants were regenerated. A genetic characterization of these "cybrids" is now underway. This technique for transferring organellar genomes in horticultural crop plants may enable the breeder to use chloroplast and mitochondrial traits in breeding. Transmission of these traits was previously restricted to maternal inheritance.

Work started to evaluate germplasm of windbreak tree species - Mandan, North Dakota. Pest resistance is being evaluated within a broad-based gene pool of elm (Ulmus) genotypes. One hundred fifty-one Siberian elm, Japanese elm, and elm hybrids were selected for superiority in one or more traits, such as cankerworm tolerance, stem canker resistance and good stem form, and then were established in stool beds. Greenhouse screening has identified four clones with useful cankerworm tolerance.

Water relationships and performance of windbreak tree species evaluated - Mandan, North Dakota. Green ash, hackberry, American elm, and Siberian elm trees, used in windbreak plantings in the Northern Great Plains, were evaluated for their responses to increasing soil water deficits, competition with adjacent crops for water, and tree growth characteristics. Transpiration rates were considerably higher for Siberian elm than for American elm or green ash. The higher susceptibility to water stress in leaves of green ash and hackberry contributes to early growth cessation and leaf drop during late summer, which should reduce total soil water use by the trees and leave more water for adjacent crops. Selection of Siberian elms for early growth cessation and leaf drop should initiate the hardening processes earlier and result in improved tolerance to winter injury and stress related to disease and insect attack.

Technological Objective 2: Develop new and improved cultural and management practices that increase florist and nursery crop yields, minimize production losses, improve quality attributes, and conserve and use scarce resources efficiently.

Research Locations:

Tifton, Georgia
Beltsville, Maryland
Delaware, Ohio
Corvallis, Oregon
Puyallup, Washington

Examples of Recent Progress:

New monoclonal antibodies to plant viruses developed - Beltsville, Maryland. Hybridomas secreting monoclonal antibodies to Prunus necrotic ringspot (NRSV), apple mosaic (ApMV), tobacco streak (TSV), and alfalfa mosaic (AMV) viruses were successfully produced. Five clones secrete antibodies against ApMV, one clone secretes antibodies against ApMV and NRSV, six secrete antibodies against TSV, and two secrete antibodies against AMV. Results to date indicate that the antibodies produced by the new hybridoma procedure are of very high titer and good quality, and should be useful both as diagnostic and taxonomic tools.

Virus detection method improved - Beltsville, Maryland. The method involves using the $F(ab^1)_2$ portion of antibodies to detect the tobacco ringspot, tomato ringspot, apple mosaic, Prunus necrotic ringspot, prune dwarf, potato A, potato X, and tobacco etch viruses. Just one enzyme-protein A conjugate can be used to detect all these viruses, thus eliminating the need for preparing any enzyme-antibody conjugate for each virus to be assayed.

Development of integrated control systems underway for florist greenhouse production - Beltsville, Maryland. An extensive biocontrol screening experiment is underway in search of candidate organisms for controlling Fusarium wilt of carnation. Several promising organisms have been identified for controlling Fusarium on chrysanthemum. An integrated system utilizing a benomyl-tolerant Trichoderma in combination with the fungicide benomyl has shown promise, and is being evaluated in a cut flower bench system.

Rose cultivars from commercial field-grown roses identified by their "fingerprints" - Beltsville, Maryland. The standard high pressure liquid chromatography (HPLC) techniques developed for "fingerprinting" roses were used to positively identify cultivars difficult to distinguish. 'White Saratoga' and 'White Lightning' were positively identified on the basis of their flavonol contents, which widely differ quantitatively. The HPLC "fingerprints" of the red cultivars 'Gypsy' and 'Scarlet King' also positively identified each cultivar. Both quantitative and qualitative flavonol differences were evident. The major anthocyanin in both red cultivars was cyanidin 3,5-diglucoside, and only 'Gypsy' contained traces of pelargonidin 3,5-diglucoside.

Cultivars identified by scanning electron microscopy (SEM) - Delaware, Ohio. Accurate identification or "fingerprinting" of cultivars is becoming increasingly important for research workers, nurserymen, and consumers. Twenty

cultivars of hybrid tea rose, Rosa hybrida, were identified by SEM on the basis of differences in stomatal configurations, leaf wax textures, stem surfaces, and oil gland morphology. Closely related species of black maple, Acer nigrum, and two sugar maple cultivars, Acer saccharum, were separated due to differences on the surfaces of leaf hairs as well as by the presence or absence of flocculent leaf wax.

Benzimidazole-tolerant strains of Verticillium found - Delaware, Ohio. Benzimidazole fungicides have exhibited some potential for controlling Verticillium wilt in a number of herbaceous and woody plants, including maples, the leading shade tree. The discovery of high levels of benzimidazole tolerance in Verticillium dahliae is significant because it points to the possible reduction in efficacy when using benzimidazoles to control Verticillium wilt. The fact that all tolerant strains thus far discovered are mycelial and white provides a useful marker for this physiological trait. It also provides a useful means of identifying the tolerant characteristic and will be a good marker in genetic recombination studies between white mycelial isolates and the black microsclerotial ones. The tolerant, white mycelial isolates have been shown to be less pathogenic to American elms and red maples and less able to survive in soil than microsclerotial isolates.

Plant and environmental factors found to influence efficacy of growth retardants - Delaware, Ohio. Increases in canopy size of sycamore trees decreased the effectiveness of dikegulac injections in retarding growth. Conversely, increased moisture stress enhanced the growth retardation effects of maleic hydrazide. Full knowledge of the effects of environmental factors on tree growth is essential for accurately evaluating, and making recommendations for applying, growth retardants under field conditions.

Photosynthesis by cuttings found to be important to rooting - Corvallis, Oregon. A significant question to the propagation of leafy cuttings in commercial horticulture is the extent to which their photosynthesis affects root formation. Tests showed that root formation on leafy pea cuttings was reduced by 50 percent when either light or CO_2 was reduced to the compensation point during the rooting period. This indicates that photosynthesis has a major role in root formation.

Biotypes of rose powdery mildew identified by detached-leaf tests - Corvallis, Oregon. By using sporulation characteristics and disease reactions on differential rose cultivars, it was possible to distinguish five biotypes of Sphaerotheca pannosa var. rosae. When these reactions were compared on detached and attached rose leaves, it was shown that the detached leaf method was easier, yet gave the same results as the attached leaf method. Thus, new biotypes that arise in commercial practice can readily be characterized by the detached leaf tests.

Root rot severity of nursery plants increased by inadequate light - Corvallis, Oregon. Plants may receive inadequate light in the field under certain conditions or during post-production handling. Tests showed that 92 percent shade, but not 73 percent, significantly increased root rot and mortality of Monterey pine inoculated with Phytophthora cinnamomi. The increase may have been due to altered levels of microbial biocontrol organisms that are present

in the rhizophere and that normally check pathogen progress.

Weevil feeding stimulants and repellents present in rhododendrons identified - Puyallup, Washington. It was previously shown that weevil feeding preference on rhododendrons was controlled by chemical feeding stimulants present in susceptible plants or repellents present in resistant plants. The stimulants have now been identified as sucrose and/or several nonpolar substances, including sitosterol, quercetin-3-glucoside, and quercetin-3-rhamnoside. The volatile terpene germacrone has been identified as a weevil repellent present in resistant lepidote rhododenrons. Slow-release formulations containing germacrone might therefore be used to control feeding damage by these pests that occur on many horticultural species.

Technological Objective 3: To enhance environmental quality by reducing pollution and improving human surroundings.

Research Locations:

Beltsville, Maryland
Delaware, Ohio

Examples of Recent Progress:

Coleus cultivars found to differ widely in tolerance to air pollutants - Beltsville, Maryland. Fifteen cultivars of Coleus were tested for tolerance to ozone and sulfur dioxide. Of the nine cultivars injured by both pollutants, 'Buckley Supreme' and 'Glory of Luxembourg' showed the greatest sensitivity to O_3 and SO_2. 'Pineapple Beauty' was not injured by either pollutant. 'Marty,' 'Paisley Shawl,' 'Campfire,' and 'Aetna,' were not injured by SO_2 and were only slightly injured by the highest dose of O_3. The wide range in tolerance among the 15 cultivars tested indicates a potential for breeding and selecting cultivars resistant to these pollutants.

Poinsettia cultivars found to vary in sensitivity to SO_2 - Beltsville, Maryland. Significant differences in SO_2 injury were found among 17 cultivars of poinsettia belonging to four varietal groups or families. Seven days after SO_2 fumigation (3 ppm for 3 hours), bracts showed less injury than did the true leaves. Judging by injury to bracts, sports of 'Eckespoint C-1' family were the most resistant. 'Annette Hegg' family and sports of 'Mickkel Rochford' were the most sensitive to SO_2 fumigation. No relationship was found between pigment content and degree of SO_2 injury; nor was there a relationship between location of the pigment in the epidermis or internal tissue and SO_2 sensitivity.

Fumigation chambers for intact woody plants designed and constructed - Delaware, Ohio. Four 208-liter fumigation chambers were constructed for use with containerized seedlings up to 89 cm in height. The chambers were designed so that four concentrations of SO_2 or other gaseous pollutants can be used separately or in combination at light intensities ranging up to 8000 foot-candles.

Influence of air pollution stress on stomates investigated - Delaware, Ohio. Laboratory investigations of landscape tree plant responses to gaseous air pollutants under carefully controlled environmental conditions suggest that the basis for tolerance to some pollutants does not reside in stomatal sensitivity as previously hypothesized. Although the stomates of some resistant species responded to extremely low levels of SO_2 (0.05 ppm), stomates of other resistant species were not affected by SO_2 concentrations in excess of 3.0 ppm.

CULTIVARS RELEASED

Name or Designation	Release Agencies	Reason for Release
Camellia species hybrids		
Frost Prince	ARS	Cold tolerance and fall blooming.
Frost Princess	ARS	Cold tolerance and fall blooming.
Two Marthas	ARS	Tolerance to heat and high light intensity.
Ack-Scent	ARS	High floral fragrance.
Ilex crenata		
Twiggy	ARS	Compact, globose plant habit.
Pyrus calleryana		
Whitehouse	ARS	Narrow columnar crown. Plant suited for limited space.
Capitol	ARS	Extremely narrow crown. Plant useful for windbreaks and highly restricted space.

Washington, D.C.

Ackerman, W. L. 1981. Recent breeding developments in camellias in the United States: Fragrance, heat and cold tolerance. Garden Life (of Japan) 155(2):64-69. (In Japanese).

Ackerman, W. L. 1981. Extending the range of fall flowering camellias northward. Amer. Camellia J. 36(4):5,6.

Ackerman, W. L. 1981. Growing the yellow camellia (C. chrysantha). Amer. Camellia J. 36(1):4-6.

Ackerman, W. L. 1981. Some old and new fragrant flowered camellia selections. Amer. Camellia Yrbk. 1981:113-115.

Ackerman, W. L. and K. Ackerman. 1981. The use of microfoam. Amer. Camellia J. 36(4):9-11.

Ackerman, W. L. and Margot Williams. 1981. 'Frost Prince' and 'Frost Princess' camellias. HortScience 16:690.

Ackerman, W. L. and Margot Williams. 1981. New cold hardy camellia hybrid selections. Amer. Camellia Yrbk. 1981:117-120.

Ackerman, W. L. and Margot Williams. 1981. Hardy camellias for fall color. Amer. Nurseryman 154(4):7,30.

Ackerman, W. L. and Margot Williams. 1981. Extending the blooming season and prolonging flower longevity of Iris kaempferi. Amer. Iris Soc. Review 18(1):1-3.

Egolf, D. R. 1981. 'Helene' rose of sharon (Althea). HortScience 16:226-227.

Egolf, D. R. 1981. Hibiscus syriacus 'Helene', new from the U.S. National Arboretum. Southern Florist & Nurseryman 94(4):15,19.

Egolf, D. R. 1981. Meet 'Helene', a new Hibiscus syriacus. Amer. Nurseryman 154(6):11, 66-67.

Egolf, D. R. 1981. U.S. National Arboretum introduces Hibiscus syriacus 'Helene'. The Seed Pod 32(2):12-13, 29.

Egolf, D. R. 1981. 'Chesapeake' Viburnum. HortScience 16:350.

Egolf, D. R. 1981. 'Eskimo' Viburnum. HortScience 16:691.

Egolf, D. R. 1981. 'Muskogee' and 'Natchez' Lagerstroemia. HortScience 16:576-577.

Eisenbeiss, G. K. and T. R. Dudley. 1981. International holly registration. Holly Letter No. 70. pp. 1.

Santamour, Frank S., Jr. 1981. City trees for the future. Floralies Internationales Symp. Proc. pp. 25-35.

Santamour, Frank S., Jr. 1981. How to build a better tree. Hort. Res. Inst. New Horizons - 1980. pp. 1-3.

Shimizu, Holly H. 1981. A walk through the National Herb Garden. Brooklyn Botanic Garden Record/Plant & Garden 36(4):4-10.

Shimizu, Holly H. 1981. Dioscorides Garden, American Indian Garden, Industrial Garden. The Herbarist, A publication of The Herb Society of America. No. 47. pp. 7-14.

Shimizu, Holly H. 1981. The development and importance of the National Herb Garden. J. of Natl. Agricultural Library Associates. New Series Vol. 5(3&4). pp. 93.

Williams, Margot. 1981. Tissue culture of diploid Hippeastrum reginae Herb. The Amaryllis Bul. 2(1):7-9.

Williams, Margot. 1981. Chromosome count for Paromongaia weberbaueri Velarde. Plant Life 37:83-89.

Beltsville, Maryland

Gillaspie, A. G., Jr., M. J. Davis, R. W. Harris, and R. H. Lawson. 1981. Isolation and pathogenicity of the ratoon stunting disease bacterium. Intern. Sugar J. 83:324-326.

Griesbach, R. J. 1981. Genetics and taxonomy. Orchid Digest 45:219-221.

Griesbach, R. J., P. Koivuniemi, and P. S. Carlson. 1981. Extending the range of plant genetic manipulations. BioScience 31:754-756.

Lawson, R. H. 1981. Controlling virus diseases in major international flower and bulb crops. Plant Dis. 65:780-786.

Lawson, R. H. 1981. Contributed three chapters. In Morrison Rogoso (ed.) National Work Conference on Microbial Collections of Major Importance to Agriculture. March 1980. The American Phytopathological Society, pp. 52.

Semeniuk, P. and H. E. Heggestad. 1981. Differences among coleus cultivars in tolerance to ozone and sulfur dioxide. J. Hered. 72:459-460.

Mandan, North Dakota

Cunningham, R. A. and E. J. George. 1981. 'Dakota Sunrise' cinquefoil. HortScience 16:225-226.

Frank, A. B. 1981. Water relations of four windbreak tree species during soil drying. J. Soil and Water Conservation 37:189-192.

Krupinsky, J. M. 1981. Botryodiploida hypodermia and Tubercularia ulmea in cankers on Siberian elm in Northern Great Plains windbreaks. Plant Dis. 65:677-678.

Delaware, Ohio

Krause, C. R. 1981. Diagnosis of ambient air pollution injury to red maple leaves. Proc. SEM-81, III SEM Inc., AMF O'Hare, IL, pp. 202-206.

Roberts, B. R. 1981. Abiotic elm diseases: Salt and air pollution. In R. J. Stipes and R. J. Campana (eds.). Compendium of Elm Diseases. American Phytopathological Society, St. Paul, MN. pp. 61-62.

Roberts, B. R. and S. C. Domir. 1981. Influence of sulfur dioxide fumigation on regrowth of American sycamore seedlings treated with maleic hydrazide. HortScience 16:84-85.

Schreiber, L. R. and G. F. Gregory. 1981. Growth of Ceratocystis ulmi on low concentrations of hydrochloride and phosphate salts of methyl 2-benzimidazolecarbamate and on thiabendazole hypophosphite. Phytopathology 71:1261-1263.

Schreiber, L. R. and A. M. Townsend. 1981. Dothiorella wilt. In R. J. Stipes and R. J. Campana (eds.). Compendium of Elm Diseases. American Phytopathological Society, St. Paul, MN. pp. 24-25.

Schreiber, L. R. and A. M. Townsend. 1981. Sources and genetics of host resistance in shade trees. In M. Mace et al. (eds.): Fungal Wilt Diseases of Plants. Academic Press. New York. pp. 413-429.

Townsend, A. M. 1981. Genetic response of trees to pollution. In P. K. Khosla (ed.). Advances in Forest Genetics. Ambika Publications, New Delhi, India. pp. 311-316.

Townsend, A. M. 1981. Identifying trees tolerant to soil salt. Proc. Metropolitan Tree Improvement Conf. (METRIA) III:24-32.

Corvallis, Oregon

Axelrood-McCarthy, P. E. and R. G. Linderman. 1981. Ethylene production by cultures of Cylindrocladium floridanum and C. scoparium. Phytopathology 71:825-830.

Coyier, D. L. 1981. Chlorotic ringspot and decline of ornamental shamrock (Oxalis regnelli). Plant Dis. 65:275-276.

Davis, T. D. and J. R. Potter. 1981. Current photosynthate as a limiting factor in adventitious root formation on leafy pea cuttings. J. Amer. Soc. Hort. Sci. 106:278-282.

Puyallup, Washington

Byrne, T. G. and R. P. Doss. 1981. Development time of 'Cara Mia' rose shoots as influenced by pruning position and parent shoot diameter. J. Amer. Soc. Hort. Sci. 106:98-100.

Doss, R. P. and J. K. Christian. 1980. Iris pre-forcing treatments: A summary of three years of trials. Proc. 32nd Northwest Bulb Grower's Conf. pp. 17-25.

Doss, R. P., J. K. Christian, and J. L. Paul. 1980. Nutrient requirements for bulbous iris forcing. Proc. 32nd Northwest Bulb Grower's Conf. pp. 4-11.

Doss, R. P. 1981. Effects of durations of 32°C and 20°C postharvest bulb treatments on early forcing of Ideal iris. Can. J. Plant Sci. 61:647-652.

Doss, R. P. 1981. Bulbous iris forcing -- fertilizer requirements. Ornamentals Northwest Newsletter 5(4):4-5.

Doss, R. P. 1981. The chemical basis for resistance of certain Rhododendron cultivars to foliar feeding by root weevils. Ornamentals Northwest Newsletter 5(5):6-8.

NRP 20030 - FLORIST AND NURSERY CROPS

WASHINGTON, D.C. 20002

H. M. Cathey
U. S. National Arboretum
202-472-9242

TIFTON, GA 31794

M. W. Smith
Georgia Coastal Plain
Experiment Station
912-386-3355

BELTSVILLE, MD 20705

R. H. Lawson
Florist and Nursery Crops Lab.
Horticultural Science Institute
BARC-West
(FTS) 344-3244

MANDAN, ND 58554

R. Cunningham
Northern Great Plains
Research Laboratory
P.O. Box 459
701-663-6448

DELAWARE, OH 43015

L. R. Schreiber
Nursery Crops Research Lab.
P.O. Box 365
614-363-1129

CORVALLIS, OR 97330

R. G. Linderman
Ornamental Plants Res.
Lab.
3420 SW Orchard Street
(FTS) 420-4544

PUYALLUP, WA 98371

R. P. Doss
Western Washington Research
and Extension Center
206-593-8531

National Research Program 20040

BREEDING AND PRODUCTION - CORN, SORGHUM, AND MILLETS

Technological Objective 1: New and improved genetic populations, breeding lines, and hybrids of corn, sorghum, and millets that combine improved yield potentials and favored quality characters, including reduced contents of undesirable constituents, with better resistance to pests, tolerance to environmental stress, and adaptation for mechanized culture, harvesting, and handling. Develop basic genetic, cytogenetic, physiologic, and biochemical knowledge necessary to accomplish these goals.

This program is part of the USDA-ARS Mission 2 - Agricultural Production Efficiency with the goal of producing new knowledge and improved germplasm to increase grain productivity. These important feed grains (see NRP 20100 for forage aspects of these commodities) are of major significance for both domestic and export utilization as food, feed, and industrial use. To a lesser degree the program contributes to Mission 3 - Agricultural Marketing and Distribution and Mission 10 - Foreign Agricultural Development. The program is organized under two technological objectives.

NPS Contact: K. F. Schertz

Research Locations:

Gainesville, Florida
Tifton, Georgia
Urbana, Illinois
West Lafayette, Indiana
Ames, Iowa
Manhattan, Kansas
Mississippi State, Mississippi
Columbia, Missouri
Lincoln, Nebraska
Raleigh, North Carolina
Wooster, Ohio
Mayaguez, Puerto Rico
Brookings, South Dakota
College Station, Texas
Kenya, East Africa

Examples of Recent Progress:

Corn:

Friable calli with changed DNA constitution isolated - Gainesville, Florida. Friable calli were isolated from corn with S-cytoplasmic-nuclear male sterility and it was determined that these calli lacked the plasmidlike DNA's. These DNA's may be associated with mitochondrial DNA as the result of transposition.

Dominance and epistasis are important genetic effects in the control of maysin content of silks of corn - Tifton, Georgia. High levels of maysin were detected in some plants within progeny from crosses, indicating the potential for successful selection. Dominance and epistasis seem to be more important than additive gene action in controlling maysin content. Relationships of silk feeding and maysin content are under study.

Corn earworm moths were heavily contaminated with spores of Aspergillus flavus - Tifton, Georgia. Eighty-four percent of the trapped moths of corn earworm carried spores for A. flavus. They were, thus, potential sources of infestation of corn with A. flavus, a producer of aflatoxin.

Polyacrylamide gel technique was refined for the study of variation in endosperm proteins - Urbana, Illinois. Combinations and modifications of techniques were tested to develop a more reliable procedure for characterizing the endosperm proteins of corn. With the technique developed, as little as 0.06 g ordinary protein and 0.25 g zein can be detected.

More than one gene locus was determined to control linoleic acid in the oil of corn germ - Urbana, Illinois. Results from segregating progeny of five parents indicated that linoleic acid content in corn germ oil was controlled by more than a single locus. There was evidence for maternal influence.

No indication was found of races of Colletotrichum graminicola - West Lafayette, Indiana. Seventy-five isolates of C. graminicola were tested on corn lines with known disease responses. None of the isolates differed, thus providing no evidence for physiological races in this organism.

Early detection of plants with strong roots established as reliable for improving standability - Ames, Iowa. Root pulling studies indicated that selections for root strength could be made before flowering. Heritability estimate over populations was 36%, indicating that selection at that time could be effective and, thereby, those progenies superior in root strength could be identified in time to make the appropriate crosses in the same season in which tested.

Effects of genetic drift on gains from recurrent selection - Ames, Iowa. Studies of the effectiveness of various recurrent selection procedures and the mitigating factors were continued. Selected lines were recombined to form three subpopulations with the objective of determining the effect of genetic drift on realized gains from recurrent selection for agronomically desirable characteristics.

Procedures developed for testing of resistance to stalk rotting organisms - Ames, Iowa. Progenies from selected and nonselected plants were compared for stalk breakage under conditions of heavy pathogen infection. Determination can then be made of the most effective selection system to use for deriving resistant lines.

Protein and lysine content of selected lines were determined - Manhattan, Kansas. Lines from selection programs were evaluated for content of protein and the amino acid lysine.

A corn inbred resistant to leaf feeding of the southwestern corn borer was selected for germplasm release - Mississippi State, Mississippi. Among the many lines, both local and introduced, that were tested, some showed desirable resistance to leaf feeding by the southwestern corn borer. One of these was selected for release as germplasm. This release will be available to private and public breeders and should result in more resistant hybrids.

A "pinbar" instrument was effective for inoculating ears of corn with Aspergillus flavus - Mississippi State, Mississippi. A bar with attached pins was used to infest corn with A. flavus. Consistent differences were obtained among hybrids in percentage of infected kernels. The technique shows promise as a way in which to select resistant lines.

Grasses found to be symptomless hosts of maize dwarf mosaic viruses - Mississippi State, Mississippi. Perennial grass species, Festuca rubra, Glyceria striata, Stripa avenacia, and others collected in Mississippi contained maize dwarf mosaic virus (MDMV) strain A, MDMV strain B, and/or sugarcane mosaic virus.

Plants infested with southwestern corn borer larvae at three weeks were most severely affected - Mississippi State, Mississippi. When infestations with southwestern corn borer larvae were made at weekly intervals from three to eight weeks after planting, those at three weeks were most effective. Infestations at three weeks affected plant height and infestations at three and at four weeks affected yield.

The anthocyanin gene Bz has been identified as the structural gene for an enzyme isolated and characterized from corn pollen, seed, and leaf sheath - Columbia, Missouri. The gene Bz was determined to be the structural gene for the enzyme uridine diphosphateglucose:quercetin glucosyltransferase. A unique dominant gene dosage:enzyme level relationship has been established.

Development of a tendency toward preferential pairing of chromosomal segments is noted in tetraploids - Columbia, Missouri. A marked decrease in pollen with waxy (wx) versus nonwaxy (Wx) starch may be influenced by preferential pairing. Such preferential pairing may indicate a tendency toward allotetraploidization in autotetraploid corn.

B-A translocations are being refined for use in definitive gene linkage studies - Columbia, Missouri. Stocks with translocations between B and A chromosomes are being tested and backcrossed. Tests are being made to identify the most effective stocks with translocations on specific chromosome arms. Most of the translocation stocks have been back-crossed to a single line for seven or more generations to prepare them for use.

Selection was completed to evaluate progress in improving stalk strength - Columbia, Missouri. Populations have been established for high levels of resistance to stalk crushing. Some are from those previously selected for high resistance and some from those for low resistance. The intent is to develop lines with strong stalks and high grain yields.

Aspergillus flavus was discovered in parts of the corn plant in addition to the kernels - Columbia, Missouri. *A. flavus* was found to invade the roots, leaves, and stems of corn plants. The effects of infection at these other sites on kernel infection are problematical but could be significant.

Duplicate factors found to control yellow and purple pigments and pollen function - Columbia, Missouri. Genetic factors C2 and Whp acted as duplicate factors and may permit the design of male-sterility systems. Mixtures of white- and yellow pollen and sequential pollinations revealed no influence of different types of pollen on the effectiveness of each other.

Sensitivity to photoperiod is controlled additively - Raleigh, North Carolina. Photosensitivity in corn was found to be controlled mainly by additive gene action. This information will be useful in developing systems for the efficient introduction and incorporation of corn germplasm into U.S. research programs.

Aflatoxin production monitored in a controlled environment - Raleigh, North Carolina. In a controlled environment aflatoxin was detected two days after inoculation and reached high levels in nine days. This information may now be used as a base against which to compare the effects of environmental variables.

Population dynamics in host-pathogen systems - Raleigh, North Carolina. A revised model of population genetics of host-pathogen systems that includes population size, as well as gene frequencies, is being developed and tested against other models. With an earlier model, equilibrium points for gene frequencies were stable for some combinations of values but not for others.

Advanced generation retains resistance of *Zea diploperrenis* to maize chlorotic dwarf virus - Wooster, Ohio. *Zea diploperrenis*, a relative of corn from southern Mexico, is being utilized as a source of resistance to maize chlorotic dwarf virus (MCDV). Some progenies in their fourth backcross generation are resistant. This source has promise of being useful to produce corn lines resistant to MCDV, the cause of a major U.S. corn viral disease.

The incidence and inheritance of resistance to maize dwarf mosaic virus (MDMV) are being determined - Wooster, Ohio. Surveys of grass species did not reveal any new hosts of MDMV. Progeny from crosses are being tested to determine the genetic control of resistance.

Maize stripe virus and rice stripe virus were found to be closely related members of a new virus group - Wooster, Ohio. The maize stripe virus (MStpV) and rice stripe virus (RSV) were characterized from determinations of molecular weights of single capsid and noncapsid protein and were closely related. The findings may help resolve the etiology of some viral diseases by providing a basis for reliably detecting and isolating the causal viruses.

Superior lines selected from Latin American corn were intercrossed for further testing - Mayaguez, Puerto Rico. Lines selected from Mayorbella x Diente de Cabella progenies were advanced for additional selection of corn adapted to Puerto Rico and other Caribbean locations.

Late maturing lines tended to have less rootworm damage than did earlier lines - Brookings, South Dakota. In a test of 48 lines, the later maturing lines tended to have less rootworm feeding than did the others. These differences may provide a basis for determining the environmental and/or plant characteristics involved in resistance and thus facilitate genetic and selection programs.

Two genes determined to control resistance to downy mildew - College Station, Texas. Resistance to downy mildew, caused by Peronosclerospora sorghi, was determined to be partially dominant and the response was controlled by two linked factors. This information will improve the efficiency of breeding programs incorporating downy mildew resistance into corn hybrids.

Sorghum:

Plasmidlike DNA's of sorghum share characteristics with DNA's of corn - Gainesville, Florida. Two plasmidlike DNA's of male-sterile sorghum share molecular homology with plasmidlike DNA's in male-sterile corn. The plasmidlike DNA's of sorghum also share homology with normal cytoplasm of corn. These similarities suggest some shared male-sterility characteristics in these two crops.

The primary site sensitive to Periconia toxin was determined to be within the cell, rather than at the membrane - West Lafayette, Indiana. Membrane protein composition of susceptible sorghum genotypes was indistinguishable from that of resistant genotypes. Resistant and susceptible genotypes take up toxin at identical rates.

Water-use efficiency of plants was changed as moisture stress was imposed - Lincoln, Nebraska. The efficiency of sorghum to produce total dry matter per unit of water increased as the water level available to the roots was lowered. At the same time, this water-use efficiency calculated on a grain production basis decreased as water was restricted. These results indicate that a greater percentage of photosynthate was translocated to the roots when water was restricted.

Rapid and inexpensive methods for screening sorghum plants for tolerance to mineral element deficiencies and toxicities in nutrient solutions were developed - Lincoln, Nebraska. Mineral element variables were added to a base nutrient solution to establish tolerances. Diversity was found among lines for response to N, P, and Fe deficiencies and Al and Mn tolerances. Plants exhibiting wide variations to these elements had differences in element uptake rates, root phosphates activities, and distribution within the plant.

The relative efficiencies of breeding methods were established - Lincoln, Nebraska. Top crosses of females x random mating populations were found useful for preliminary evaluation of females. S_1 progenies randomly taken from the same base population in three years exhibited small mean population differences for yield, height, and flowering; but practically, the mean population differences were small and would not be expected to affect the success of recurrent selection.

Disease organisms differed in their effects on stress-related physiological parameters - Lincoln, Nebraska. Maize dwarf mosaic virus did not cause a major change in the gas exchange rates or the resistance to diffusion of gases in fested plants. Tissue infected with Peronosclerospora sorghi, however, had a great alteration in gas exchange rate.

The conversion of tropical sorghum lines to adaptation in the U. S. continued - Mayaguez, Puerto Rico. Additional lines were entered into the conversion program and others were advanced in generations to provide useful germplasm not previously available to private and public breeders in the U. S.

Diverse cytoplasms identified and incorporated into germplasm - College Station, Texas. Cytoplasms from two diverse sources were further established as differing from milo, the cytoplasm now used to induce male sterility in sorghum. These cytoplasms are now being incorporated into established lines to determine their potential usefulness. These and other newly identified cytoplasms will diversify the cytoplasms in sorghum hybrids and thus reduce vulnerability to hazards.

Technological Objective 2: New and improved cultural and management practices that increase corn, sorghum and millet yields, minimize production losses, improve quality attributes, and conserve and use scarce resources efficiently.

Research Locations:

West Lafayette, Indiana
Mississippi State, Mississippi
Columbia, Missouri
Brookings, South Dakota

Examples of Recent Progress:

Corn:

Infestation of corn with fall armyworm was most effective at the 6-leaf stage - Tifton, Georgia. Applications of fall armyworm larvae at the 6-leaf stage resulted in the most damage to the plants from the insects. Twenty larvae per plant in two applications was most effective.

An applicator was developed for low volume solutions with NH_3 - West Lafayette, Indiana. An applicator was developed that can be used to apply NH_3 and other chemicals simultaneously without prior mixing. Substances unstable when mixed with NH_3 can now be applied at the same time as NH_3.

Stalk strength is correlated with kernel hardness - Columbia, Missouri. A study of factors affecting kernel breakage revealed that resistance to kernel breakage by impaction was positively correlated with improvement in stalk crushing strength. This may provide an opportunity for simultaneous improvement in these characteristics.

RELEASES

Name or Designation	Release Agencies	Reason for Release
CORN		
B87	ARS-Iowa AES	Inbred line with resistance to first-brood European corn borer
BS23	ARS-Iowa AES	Synthetic that contains some teosinte (*Zea mexicana*) germplasm and has "stay-green" characteristics
Oh570	ARS-Ohio AES	Inbred with tolerance to maize dwarf mosaic virus (MDMV) and maize chlorotic dwarf virus (MCDV)
Oh572	ARS-Ohio AES	Inbred with tolerance to maize dwarf mosaic virus (MDMV) and maize chlorotic dwarf virus (MCDV)
OHCB-TF	ARS-Ohio AES	Synthetic derived from crosses of tropical flint and corn belt types and has desirable agronomic characteristics

P U B L I C A T I O N S

Gainesville, Florida

Chourey, P. S. 1981. Electrophoretic analysis of sucrose synthetase proteins in the complementing heterozygotes at the shrunken locus in maize. Theor. Appl. Genet. 59: 231-234.

Chourey, P. S., and D. Zurawski. 1981. Callus formation from protoplasts of a maize cell culture. Theor. Appl. Genet. 59: 341-344.

Gengenbach, B. G., J. A. Connelly, D. R. Pring, and M. F. Conde. 1981. Mitochondrial DNA variation in maize plants regenerated during tissue culture selection. Theor. Appl. Genet. 59: 161-167.

Tifton, Georgia

Lillehoj, E. B., W. F. Kwolek, M. S. Zuber, A. J. Bockholt, O. H. Calvert, W. R. Findley, W. D. Guthrie, E. S. Horner, L. M. Josephson, S. King, A. Manwiller, D. B. Sauer, D. Thompson, M. Turner, and N. W. Widstrom. 1980. Aflatoxin in corn before harvest: Interaction of hybrids and locations. Crop Sci. 20: 731-734.

McMillian, W. W., N. W. Widstrom, D. M. Wilson, and R. A. Hill. 1980. Transmission by maize weevils of Aspergillus flavus and its survival on selected corn hybrids. J. Econ. Entomol. 73: 793-794.

Widstrom, N. W., W. W. McMillian, and B. R. Wiseman. 1981. The influence of timely harvest on maize weevil feeding and fecundity on corn. J. Ga. Entomol. Soc. 16: 234-239.

Widstrom, N. W., D. M. Wilson, and W. W. McMillian. 1981. Aflatoxin contamination of preharvest corn as influenced by timing and method of inoculation. Appl. Environ. Microbiol. 42: 249-251.

Wilson, D. M., N. W. Widstrom, L. R. Marti, and B. D. Evans. 1981. Aspergillus flavus group, aflatoxin, and bright greenish yellow fluorescence in insect-damaged corn in Georgia. Cereal Chem. 58: 40-42.

Urbana, Illinois

Weber, E. J. 1981. Compositions of commercial corn and soybean lecithins. J. Am. Oil Chem. Soc. 58: 898-901.

Wilson, C. M. 1981. Variations in soluble endosperm proteins of corn (Zea mays L.) inbreds as detected by disc gel electrophoresis. Cereal Chem. 58: 401-408.

Wilson, C. M., P. R. Shewry, A. J. Faulks, and B. J. Miflin. 1981. The extraction and separation of barley glutelins and their relationship to other endosperm proteins. J. Exp. Bot. 32: 1287-1293.

Wilson, C. M., P. R. Shewry, and B. J. Miflin. 1981. Maize endosperm proteins compared by sodium dodecyl sulfate gel electrophoresis and isoelectric focusing. Cereal Chem. 58: 275-281.

West Lafayette, Indiana

Dunkle, L. D., and T. J. Wolpert. 1981. Independence of milo disease symptoms and electrolyte leakage induced by the host-specific toxin from Periconia circinata. Physiol. Plant Pathol. 18: 315-323.

Huber, D. M., P. K. Karamesines, H. L. Warren, and D. W. Nelson. 1981. Equipment to mix chemical additives with anhydrous ammonia during application to soil. Agron. J. 73: 1046-1048.

Nicholson, R. L., and H. L. Warren. 1981. The issue of races of Colletotrichum graminicola pathogenic to corn. Plant Dis. 65: 143-145.

Warren, H. L. 1981. Registration of H102 and H103 maize germplasm. Crop Sci. 21: 477.

Ames, Iowa

Hallauer, Arnel R. 1981. Progress to date in the use of exotic materials in conventional breeding programs. Proc. 4th South African Maize Symp. 35-40.

Hallauer, Arnel. R. 1981. Selection and breeding methods. pages 3-55. In K. J. Frey (ed.) Plant Breeding II. Iowa State Univ. Press. Ames, IA.

Hallauer, Arnel R., and J. B. Miranda Fo. 1981. Quantitative Genetics in Maize Breeding. Iowa State University Press. 468 pp.

Lantin, M. M., and A. R. Hallauer. 1981. Response to reciprocal full-sib and mass selection in corn (Zea mays L.). Iowa Acad. Sci. 88: 172-178.

Moll, R. H., and O. S. Smith. 1981. Genetic variances and selection responses in an advanced generation of a hybrid of widely divergent population of maize. Crop Sci. 21: 387-391.

Vakili, N. G. 1981. Distribution of Phakopsora pachyrhizi on Lablab purpureus in Puerto Rico. Plant Dis. 65: 817-819.

Mississippi State, Mississippi

Davis, Frank M., and W. Paul Williams. 1981. Southwestern corn borer: comparison of techniques for infesting corn for plant resistance studies. J. Econ. Entomol. 73: 704-706.

Gordon, D. T., O. E. Bradfute, R. E. Gingery, J. K. Knoke, R. Louie, L. R. Nault, and G. E. Scott. 1981. Introduction: history, geographical distribution, pathogen characteristics, and economic importance. Pages 1-12 In D. T. Gordon, J. K. Knoke, and G. E. Scott, ed. Virus and Viruslike Diseases of Maize in the United States. South. Coop. Ser. Bull. 247. June 1981. 210 pp.

Josephson, L. M., and G. E. Scott. 1981. Sources of disease resistance in corn. Pages 132-136 In D. T. Gordon, J. K. Knoke, and G. E. Scott, ed. Virus and Viruslike Diseases of Maize in the United States. South. Coop. Ser. Bull. 247. June 1981. 210 pp.

Scott, G. E., and E. Rosenkranz. 1981. Effect of field distribution of maize dwarf mosaic diseased corn plants on yield. Plant Dis. 65: 802-803.

Scott, G. E., and E. Rosenkranz. 1981. Effectiveness of resistance to maize dwarf mosaic and maize chlorotic dwarf viruses in maize. Phytopathol. 71: 937-941.

Williams, W. P., and F. M. Davis. 1981. Evaluation of commercial corn hybrids for resistance to leaf feeding by the southwestern corn borer and the fall armyworm. Mississippi Agric. and For. Exp. Sta. Res. Rept. Vol. 5, No. 16.

Wiseman, B. R., W. P. Williams, and F. M. Davis. 1981. Fall armyworm: resistance mechanisms in selected corns. J. Econ. Entomol. 74: 622-624.

Columbia, Missouri

Coe, E. H., Jr., S. McCormick, and S. A. Modena, 1981. White pollen in maize. J. Hered. 72: 318-320.

Darrah, L. L., and M. S. Zuber. 1981. Missouri Crop Performance, 1980, White Maize. Spec. Rept. 263, Univ. of Missouri, Columbia, MO.

Holtmeyer, M. G., and J. R. Wallin. 1981. Incidence and distribution of airborne spores of Aspergillus flavus in Missouri. Plant Dis. 65: 58-60.

Lincoln, Nebraska

Bennett, J. M., and C. Y. Sullivan. 1981. Effects of water stress preconditioning on net carbon exchange of grain sorghum. Photosynthetica 15: 330-337.

Clark, R. B. 1981. Effect of light and water stress on mineral nutrient composition of plants. J. Plant Nutr. 3: 853-885.

Clark, R. B., J. C. Brown, R. A. Olsen, and J. H. Bennett. 1981. Biological aspects of iron in plants. pages 272-338. In Multicriteria for Iron and its Compounds. Environ. Protect. Agency, Cincinnati, OH.

Clark, R. B., P. A. Pier, D. Knudsen, and J. W. Maranville. 1981. Effect of trace element deficiencies and excesses on mineral nutrients in sorghum. J. Plant Nutr. 3: 357-373:

Furlani, P. R., and R. B. Clark. 1981. Screening sorghum for aluminum tolerance in nutrient solutions. Agron. J. 73: 587-594.

Knudsen, D., R. B. Clark, J. L. Denning, and P. A. Pier. 1981. Plant analysis of trace elements by X-Ray. J. Plant Nutr. 3: 61-75.

Olsen, R. A., R. B. Clark, and J. H. Bennett. 1981. The enhancement of soil fertility by plant roots. Am. Sci. 69: 378-384.

Ross, W. M., K. D. Kofoid, J. W. Maranville, and R. L. Voigt. 1981. Selecting for grain protein and yield in sorghum random-mating populations. Crop Sci. 21: 774-777.

Sullivan, C. Y., D. G. Watts, D. P. Garrity, and R. E. Maurer. 1981. Responses of sorghum and corn to limited irrigation. Proc. 35th Ann. ASTA Corn and Sorghum Res. Conf., 1980, Chicago. pp. 205-218.

Raleigh, North Carolina

Goodman, M. M., K. J. Newton, and C. W. Stuber. 1981. Malate dehydrogenase: Viability of cytosolic nulls and lethality of mitochondrial nulls in maize. Proc. Natl. Acad. Sci. 78: 1783-1785.

Imhoff, M. W., C. E. Main, and K. J. Leonard. 1981. Effect of temperature, dew period, and age of leaves, spores and source pustules on germination of bean rust urediospores. Phytopathol. 71: 577-583.

Leonard, K. J., and R. H. Moll. 1981. Durability of general resistance: Evaluation of cultivar x isolate interactions. Proc. Symp. IX Int. Congr. Plant Prot. 5-11 August 1979. Washington, D.C. Vol. I. pp. 190-193.

Thompson, D. L. 1981. Growth of gaspe flint corn and three crosses in controlled environments. Research Report No. 79. Dep. Crop Sci. N.C. State University, Raleigh, N.C. 71 pp.

Wooster, Ohio

Findley, W. R., L. M. Josephson, and E. J. Dollinger. 1981. Breeding for disease resistance in corn. Pages 137-140 In D. T. Gordon, J. K. Knoke, and G. E. Scott, ed. Virus and Viruslike Diseases of Maize in the United States. South. Coop. Ser. Bull. 247. June 1981 210 pp.

Gingery, R. E. 1981. Chemical and physical properties of maize viruses in the United States. Pages 38-29 In D. T. Gordon, J. K. Knoke, and G. E. Scott, ed. Virus and Viruslike Diseases of Maize in the United States. South. Coop. Ser. Bull. 247. June 1981. 210 pp.

Gingery, R. E., and D. T. Gordon. 1981. Assays for viruses and mycoplasms infecting Maize in the United States. Pages 19-24 In D. T. Gordon, J. K. Knoke, and G. E. Scott, ed. Virus and Viruslike Diseases of Maize in the United States. South. Coop. Ser. Bull. 247. June 1981. 210 pp.

Gingery, R. E., D. T. Gordon, L. R. Nault, and O. E. Bradfute. 1981. Maize chlorotic dwarf virus. Pages 10-32 In E. Kurstak, ed. Handbook of Plant Virus Infections-Comparative Diagnosis. Elsevier/North Holland Biomedical Press, Amsterdam. 943 pp.

Gingery, R. E., L. R. Nault, and O. E. Bradfute. 1981. Maize stripe virus: characteristics of a member of a new virus class. Virology 112: 99-108.

Gordon, D. T., O. E. Bradfute, R. E. Gingery, J. K. Knoke, R. Louie, L. R. Nault, and G. E. Scott. 1981. Introduction: history, geographical distribution, and economic importance. Pages 1-12 In D. T. Gordon, J. K. Knoke, and G. E. Scott, ed. Virus and Viruslike Diseases of Maize in the United States. South. Coop. Ser. Bull. 247. June 1981. 210 pp.

Knoke, J. K., R. J. Anderson, W. R. Findley, R. Louie, J. J. Abt, and D. T. Gordon. 1981. The reaction of sweet corn hybrids to maize dwarf mosaic dwarf virus strains and maize chlorotic dwarf virus. Ohio Agric. Res. Dev. Cent. Res. Bull. 1135. 22 pp.

Knoke, J. K., R. Louie, L. V. Madden, and D. T. Gordon. 1981. The spread of maize dwarf mosaic virus from johnsongrass to maize. Phytopathol. 71: 886.

Louie, R., D. T. Gordon, and P. E. Lipps. 1981. Transmission of maize white line mosaic virus. Phytopathol. 71: 1116.

Louie, R., and J. K. Knoke. 1981. Solid stream inocula for transmission of maize dwarf mosaic virus. Phytopathol. 71: 891.

Louie, R., and J. K. Knoke. 1981. Symptoms and disease diagnosis. Pages 13-18 In D. T. Gordon, J. K. Knoke and G. E. Scott, ed. Virus and Viruslike Diseases of Maize in the United States. South. Coop. Ser. Bull. 247. June 1981. 210 pp.

Nault, L. R., and W. R. Findley. 1981. Zea diploperennis primitive relative offers new traits for corn improvement. Ohio Report 66 (6): 90-92.

Scott, G. E., W. R. Findley, and E. J. Dollinger. 1981. Genetics of resistance in corn. Pages 141-144 In D. T. Gordon, J. K. Noke, and G. Scott, ed. Virus and Viruslike Diseases of Maize in the United States. South. Coop. Ser. Bull. 247. June 1981. 210 pp.

Mayaguez, Puerto Rico

Schertz, K. F., D. T. Rosenow, and A. Sotomayor-Rios, 1981. Registration of three pairs (A and B) of sorghum germplasm with A2 cytoplasmic genic sterility system. (Reg. Nos. GP 70 to 72) Crop Sci. 21: 148.

Sotomayor-Rios, A., and A. Santiago, 1981. Performance of F_1 hybrids from crosses of three sudangrasses and six forage sorghums with a Rhodesian sudangrass. J. Agric. Univ. P.R. 50(2): 73-112.

Sotomayor-Rios, A., and F. Zannier-Valenzuela. 1981. Agronomic comparison, hydrocyanic acid potential (HCN-p) and nutritive evaluation of parents, single crosses and three-way hybrids in Puerto Rico. (In Spanish.) In: XXVII Annual Meeting, PCCMCA, Santo Domingo, Dominican Republic.

Brookings, South Dakota

Kahler, A. L., and R. W. Allard. 1981. World-wide patterns of genetic variation among four esterase loci in barley (Hordeum vulgare L.). Theor. Appl. Genet. 59: 101-111.

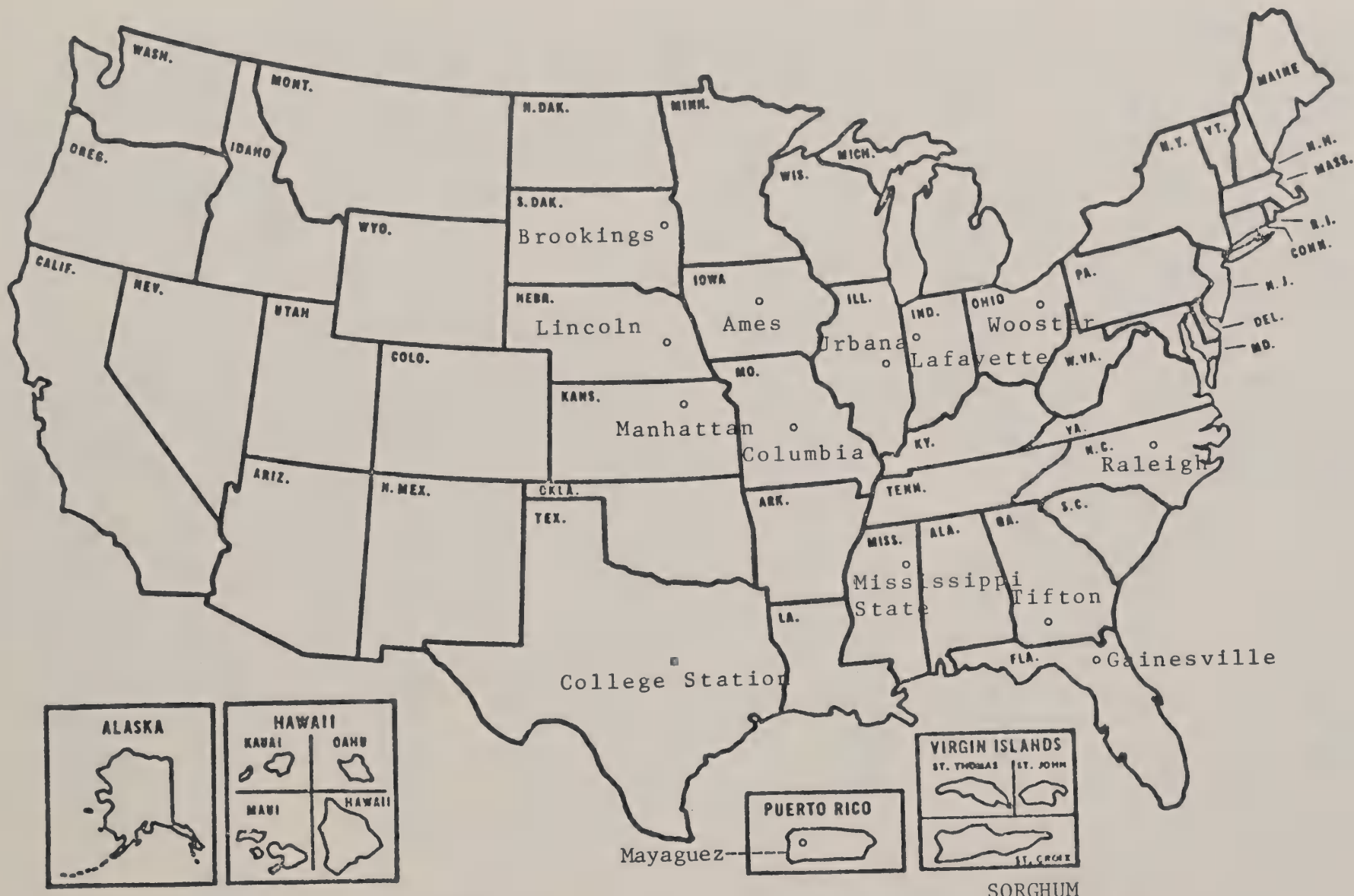
Kahler, A. L., S. Heath-Pagliuso, and R. W. Allard. 1981. Genetics of isozyme variants in barley. II. 6-phosphogluconate dehydrogenase, glutamate oxalate transaminase and acid phosphatase. Crop Sci. 21: 536-540.

Kahler, A. L., M. Krazkowa, and R. W. Allard. 1981. Isozyme phenotypes in five species of Bromus sect. Genea. Bot. Jahrb. Syst. 102: 401-409.

Kahler, A. L., M. I. Morris, and R. W. Allard. 1981. Gene triplication and fixed heterozygosity in diploid wild barley (Hordeum spontaneum). J. of Hered. 72: 374-376.

Shaw, D. V., A. L. Kahler, and R. W. Allard. 1981. A multilocus estimator of mating system parameters in plant populations. Proc. Natl. Acad. Sci. 78: 1298-1302.

CORN AND SORGHUM RESEARCH LOCATIONS IN THE U.S. NRP 20040



CORN

Gainesville, FL
Tifton, GA
Urbana, IL
Manhattan, KS
Lafayette, IN
Ames, IA
Mississippi State, MS
Columbia, MO
Raleigh, NC
Wooster, OH
Brookings, SD
College Station, TX
Mayaguez, PR

SORGHUM

Gainesville, FL
Tifton, GA
Lafayette, IN
Lincoln, NB
College Station, TX
Mayaguez, PR

LOCATIONS - NRP 20040

GAINESVILLE, FLORIDA

Dr. D. R. Pring
Plant Virus Laboratory
University of Florida
Gainesville, FL 32611
904/392-3631

TIFTON, GEORGIA

Dr. N. W. Widstrom
Southern Grain Insects Research Lab.
Georgia Coastal Plain Experiment Sta.
Tifton, GA 31793
912/382-6904

URBANA, ILLINOIS

Dr. C. M. Wilson
Department of Agronomy
S-318 Turner Hall
University of Illinois
Urbana, IL 61801
217/333-1117 - FTS-958-5532

WEST LAFAYETTE, INDIANA

Dr. H. L. Warren
Department of Botany and Plant Path.
Rm. 1-308 Life Science Bldg.
Purdue University
West Lafayette, IN 47907
317/494-4630

AMES, IOWA

Dr. A. R. Hallauer
Rm. 101, Agronomy Building
Iowa State University
Ames, IA 50011
515/294-7378 - FTS-865-3052

MANHATTAN, KANSAS

Dr. Y. Pomeranz
U.S. Grain Marketing Research Lab.
1515 College Avenue
Manhattan, KS 66502
913/539-9141, Ext. 202 - FTS-752-4201

MISSISSIPPI STATE, MS

Dr. G. E. Scott
Plant Science Institute
P. O. Box 5248
Mississippi State, MS 39762
601/325-2311

COLUMBIA, MISSOURI

Dr. E. H. Coe, Jr.
210 Curtis Hall
University of Missouri
Columbia, MO 65201
314/882-2768 - FTS-276-5349

LINCOLN, NEBRASKA

Dr. C. Y. Sullivan
Kiesselbach Crops Lab.
University of Nebraska
Lincoln, NB 68583
402/472-3058 - FTS-622-3058

RALEIGH, NORTH CAROLINA

Dr. C. W. Stuber
Department of Genetics
North Carolina State Univ.
Raleigh, NC 27650
919/737-2289 - FTS-672-4564

WOOSTER, OHIO

Dr. W. R. Findley, Jr.
Department of Agronomy
Ohio Agricultural Research and
Wooster, OH 44691
216/264-1021, Ext. 191

MAYAGUEZ, PUERTO RICO

Dr. A. Sotomayor-Rios
Federal Experiment Station
Mayaguez Institute of Trop. Agri.
Box 70
Mayaguez, PR 00709
809/832-2435

BROOKINGS, SOUTH DAKOTA

Dr. A. L. Kahler
Northern Grain Insects Res. Lab
Rural Route 3
Brookings, SD 57006
605/693-5207

COLLEGE STATION, TEXAS

Dr. J. Craig
Plant Sciences Dept.
Texas A&M University
College Station, TX 77843
713/845-7522

National Research Program 20050

BREEDING AND PRODUCTION--SMALL GRAINS (WHEAT, OATS, BARLEY, RICE, RYE, TRITICALE, WILD RICE, BUCKWHEAT)

Technological Objective 1: New and improved genetic populations, breeding lines, and varieties of small grains that combine greater yield potentials and favored quality characters, including reduced contents of undesirable constituents, with better resistance to pests, tolerance to environmental stress, responsiveness to new cultural and management practices, and adaptation for mechanized culture, harvesting, and handling.

This National Research Program involves research in breeding and production of the cereal small grains to develop new and improved genetic and cultural methods that will result in lower costs and better quality to consumers and increased efficiency of production for growers. Research agronomists, geneticists, plant pathologists, plant physiologists, cereal chemists, and other scientists work in a team approach to evaluate and improve small grain varieties and improve cultural methods, or conduct basic research to provide the scientific information necessary to improve techniques of breeding or evaluation.

NPS Contact: L. W. Briggle

Research Locations:

Palmer, Alaska
Tucson, Arizona
Stuttgart, Arkansas
Davis, California
Gainesville, Florida
Aberdeen, Idaho
Urbana, Illinois
Ames, Iowa
Manhattan, Kansas
Crowley, Lousiana
Beltsville, Maryland
East Lansing, Michigan
St. Paul, Minnesota
Columbia, Missouri
Bozeman, Montana
Lincoln, Nebraska
Fargo, North Dakota
Wooster, Ohio
Stillwater, Oklahoma
Corvallis, Oregon
University Park, Pennsylvania
Mayaguez, Puerto Rico
Brookings, South Dakota
Beaumont, Texas
Logan, Utah
Pullman, Washington
Madison, Wisconsin

Examples of Recent Progress:

Small Grains in General:

Seed increase - Aberdeen, Idaho. About 8,500 single or multi-row plots and over 4,300 spaced plants or hills of oats, barley, and wheat were grown for 20 ARS

and Agricultural Experiment Stations, and industry projects located in 14 States in 1981.

Seed Increase - Obregon, Mexico. About 20,000 selections, genetic lines, and separate seed lots of durum, hard red spring wheat, and barley were grown in the winter increase program which is conducted cooperatively by ARS, the Crop Quality Council (Minneapolis, Minnesota), and the North Dakota, South Dakota, and Minnesota Agricultural Experiment Stations. This service is provided to small grains research personnel in the spring grain area. Use of the winter nursery allows an advance of an extra generation per year toward homozygosity, additional selection for favorable characters and disease resistance, identification of certain genetic traits such as daylength sensitivity, plus seed increase for yield and quality tests.

Special nurseries - Beltsville, Maryland. Three international and four uniform wheat and oat nurseries, consisting of 970 entries, were prepared and distributed to 117 locations in 44 countries for determining reactions to different biotypes of disease-producing organisms. In addition, two more wheat international nurseries were distributed from Lincoln, Nebraska, and approximately 20 uniform nurseries involving wheat, oats, barley, and rice were distributed within the United States from project locations other than Beltsville. Most of the latter are performance nurseries where advanced breeding lines are tested for characters such as yield, disease resistance, and lodging resistance. These Uniform Regional Performance nurseries are a very important part of all small grain improvement programs, whether they be State, Federal, or industry programs.

Wheat:

Hessian fly resistant germplasm under development for soft white spring wheats in Western Region - Aberdeen, Idaho. Hessian fly resistance was transferred to productive Soft White Spring wheats, along with resistance to leaf rust and powdery mildew, from Soft Red Winter wheats developed in the Eastern States where the fly has long been a problem. Resistance is needed in the West where Hessian fly has only recently been recognized as a pest.

Barley yellow dwarf virus affects milling and baking quality of wheat - Urbana, Illinois and Manhattan, Kansas. Barley yellow dwarf virus not only causes yield loss in wheat, but also reduces grain quality. Results are variable, depending upon time of infection (fall or spring) with the virus, and upon the variety or class of wheat.

Hard red winter wheat breeding lines tested for quality - Manhattan, Kansas. Nearly 1,000 small samples of early generation Hard Red Winter wheat lines were micromilled and evaluated for quality. About 60% had promising functional properties. Nearly half of that 60% had 1.0 to 3.9 percentage points more grain protein than their controls, a very important stride forward in our attempt to increase grain protein in Hard Red Winter wheat. About 350 advanced lines (potential new varieties) and recently released new varieties were more thoroughly tested for quality. About one-third of these had good milling and baking characteristics. The leading commercial wheat varieties of tomorrow are in that group. About 15% had from 1.0 to 4.0 percentage points more protein than their controls.

New sources of resistance to leaf rust (Puccinia recondita) - Manhattan, Kansas. Tests of 400 wheat and 246 triticale lines from the World Collection were made with a composite culture of P. recondita. Several were highly resistant. Tests with wild wheat relatives indicated that a majority had low infection types (degree of resistance) to most of the rust cultures. Most lines of Triticum dicoccoides, a tetraploid wild wheat now commanding a great deal of attention, were susceptible.

Wild wheat is under extensive study as a source of mildew resistance and high grain protein - Beltsville, Maryland. Many accessions of Triticum dicoccoides from Israel have been identified for high grain protein (up to 25%) and for resistance to powdery mildew. Some genotypes are resistant to stripe rust.

Productive, high quality winter habit small grain plants survive low temperatures by means of a sequence of cryoprotective systems - East Lansing, Michigan. One system involves intercellular solutes that protect by inhibiting adhesive interaction between the plasmalemma and ice. Intercellular liquid was sampled by a forced guttation technique. During 1981 techniques were developed for analysis of composition and concentration of intercellular solutes and the changes induced by freezing. Another system involves intercellular mucilages that protect by inhibiting growth of ice crystals. Mucilages from various genotypes are being analyzed to determine compositional features that affect freezing inhibitory activity.

Positive relationship between presence of telomeric heterochromatin and aberrant endosperm development in wheat x rye hybrids - Columbia, Missouri. The relationship between telomeric (at the end of a chromosome) heterochromatin (deeply staining genetically inert chromatin) on rye (Secale cereale) chromosomes, the occurrence of aberrant endosperm development, and kernel characteristics at maturity were studied in wheat x rye hybrids (triticale). Removal of blocks of telomeric heterochromatin thus far analyzed resulted in improved endosperm development and the effect was additive if more than one block of heterochromatin was removed. A corresponding improvement was observed in kernel weight and yield.

Sources of pest resistance from alien species - Fargo, North Dakota. Numerous accessions of Aegilops and Triticum species have different degrees of resistance to diseases and insects in greenhouse and field plantings. One accession of A. ovata was resistant to barley stripe mosaic virus (BSMV), barley yellow dwarf virus (BYDV), leaf rust, and stem rust. An accession of A. triaristata and one of A. caudata were resistant to BSMV, leaf rust, and stem rust, and two accessions of A. ligustica and one of A. columnaris were resistant to BYDV, leaf rust, and stem rust. These and other accessions are rich sources of pest resistant germplasm for use in wheat improvement.

Major gene for durum wheat quality on chromosome 1B - Fargo, North Dakota. The pair of 1B chromosomes from Edmore (strong gluten variety of durum) were substituted for the pair of 1B chromosomes from Langdon (weak gluten variety), to determine location of the major gene for strong gluten in Edmore. This gene directs production of a polypeptide of gliadin protein in the endosperm which has a major effect on the pasta and bread baking quality of wheat.

Quality of desert durum wheats markedly increased - Fargo, North Dakota. Desert durum production in Arizona and California has increased during the past 5 years, but grain quality has been less than desired. New selections are showing vast improvement in durum quality as a result of quality evaluation at the ARS Hard Red Spring and Durum Quality Laboratory at Fargo. It is essential that the Southwestern durum production area produces high quality grain for the domestic and export market.

Hard red spring and durum wheat breeding lines tested for quality - Fargo, North Dakota. Quality evaluation tests were conducted on 1,250 Hard Red Spring samples from 21 experiment stations in 9 States. A total of 682 durum grain samples were analzyed from 17 experiment stations in 7 States. An additional 26 large-scale Crop Quality Council Hard Red Spring wheat lots were processed for evaluation by this laboratory and by participating collaborators from industry. In collaboration with the Montana Wheat Quality Council, 27 flour samples were evaluated. As a service to the Federal Grain Inspection Service (FGIS), 5 durum cargo samples were evaluated.

Eastern soft red winter and soft white winter wheat tested for quality - Wooster, Ohio. Breeders in the Eastern and Southern Soft Wheat Regions submitted 222 drill plot (large size) samples, 1,059 advanced nursery samples, and 2,537 samples for early generation screening for milling and baking quality. The breeding material originated from 16 States and 1 Canadian Province. Through this activity the ARS Soft Wheat Quality Laboratory has continued to monitor quality of soft wheat produced in the Eastern and Southern States. This testing ensures maintenance of acceptable standards and minimizes the possibility of economic loss associated with release of varieties of uncertain or substandard quality.

Tan-spot (Pyrenophora trichostoma) resistance in hard red winter wheat - Stillwater, Oklahoma. Triumph 64 and Payne (a derivative of Triumph 64) show significantly higher levels of resistance to tan spot when they are compared to other commercially grown varieties of Hard Red Winter wheat. Data are based on adult plant reactions in the field and seedling tests in the greenhouse. Tan spot was not observed in Oklahoma until 1978, 3 years after the prominant variety Triumph 64 was replaced by new susceptible varieties.

Specially developed new races of common bunt (smut) carry new combinations of virulence genes - Corvallis, Oregon. Seven new races of common bunt were obtained from hybridizing existing races. Each of the 7 new ones carries a new combination of genes for virulence on wheat. These new races will be used to identify wheat segregates that carry adequate resistance to dwarf bunt (TCK). Some progenies from wheat x Triticum timopheevi crosses exhibit a high level of resistance to common bunt.

Ash from Mount St. Helens lowers grain test weight but does not harm baking quality - Pullman, Washington. Extensive studies were made to determine effects of volcanic ash on end-use quality of wheat. Results from treated and field samples revealed significant loss in test weight with only trace amounts of ash. Most of the ash (90% or more) could be removed with conventional seed cleaning equipment. No detrimental effects to baking performance occurred, even at high levels of ash.

Record wheat yields in the Pacific Northwest - Pullman, Washington. Varieties, management practices, and weather combined to produce the second straight record wheat crop in the Pacific Northwest. Recently released wheat varieties with high yield potential, among which are ARS cooperatively released varieties Daws, Barbee, and Tyee, helped to contribute to the record yields. Their superior winterhardiness, disease resistance, and yield potential made it possible for the growers to capitalize on excellent growing conditions.

Wheat germplasm with combined resistance to four diseases developed - Pullman, Washington. Progeny from crosses involving a weedy wheat relative, Aegilops ventricosa, and common wheat have combined resistance to strawbreaker foot rot, Cephalosporium stripe, leaf rust, and stripe rust. These four diseases represent the major constraints to seeding wheat early in the fall on fallow land in the Pacific Northwest. Early seeding is the most effective way to control erosion in wheat-fallow rotations in this region.

Quality testing of Western wheats - Pullman, Washington. Evaluation for end-use milling and baking quality was determined on over 2,000 samples from breeding lines. An additional 4,087 early generation samples (F_3 - F_4) were evaluated for milling and baking quality by small-scale tests. This evaluation activity is an integral part of wheat improvement in the Western Region and assures release of good agronomic and high quality wheat varieties. About 1,800 additional breeding lines were tested for grain protein and lysine, and another 355 for alpha amylase--an indication of susceptibility to preharvest sprouting.

Oats:

Mechanisms that control low receptivity (component of nonspecific resistance) to cereal rusts are influenced by light - Gainesville, Florida. High light intensity enhanced low receptivity of oats to crown rust if the plants were exposed before inoculation. Low receptivity was inhibited when plants were maintained in low light before inoculation. One of the major components of nonspecific resistance in Red Rustproof oats is a long latent period after inoculation.

Tissue culture facilitates interspecific gene transfer - St. Paul, Minnesota. Lines of the diploid oat species Avena strigosa and the tetraplid A. magna were identified which initiated regenerable tissue cultures. Of even greater significance, hybrids of these species involving hexaploid cultivated oats (A. sativa), also produced regenerable tissue cultures. The hybrid cultures have potential use in interspecific gene transfer.

Oat globulin is similar to the globulins of legumes - Madison, Wisconsin. Globulin, the principal storage protein of oats, was purified and separated into two groups of polypeptides by ion exchange chromatography; one group had a basic and the other an acidic iso-electric point range. Each polypeptide group was heterogeneous, as shown by two-dimensional electrophoresis. A model is proposed whereby the native protein consists of six subunits, each composed of a disulfide-linked acidic and basic polypeptide. In this respect, oat globulin is similar to legumin of pea or cowpea and glycinin of soybean.

Quality testing of oats - Madison, Wisconsin. Oat groat samples totaling 25,535 were analyzed for protein and moisture by near infrared reflectance (NIR) spectroscopy. A new computer program was implemented to select representative samples from within each group of samples for standardization of the NIR instrument with data from Kjeldahl analysis.

Barley:

Barley production in Alaska rapidly expanding - Palmer, Alaska. Release in 1981 of significantly earlier maturing barley varieties (see Table on Varieties Released) will provide greater stability of grain production, particularly on newly cleared land in the interior of Alaska.

"Land Races" and outstanding varieties of barley obtained from foreign countries- Beltsville, Maryland. Seed of 375 land races from 18 countries and 131 leading varieties from 24 countries of spring barley has been obtained very recently. In addition, seed of more than 100 land races and outstanding winter barley varieties has been collected from several countries. Seed is under increase and will be placed in the Small Grains World Collection at Beltsville, where it will be available to any research scientist.

Identification of salt tolerant barley and wheat - Beltsville, Maryland. Barley and wheat lines and varieties tolerant to high soil salt concentrations were identified in Egypt. The Southwestern United States, Mexico, and many other countries around the globe are faced with increasing soil areas and irrigation water becoming alarmingly high in salts. By breeding and selecting for salt tolerance, barley in particular is under study and development for growing under such conditions.

Wild barley is under extensive study as a source of disease resistance - Beltsville, Maryland. Hordeum spontaneum, a progenitor of barley, has genotypes that are resistant to powdery mildew, leaf rust, scald, or net blotch. Some have multiple resistance to several diseases. H. spontaneum is a rich source of resistance to various diseases of barley.

Antiserum against oat blue dwarf virus - Fargo, North Dakota. An antiserum has been produced in preliminary tests. Production is very difficult because the yield of virus from one gram of infected tissue is about one microgram. Availability of the antiserum will make it possible to determine losses due to the virus infection, perhaps leafhopper (oat blue dwarf virus vector) populations can be monitored for virus, and host-virus relationships can be determined with greater efficacy.

Quality testing of malting barley - Madison, Wisconsin. Three thousand breeding lines were analyzed for malting quality. Samples for analysis were received from 12 State and Federal breeding programs. Of these, about 12% were early generation samples.

Cholesterol inhibitors and growth promoter found in barley - Madison, Wisconsin. Presence in barley of two inhibitors of cholesterol biosynthesis was demonstrated in chickens and rats. In addition, a growth promoter from barley was found in chickens and in swine. Separation methods were developed for isolation of the active compounds. These results indicate a potential for preventing

hypercholesteremia in humans and for increasing growth rates in poultry and swine.

Rice:

Yield of over 9,000 pounds per acre (150 bu/acre) produced on experimental plots - Stuttgart, Arkansas. An average yield of 9,270 lb/acre was produced by the variety Mars in a replicated nitrogen fertilizer test with sulfur-coated urea.

Improved resistance to stem rot transferred from wild rice - Davis, California. Interspecific transfer of improved resistance to stem rot (fungal disease) was accomplished in a cross between Oryza rufipogon and cultivated rice, O. sativa. No suitable sources of resistance are available in cultivated rice. Straw burning has been the most effective means of control.

Genetic male sterility induced in rice - Davis, California. Eleven genetic male-sterile genotypes resulted from radiation of the California rice variety M-101. Use of these lines in mass crossing should facilitate improved crop breeding techniques such as recurrent selection in this normally self-pollinated crop.

Quality testing of rice - Beaumont, Texas. Cooking and processing characteristics were determined on 7,500 rice breeding lines and on 500 new accessions in the Rice World Collection. This testing system assures selection of only high quality lines for further development and possible release from rice breeding programs in Arkansas, California, Louisiana, Mississippi, and Texas.

Technology Objective 2: New and improved cultural and management practices that increase small grain yields through disease, insect, and weed control; that minimize environmental stress; that improve physical and nutritional quality attributes; that minimize production losses and that conserve and use scarce or irreplaceable resources more efficiently.

Research Locations:

Palmer, Alaska
Gainesville, Florida
Aberdeen, Idaho
Urbana, Illinois
Manhattan, Kansas
Lincoln, Nebraska
Corvallis, Oregon
University Park, Pennsylvania
Brookings, South Dakota
Beaumont, Texas
Logan, Utah
Pullman, Washington
Madison, Wisconsin

Examples of Recent Progress:

Wheat:

Management practices help control Septoria head blight in wheat - Gainesville, Florida. Infested soil or infected seed (only one or the other) exerted similar influence on disease development. Seed treatment can be used effectively in land with a low amount of inoculum. Rotation reduced disease severity; 1-year rotation was as effective as a 2-year rotation. Seed treatment reduced disease severity in 0, 1, or 2-year rotations.

Soilborne wheat mosaic virus not evident in the vector Polymyxa graminis - Lincoln, Nebraska. All stages of the life cycle of P. graminis (and P. betae) in virus-infected roots of their host plants were carefuly examined for presence of the virus in ultrathin sections in the electron microscope. No virus could be identified in zoospores, plasmodia, or cystosori of either fungus. Virus was readily identified in host cell cytoplasm, often in close contact with plasmodia, but not inside the fungus.

Progress toward identification of common bunt (Tilletia caries) spores versus dwarf bunt (T. controversa) spores - Corvallis, Oregon. Common and dwarf bunt spores were analzyed for K, P, Mg, S, and Ca by x-ray microanalysis. Statistical analysis revealed that these two fungal species can be distinguished from each other on the basis of level of K and S. Research was also focused on development of monoclonal antibodies specific to spores of each bunt species. Five hybrid mouse spleen cell colonies have been developed that are producing antibodies against spores of dwarf bunt.

Narrow rows increase wheat yields in the Northeast - University Park, Pennsylvania. In management tests with wheat grown in Pennsylvania in 1981, yields from plantings with 5-inch spacing between rows were consistently higher than from plantings with 7-inch spacing. Yields averaged 12 bushels/acre more for the narrow-row spacing at 10 farm field locations. This represented an increase in value of $43 per acre.

Soilborne pathogens reduce winterhardiness of wheat - University Park, Pennsylvania. Infections reduced winterhardiness and caused significant stand reductions in both winter wheat and winter barley. Root rot, caused by Helminthosporium teres, predisposed barley to the foliar disease commonly known as net blotch (caused by Pyrenophora teres).

Sanitization of TCK-infested grain by fumigation - Logan, Utah. Complete elimination of dwarf bunt (TCK) contamination in wheat by disease control in the field does not appear feasible. Because of the persistent residue of TCK contamination, sanitization of grain before shipping is a more realistic control than eradication. Results of preliminary tests conducted in cooperation with the ARS-USDA Stored Products Insect Laboratory, indicated that spores in grain can be killed by methyl bromide or other fumigants. If fumigation is feasible in commercial practice, it may offer a solution to the TCK contamination problem which has hampered sale of U.S. wheat to China (PRC).

Systemic chemicals effectively control several diseases - Pullman, Washington. The systemic fungicides Bayleton and Tilt, applied as sprays, are highly effective for control of stripe rust, leaf rust, and powdery mildew of wheat. Bayleton also reduced leaf spots and mildew in winter and spring barley and thereby increased barley yields. Guidelines for use of Bayleton based upon amount of rust, type of resistance, and growth stage were developed. More than 100,000 acres of wheat in the Pacific Northwest were sprayed with Bayleton which resulted in an estimated savings of 1,000,000 bushels. Bayleton and Baytan seed treatments reduced damage from the root rot "take-all." Several systemic seed treatments control flag smut.

Crop residue is survival food for foot rot fungus - Pullman, Washington. The discovery of increased damage from Pythium root rot in soil amended with wheat chaff provides an important lead as to why Pythium root rot is favored by minimum- and no-till systems. The chaff (and possibly other components of wheat residue left after harvest) is apparently a direct food source for Pythium to increase its population and energy for its attack on the next crop of young wheat plants. Pythium control must be a goal of future research so that soil conservation practices such as minimum- and no-till will become more acceptable to wheat growers.

Bacteria control take-all disease - Pullman, Washington. Successful control of take-all for the third consecutive year with a living seed treatment of a root-colonizing Pseudomonas fluorescens gives strong support to the emerging concept that beneficial root microorganism associations can be used in agriculture to protect root health and increase crop yield. The effective strains are thought to be only prototypes of more effective strains of root colonizing bacteria still to be found or developed. Future research may involve genetic engineering methods to produce improved strains of microorganisms for inoculation on wheat or other crops.

VARIETIES RELEASED

Name or Designation	Class or Type	Release Agencies	Reason for Release
WHEAT			
Nogal	Hard Red Spring	ARS-Alaska AES	Early maturity, stiff-straw, and large kernels should be useful to farmers desiring to grow wheat in Alaska.
Ingal	Hard Red Spring	ARS-Alaska AES	Satisfactory for home use in milling and baking. Considered as a feed grain at present.
Owens	Soft White Spring	ARS-Idaho and Oregon AES	Resistant to the races of leaf and stripe rust found in the major wheat growing areas of the Pacific NW.
McKay	Hard Red Spring	ARS-Idaho, Oregon, and Colorado AES	Semidwarf variety which has moderately stiff straw. Has been moderately resistant to mildew races and resistant to the leaf rust races prevalent in the Pacific NW.
Crew	White Club Winter	ARS-Washington and Idaho AES	The multiline is being released to reduce the vulnerability of Western club wheat production to stripe rust. Crew is the first multiline wheat cultivar released in the U.S.A.

Name or Designation	Class or Type	Release Agencies	Reason for Release
BARLEY			
Clark	Two-row spring	ARS-Montana AES	Recommended as a dryland feed barley with malting potential. Clark has more tolerance to spot and net blotch than Klages.
Otal	Six-row spring	ARS-Alaska AES	The combination of early maturity and favorable grain yield should prove beneficial in Alaska.
Datal	Six-row spring	ARS-Alaska AES	Early maturing, short, stiff-strawed, high yielding.
Thual	Six-row spring	ARS-Alaska AES	Early maturing, mid-tall, moderately stiff-strawed. A hull-less barley, which yields a higher percent of food product than regular barley when processed for human consumption, may find acceptance in certain export markets.
Karla	Six-row spring feed	ARS-Idaho, Oregon, and Utah AES	Midseason, white-aleurone, high yielding.
Kris	Two-row spring feed	ARS-Idaho and Oregon AES	Early maturing and generally better grain quality as measured in terms of kernel plumpness than Klages.

Name or Designation	Class or Type	Release Agencies	Reason for Release
RICE			
Bellemont	Long grain	ARS-AES of Texas A&M University	The first long-grain semi-dwarf rice cultivar developed in the U.S.
M-302	Medium grain short stature	ARS-California Co-operative Rice Res. Foundation, Inc. and California AES	Good seedling vigor, resistance to sterility caused by low temperatures 10 to 14 days before heading.
M-401	Medium grain	ARS-California Co-operative Rice Res. Foundation, Inc. and California AES	M-401 is intended as a replacement for M7. It will be grown on limited acreage for the premium quality market.
Calmochi-202	Short grain	ARS-California Co-operative Rice Res. Foundation, Inc. and California AES	Has seedling vigor similar to that of Calmochi-201 and, like Calmochi-201, is moderately susceptible to cool temperature-induced sterility.
OATS			
Ogle	Spring	ARS-Illinois, Nebraska, New York, and Pennsylvania AES, and Ohio Agric. Res. and Dev. Center	Very high yielding, widely adapted, medium maturing variety with excellent resistance to barley yellow dwarf virus.

Name or Designation	Class or Type	Release Agencies	Reason for Release
OATS			
Porter	Spring	ARS-Purdue University AES	Mid-late season oat that heads about one week later than Otee; has excellent kernel size and test weight. Its most important contribution is the excellent level of resistance to barley yellow dwarf virus combined with high yielding potential. It has excellent resistance to crown rust.
NONCOMMERCIAL GERMPLASM RELEASED			
WHEAT			
Random Mating Stillwater 1 Winter Wheat Population	Hard Red Winter	ARS-Oklahoma AES	Provides desirable germplasm in the form of a very heterogenous population consisting of recombinant plants involving characteristics from 7 high yielding, good quality, good plant type hard red winter wheat varieties. The population is still in a recombining form because of a gene for male sterility.

NONCOMMERCIAL GERMPLASM RELEASED

Name or Designation	Class or Type	Release Agencies	Reason for Release
WHEAT			
Increased Kernel Weight Wheat Germplasm	Winter Wheat	ARS-Oklahoma AES	Germplasm lines possessing increased kernel weight.
SD8011 and SD8014 Wheat Germplasm	Hard Red Spring	ARS-South Dakota AES	Resistant to Hessian fly.
Stella	Soft Red Winter	ARS-Purdue Univ. AES	Moderate level of winter-hardiness; germplasm line available to provide new genes for Hessian fly.
Ella	Soft Red Winter	ARS-Purdue Univ. AES	Facultative winter wheat with low level of winterhardiness; germplasm line available to provide new genes for resistance to Hessian fly.
Rosette	Soft Red Winter	ARS-Purdue Univ., & Illinois AES	Will detect the presence of soilborne mosaic; used as susceptible indicator.
10 High Protein Spring Wheat Lines	Spring	ARS-Montana AES	Five of lines selected on the basis of grain protein yield and the other five selected on the basis of grain protein percentage.
KS81H1640GB and KS81H1640HF	Hard Red Winter	ARS-Kansas AES	Hard red winter wheat germplasm resistant to greenbug and Hessian fly.

NONCOMMERCIAL GERMPLASM RELEASED

BARLEY

Name or Designation	Class or Type	Release Agencies	Reason for Release
18 Hull-less and Hull-less Short Awned Spring Barley Lines	Spring	ARS-Montana AES	Use in genetic, physiological, and nutritional studies.
Composite Cross XXXIX (CC XXXIX)	Spring	ARS-Arizona AES	Germplasm source for recurrent selection programs in specific environments where water is limited. Source of drought tolerance.

RICE

Four short stature mutants with normal leaves, two short stature mutants with short narrow leaves, and four early maturing mutants	Rice Germplasm	ARS-California Co-operative Rice Research Foundation, Inc., and California AES	These mutants are useful parent lines for rice breeding programs for temperate areas.

P U B L I C A T I O N S

Gainesville, Florida

Barnett, R. D., and H. H. Luke. 1981. Registration of Florida 301 Wheat. Crop Sci. 21:635-636.

Luke, H. H., P. L Pfahler, and R. D. Barnett. 1981. The influence of disease severity and environmental conditions on low receptibility of oats to crown rust. Plant Dis. 65:125-127.

Urbana, Illinois

Jackson, A. D., C. M. Milbrath, and H. Jedlinski. 1981. The rhabdoviruses of Gramineae. In: Virus and Viruslike Diseases of Maize in the United States. D. T. Gordon, J. K. Knoke, and G. E. Scott, eds., Southern Coop. Ser. Bull. 247: 51-76. OARDC, Wooster, Ohio.

Jedlinski, H. 1981. Rice root aphid, Rhopalosiphum padi, a vector of barley yellow dwarf virus in Illinois and the disease complex. Plant Dis. 65:975-978.

Ames, Iowa

Simons, M. D. 1981. Effect of recurrent chemical mutagen treatment on tolerance of oats to crown rust Puccinia coronata Cda. Prot. Ecol. 3:131:140.

Beltsville, Maryland

Baenziger, P. S., J. G. Moseman, and R. A. Kilpatrick. 1981. Registration of barley composite crosses CXXXVII-A, -B, -C, Crop Sci. 21:351-352.

Kilpatrick, R. A., P. S. Baenziger, and J. G. Moseman. 1981. A multiple inoculation technique for evaluating single barley seedlings to three fungus pathogens. Plant Dis. 65:504-506.

Moseman, J. G., P. S. Baenziger, and R. A. Kilpatrick. 1981. Genes conditioning resistance of Hordeum spontaneum to Erysiphe graminis f. sp. hordei. Crop Sci. 21:229-232.

Manhattan, Kansas

Bruinsma, B. L. and K. F. Finney. 1981. Functional (breadmaking) properties of a new dry yeast. Cereal Chem. 58:477-480.

Chung, H., P. A. Seib, K. F. Finney, and C. D. Magoffin. 1981. Sucrose mono and diesters in breadmaking. Cereal Chem. 58:164-170.

Chung, O. K., M. D. Shogren, Y. Pomeranz, and K. F. Finney. 1981. Defatted and reconstituted wheat flours. VII. The effects of 0-12% shortening (flour basis) in breadmaking. Cereal Chem. 58:69-73.

Finney, K. F., O. Ntsuaki, L. C. Bolte, P. R. Mathewson, and Y. Pomeranz. 1981. Alpha-amylase in field-sprouted wheats: Its distribution and effect on Japanese type sponge cake and related physical and chemical tests. Cereal Chem. 58:355-359.

Jones, B. L., and K. J. Kramer. 1981. An aid to molecular sequence studies: Use of ceramic magnets to visualize sequences of peptides, proteins, and nucleic acids. J. Chem. Ed. 58:72.

Lookhart, G. L. 1981. Aid to chromatographers - A simple trap to eliminate inlet bubbles in high-pressure liquid chromatograph pumps. J. Chem. Ed. 58:78.

Shogren, M. D., Y. Pomeranz, and K. F. Finney. 1981. Counteracting the deleterious effects of fiber in breadmaking. Cereal Chem. 58:142-144.

East Lansing, Michigan

Olien, C. R., and M. N. Smith. 1981. Analysis and improvement of plant cold hardiness. CRC Press, Inc., Boca Raton, FL. 224 pp.

Olien, C. R., and M. N. Smith. 1981. Extension of localized freeze injury in barley by acute post-thaw bacterial disease. Cryobiology 18:404-409.

St. Paul, Minnesota

Busch, R. H., and D. D. Chamberlain. 1981. Effects of daylength response and semidwarfism on agronomic performance of spring wheat. Crop Sci. 21:57-60.

McCoy, T. J., R. L. Phillips, and H. W. Rines. 1982. Cytogenetic analysis of plants regenerated from oat (Avena sativa) tissue cultures: High frequency of partial chromosome loss. Can. J. Genet. Cytol. 24:37-50.

Rines, H. W., and T. J. McCoy. 1981. Tissue culture initiation and plant regeneration in hexaploid species of oats. Crop Sci. 21:837-842.

Bozeman, Montana

Ahokas, H., and E. A. Hockett. 1981. Cytoplasmic male sterility in barley. VI. Tests on performance at two different latitudes. Crop Sci. 21:607-611.

Hockett, E. A. 1981. Registration of hulless and hulless short awned spring barley germplasm. (GP 35 to GP 52). Crop Sci. 21:146-147.

Hockett, E. A., and D. A. Reid. 1981. Spring and winter genetic male sterile barley stocks. Crop Sci. 21:655-659.

McGuire, D. F., and E. A. Hockett. 1981. Malting quality of Betzes barley affected by awn length and naked caryopsis. Crop Sci. 21:18-21.

Lincoln, Nebraska

Brakke, M. K., and R. Samson. 1981. Effect of temperature on susceptibility of normal and aberrant ratio corn stocks to barley stripe mosaic and wheat streak mosaic viruses. Phytopathology 71:823-824.

Johnson, V. A. 1981. What makes a successful plant breeder? J. Agron. Ed. 10:85-86.

Johnson, V. A. (Editor) 1981. Proc. Third Int. Wheat Conference, May 22-June 3, 1980, Madrid, Spain. Univ. of Nebraska Misc. Publ. 41. 839 pp.

Kuhr, S. L., and V. A. Johnson. 1981. Performance of high protein lines in international trials. Proc. Third Int. Wheat Conference, May 22-June 3, 1980. Madrid, Spain. Univ. of Nebraska Misc. Publ. 41:781-796.

Kuhr, S. L., V. A. Johnson, P. J. Mattern, K. D. Wilhelmi, and J. W. Schmidt. 1981. Results of the Tenth International Winter Wheat Performance Nursery in 1978. Nebraska Res. Bull. 296. 216 pp.

Kuhr, S. L., V. A. Johnson, P. J. Mattern, and K. D. Wilhelmi. 1981. Results of the Third High Protein-High Lysine Wheat Observation Nursery grown in 1977. Nebraska Res. Bull. 297. 155 pp.

Mattern, P. J., V. A. Johnson, and S. L. Kuhr. 1981. Processing quality of high protein wheats. Proc. Third Int. Wheat Conference, May 22-June 3, 1980. Madrid, Spain. Nebraska Misc. Publ. 41:740-749.

Schmidt, J. W., V. A. Johnson, P. J. Mattern, A. F. Dreier, and D. V. McVey. 1981. Registration of Bennett wheat. Crop Sci. 21:988-989.

Schmidt, J. W., V. A. Johnson, P. J. Mattern, A. F. Dreier, and D. V. McVey. 1981. Registration of Centurk 78 Wheat. Crop Sci. 21:989.

Yasumuro, Y., R. Morris, D. C. Sharma, and J. W. Schmidt. 1981. Induced pairing between a wheat (Triticum aestivum) and an Agropyron elongatum chromosome. Can. J. Genet. Cytol. 23:49-56.

Fargo, North Dakota

Jons, V. L., R. G. Timian, W. S. Gardner, E. L. Stromberg, and P. Berger. 1981. Wheat striate mosaic virus in the Dakotas and Minnesota. Plant Dis. 65:447-448.

Salazar, G. M. and L. R. Joppa. 1981. Use of substitution-monosomics to determine the chromosomal location of genes conditioning stem rust resistance in Langdon durum. Crop Sci. 21:681-685.

Wooster, Ohio

Chaudhary, V. K., W. T. Yamazaki, and W. A. Gould. 1981. Relation of cultivar and flour particle size distribution to cake volume. Cereal Chem. 58:314.

Clements, R. L., and J. R. Donelson. 1981. Functionality of specific flour lipids in cookies. Cereal Chem. 58:204.

Clements, R. L., and J. R. Donelson. 1981. Note on a simple device for monitoring batter expansion in layer cakes during baking. Cereal Chem. 58:153.

Yamazaki, W. T., M. Ford, K. W. Kingswood. and C. T. Greenwood. 1981. Soft wheat production. In: Soft wheat: production breeding, milling and uses. W. T. Yamazaki and C. T. Greenwood, eds. American Association of Cereal Chemists, St. Paul, MN.

Corvallis, Oregon

Hess, W. M., A. C. Rencher, J. V. Allen, E. J. Trione, and J. A. Hoffman. 1981. X-ray microanalysis of Tilletia caries and T. controversa teliospores from different geographical locations and cultural conditions. Phytopathology 71: 1004-1005.

Hess, W. M., A. C. Rencher, J. A. Allen, E. J. Trione, and J. A. Hoffman. 1981. X-ray microanalysis of teliospores of three species of Tilletia. Phytopathology 71:1004.

Trione, E. J. 1981. Natural regulators of fungal development. In: Plant Disease Control: Resistance and Susceptibility. R. C. Staples (ed.), John Wiley and Sons, N.Y. pp. 129-149.

University Park, Pennsylvania

Marshall, H. G. 1981. Registration of two inbred lines of buckwheat. Crop Sci. 21:804.

Marshall, H. G. 1981. Breeding for tolerance to heat and cold. In: Breeding Plants for Less Favorable Environments, John Wiley & Sons, New York, NY. p. 47-70.

Marshall, H. G., and C. F. Murphy. 1981. Inheritance of dwarfness in three oat crosses and relationship of height to panicle and culm length. Crop Sci. 21: 335-338.

Beaumont, Texas

Bollich, C. N., B. D. Webb, M. A. Marchetti, J. E. Scott, and J. W. Stansel. 1981. Plant characteristics and performance. In: Bellemont - a Semidwarf long-grain rice variety - its characteristics and management. Tex. Agric. Exp. Sta. Misc. Publ. #1476. pp. 5-13.

Logan, Utah

Hoffmann, J. A., and J. T. Waldher. 1981. Chemical seed treatments for controlling seedborne and soilborne common bunt of wheat. Plant Dis. 65:256-295.

Pullman, Washington

Coakley, S. M., and R. F. Line. 1981. Quantitative relationships between climatic variables and stripe rust epidemics on winter wheat. Phytopathology 71:461-467.

Cook, R. James. 1981. The influence of rotation crops on take-all decline phenomenon. Phytopathology 71:189-192.

Faridi, H. A., P. L. Finney, and G. L. Rubenthaler. 1981. Micro baking evaluation of some U.S. wheat classes for suitability in Iranian breads. Cereal Chem. 58(5):428-432.

Hadwiger, L. A., and R. F. Line. 1981. Hexosamine accumulations are associated with the terminated growth of Puccinia striiformis on wheat isolines. Physiol. Plant Pathol. 19:249-255.

Johnson, R. C., R. W. Witters, and A. J. Ciha. 1981. Apparent phytosynthesis, evapotranspiration and light penetration in two contrasting hard red winter wheat canopies. Agron. J. 73:419-422.

Johnson, R. C., R. E. Witters, and A. J. Ciha. 1981. Daily patterns of apparent photosynthesis, and evapotranspiration in a developing winter wheat crop. Agron. J. 73:414-418.

Rubenthaler, G. L., and H. A. Faridi. 1981. Note on a laboratory dough molder for flat-breads. Cereal Chem. 58:6.

Madison, Wisconsin

Brinkman, M. A., D. K. Langer, R. G. Harvey, and W. C. Burger. 1981. Effect of atrazine carryover on malting quality of barley. Crop Sci. 21:973.

Prentice, N., and S. Faber. 1981. Beta-D-glucan in developing and germinating barley kernels. Cereal Chem. 58:77.

White, W. B., H. R. Bird, M. L. Sunde, N. Prentice, W. C. Burger, and J. A. Marlett. 1981. The viscosity interaction of barley beta-D-glucan with Trichoderma viride cellulase in the chicken intestine. Poultry Sci. 60:1043-1048.

SMALL GRAINS RESEARCH LOCATIONS IN THE U.S. NRP 20050

WHEAT RESEARCH

Palmer, AK
Gainesville, FL
Aberdeen, ID
Urbana, IL
Manhattan, KS
Beltsville, MD
St. Paul, MN
Columbia, MO
Bozeman, MT
Lincoln, NB
Fargo, ND
Wooster, OH
Stillwater, OK
Corvallis, OR
University Park, PA
Mayaguez, PR
Logan, UT
Pullman, WA

OAT RESEARCH

Palmer, AK
Gainesville, FL
Aberdeen, ID
Urbana, IL
Ames, IA
Beltsville, MD
St. Paul, MN
University Park, PA
Mayaguez, PR
Madison, WI

BARLEY RESEARCH

Palmer, AK
Tucson, AZ
Aberdeen, ID
Beltsville, MD
East Lansing, MI
Bozeman, MT
Fargo, ND
University Park, PA
Brookings, SD
Madison, WI

RICE RESEARCH

Stuttgart, AR
Davis, CA
Crowley, LA
Beltsville, MD
Beaumont, TX

LOCATIONS - NRP 20050

PALMER, ALASKA

Mr. R. L. Taylor
Agricultural Experiment
Station
University of Alaska
P. O. Box AE
Palmer, AK 99645
907/745-3257

TUCSON, ARIZONA

Dr. R. T. Ramage
Department of Agronomy
University of Arizona
Tucson, AZ 85721
602/626-1014

STUTTGART, ARKANSAS

Dr. T. H. Johnston
Rice Production and Weed
Control Research
P. O. Box 287
Stuttgart, AR 72160
501/673-2661

DAVIS, CALIFORNIA

Dr. J. N. Rutger
University of California
Room 215, Hunt Hall
Davis, CA 95616
916/752-2460

GAINESVILLE, FLORIDA

Dr. H. H. Luke
Department of Plant Pathology
Building 717
University of Florida
Gainesville, FL 32611
904/392-3631

ABERDEEN, IDAHO

Dr. D. W. Sunderman
Aberdeen Substation
P. O. Box AA
Aberdeen, ID 83210
208/397-4181

URBANA, ILLINOIS

Dr. H. Jedlinski
N. 431 Turner Hall
University of Illinois
Urbana, IL 61801
217/333-0996

AMES, IOWA

Dr. M. D. Simons
313 Bessey Hall
Iowa State University
Ames, IA 50011
515/294-3122

MANHATTAN, KANSAS

Mr. K. F. Finney
U.S. Grain Marketing
Research Laboratory
1515 College Avenue
Manhattan, KS 66502
913/539-9141 Ext. 270

BELTSVILLE, MARYLAND

Dr. P. S. Baenziger
Plant Genetics and
Germplasm Institute
Room 321, Bldg. 001, BARC-W
Beltsville, MD 20705
301/344-3251

LOCATIONS - NRP 20050

EAST LANSING, MICHIGAN

Dr. C. R. Olien
Crop and Soil Science
Department
Michigan State University
East Lansing, MI 48823
517/355-2233

ST. PAUL, MINNESOTA

Dr. R. H. Busch
Department of Agronomy
and Plant Genetics
Room 316, Agronomy Building
University of Minnesota
St. Paul, MN 55108
612/373-1370

COLUMBIA, MISSOURI

Dr. J. P. Gustafson
108 Curtis Hall
University of Missouri
Columbia, MO 65201
314/882-7225

BOZEMAN, MONTANA

Dr. A. L. Scharen
Department of Plant
Pathology
Montana State University
Bozeman, MT 59717
406/994-4832

LINCOLN, NEBRASKA

Dr. V. A. Johnson
324 Keim Hall, East Campus
University of Nebraska
Lincoln, NE 68583
402/472-1568

FARGO, NORTH DAKOTA

Dr. N. D. Williams
Department of Agronomy
North Dakota State University
Fargo, ND 58105
701/237-8168

WOOSTER, OHIO

Dr. R. L. Clements
Soft Wheat Quality Laboratory
Ohio Agricultural Research
and Development Center
Wooster, OH 44691
216/264-1021 Ext. 191

STILLWATER, OKLAHOMA

Dr. O. G. Merkle
Plant Science Res. Facility
P. O. Box 1029
Stillwater, OK 74076
405/624-7036

CORVALLIS, OREGON

Dr. E. J. Trione
Department of Botany and
Plant Pathology
Oregon State University
Corvallis, OR 97331
503/754-2174

UNIVERSITY PARK, PA

Dr. H. G. Marshall
Agronomy Department
Tyson Building
Pennsylvania State University
University Park, PA 16802
814/865-1141

LOCATIONS - NRP 20050

MAYAGUEZ, PUERTO RICE

Dr. A. Sotomayor-Rios
Mayaguez Institute of
Tropical Agriculture
Box 70
Mayaguez, PR 00708
809/832-2435

BROOKINGS, SOUTH DAKOTA

Dr. P. B. Price
Plant Science Department
South Dakota State University
Brookings, SD 57007
605/688-5121

BEAUMONT, TEXAS

Dr. C. N. Bollich
Rice Research
Route 7, Box 999
Beaumont, TX 77706
713/752-2741

LOGAN, UTAH

Dr. J. A. Hoffmann
UMC 63, Crop Research Lab.
Utah State University
Logan, UT 84322
801/750-3074

PULLMAN, WASHINGTON

Dr. R. E. Allan
209 Johnson Hall
Washington State University
Pullman, WA 99164
509/335-3632

MADISON, WISCONSIN

Dr. D. M. Peterson
Agronomy Department
University of Wisconsin
Madison, WI 53706
608/262-9620

National Research Program 20060
BREEDING AND PRODUCTION - COTTON

Cotton fiber, and food and feed from cottonseed are vital renewable national resources. Domestically produced cotton fiber reduces our dependence on petroleum-based synthetics. The farm value of cotton and cottonseed exceeded $4.6 billion in 1980. The mission of this national research program is to develop new knowledge which will increase production efficiency and provide consumers with a stable supply of fiber and food at a reasonable cost. The research approaches emphasize germplasm enhancement and the development of new principles to improve cultural and management practices.

NPS Contact: P. A. Miller

Research Locations:

Auburn, Alabama
Phoenix, Arizona
Shafter, California
New Orleans, Louisiana
Mississippi State, Mississippi
Stoneville, Mississippi
Las Cruces, New Mexico
Raleigh, North Carolina
Florence, South Carolina
Knoxville, Tennessee
Brownsville, Texas
College Station, Texas
Lubbock, Texas

Technological Objective 1: New and enhanced genetic populations and breeding lines of cotton that combine increased yield potentials and favored quality characteristics of seed and lint with increased resistance to pests, tolerance to environmental stresses, and adaptation to modern cultural, harvesting, and handling practices.

Examples of Recent Progress:

Germplasm identified which combines high levels of root-knot nematode resistence with improved fiber quality - Auburn, Alabama. Strains selected for high levels of root-knot resistance were reevaluated in replicated trials at two locations. Several of the strains with the best agronomic performance also had combinations of lint percentage, earliness, fiber length, and fiber strength comparable with the commercial check Stoneville 213. Lines previously selected for resistance to nematodes had fibers which were too short to be acceptable in the market. This represents a significant "breakthrough" in this germplasm enhancement.

Pima cotton germplasm identified which has a higher rate of fiber elongation under high temperature stress - Phoenix, Arizona. Two early productive experimental lines showed a significantly higher rate of fiber elongation than did the current commercial cultivar Pima S5 when grown under high temperature stress. Higher rates of fiber elongation under high temperature stress will make it possible to develop earlier maturing cotton with the extra long fiber required by the Pima market.

Genetic variation for resistance to smog (ozone) observed - Shafter, California. The commercial variety, Acala SJ-2, is relatively susceptible to damage from high levels of ozone in the atmosphere. Twenty-two experimental strains selected from SJ-2 for potential tolerance to ozone, averaged 5.3% higher in yield than the SJ-2 check when grown at Arvin, CA, a high ozone area.

New principles developed to measure cotton fiber fineness and maturity - New Orleans, Louisiana. Technology for rapid measurement of surface area and cross-section area of cotton fibers varying appreciably in fiber fineness and maturity has been achieved. This time-saving development, made possible by the modification of a near infra-red reflectance instrument, will enable textile mill operators to minimize problems caused by the variability in fiber maturity and permit rapid and accurate classification of cotton for more efficient processing.

Primitive cottons converted to flowering type - Mississippi State, Mississippi. Primitive cottons do not flower when grown in the field in the United States. A group of 56 different primitive types were converted to forms which will flower in the Cotton Belt and were released to breeders. The release of these lines broadens the germplasm base available to state and private cotton breeders. These wild cottons are an excellent source of resistance to pests and of tolerance to environmental stress.

Young larvae of the tobacco budworm do not ingest the gossypol glands in cotton leaves - Mississippi State, Mississippi. Larvae did not eat gossypol glands during the first 48 hours after hatching. They ate leaf tissue, but left the glands intact, eating around them. Between 48 to 72 hours of age, they begin consuming the gossypol glands in the leaf tissue. A better understanding of the feeding behavior of insect pests is useful in selecting for plant resistance.

Genetics and breeding effective in increasing potential yield of cotton - Stoneville, Mississippi. Data from yield tests grown between 1960 and 1980 at 63 locations, from South Carolina to California, were analyzed. Check entries at each location provided a base from which to measure both genetic and environmental effects. The results indicated that the combined effort of geneticists and applied breeders have resulted in a potential average increase in lint yield of 7 kilograms of lint per hectare per year during this period. In spite of these genetic advances, however, the study also indicated that weather or management practices may be decreasing cotton yields in many areas. Additional research on this latter observation is in progress.

Principles developed to culture haploid pollen cells - Las Cruces, New Mexico. Cotton microspores (immature pollen grains) have been successfully isolated from anthers and the technology has been developed to maintain them in a cell culture. This is an essential step to producing large numbers of haploid plants directly from pollen cells. These procedures will make it possible to utilize emerging genetic engineering technology to enhance cotton germplasm.

Genetic variability for heat tolerance of pollen observed in cotton - Las Cruces, New Mexico. A rapid and effective procedure for measuring pollen fertility has been developed. Following heat treatment of pollen of a number of genotypes, significant variability among strains was observed for heat tolerance. Pollen sterility resulting from high temperature stress appears to be associated with reduced yields of cotton during extremely hot weather. This technique provides a means for selection in the pollen phase for genetic tolerance to heat and possibly drought stress.

Desirable gene identified for increasing the pubescence of the cotton plant - Raleigh, North Carolina. Dense pubescence imparts resistance to certain leaf-feeding insect pests of cotton. The common "pilose" gene for pubescence, however, shortens the cotton fiber about 20%. A gene from a wild cotton has been identified which also imparts dense pubescence, but shortens the cotton fiber only about 3%. This latter gene would be very desirable for increasing pest resistance without concurrent decreases in fiber quality.

Germplasm pool is an extremely valuable source for improving cotton - Florence, South Carolina. The germplasm improvement program at Florence was initiated in 1935 with the major objective of overcoming the yield-quality barrier in cotton. Over the years an extremely broad-based germplasm pool has been synthesized from various wild and cultivated species and strains. Through hybridization and selection, genetic linkages have been broken and enhanced germplasms combining higher yield with increased fiber length and strength continue to be developed and released. Recently released strains represent a new plateau of desirable combinations of traits. This program illustrates the value of long-term, stable germplasm enhancement projects.

Seed of ten species of cotton collected from Australia - Knoxville, Tennessee. Of the 38 known species of Gossypium (cotton) the ten Australian species are the least understood of the genus. This new collection includes the first seed collected of two species, in addition to new collections of the other eight species. These collections will be valuable material for studying the phylogeny of the genus and will be screened and evaluated for potentially useful genetic traits to improve our U.S. cottons.

New combination of seed and flower bud gossypol identified - Brownsville, Texas. Higher flower bud gossypol repels feeding by bollworm larvae. Seed processors, however, desire seed which are free or very low in gossypol. Selection from a hybrid of an upland cotton with an Australian species produced a medium level of flower bud gossypol (.60%) while producing only very low seed gossypol (.05%). Additional research is underway.

New information developed on the genetic architecture of cotton - College Station, Texas. Detailed research is in progress on the gene order of chromosomes 12 and 26. These two chromosomes of our cultivated strains represent a portion of the Asiatic and New World contribution of genetic information to our U.S. cottons. This type of information is essential if we are to be able to exploit emerging genetic engineering technology to improve our germplasm.

Water stress responses in cotton shown to be heritable - Lubbock, Texas. Relative water content at stomatal closure in detached leaves was shown to be related to plant growth rates under water stress conditions in field soils. Genetic studies show that the mode of inheritance was complex with a heritability of about 50%. Selection for this trait would be expected to be effective in changing the response of the cotton plant to water stress.

Technological Objective 2: New principles to improve cultural and management practices that optimize yield potentials, minimize production losses, preserve quality attributes, and conserve and utilize resources efficiently.

Examples of Recent Progress:

More efficient water management procedures developed for growing cotton - Phoenix, Arizona. Growers are interested in shortening the growing season for cotton to conserve water, fertilizer, and pesticides. During 3 years of testing, water deficits before flowering had little effect on earliness or yield. Water deficits after flowering started, however, were very detrimental and greatly decreased early season yield. Maximum short season yields can be obtained by avoiding water stress during the early portion of the flowering period.

Cereals and broad-leafed plants are affected differently by low levels of nitrogen fertility - Phoenix, Arizona. In broad-leafed plants such as cotton and sunflower, growth limitation by nitrogen is from a restriction in leaf growth rates. This occurs because nitrogen deficiency lowers the ability of the plant to transport water from the soil to leaf, and the resulting leaf-water deficit inhibits cell growth. In cereal species leaf cell growth occurs at the base of the leaf where no water is lost to the atmosphere, thus, no growth-inhibiting water deficits are incurred and growth inhibition by low nitrogen is much less severe than in broad-leafed plants. As a result, cereals use nitrogen more efficiently for dry matter production when nitrogen is limiting to growth. Fundamental knowledge on nitrogen and water utilization by plants is essential to develop principles for managing our resources more efficiently.

Selective fungicides are used for research tools - Shafter, California. Fungicides have been developed which protect against seedling diseases caused by Rhizoctonia but are not active against Pythium, and vice-versa. Comparing their combined use with the protection obtained from using each fungicide individually, provides very useful information on the relative importance of the causal organisms in different soils and under different management schemes. This information is of value to scientists to develop the principles needed to control seedling diseases more effectively and efficiently.

Potential for brush stripper harvest of cotton in the Delta investigated - Stoneville, Mississippi. Harvesting costs may be reduced by using a once-over stripper type harvester. Smaller, more compact plants are needed, however, for efficient stripper harvesting. Plant height and lateral branch length of cotton grown in the Delta were reduced by 22% by using the plant growth regulator

Pix®. Lint yields were increased by brush stripper harvest in the Pix®-treated plots but decreased by this harvest method in the non- Pix®-treated plots. Grade, staple length, and other fiber properties were not affected by either chemical treatment or harvest method. Additional research is planned.

Review prepared on genetic variability of fungi - College Station, Texas. A review chapter entitled "Heteroploidy as a Mechanism of Variability Among Fungi" is scheduled for publication in the 1983 edition of Annual Review of Phytopathology. Heteroploidy is an important source of spontaneous variability in pathogenicity, metabolism, physiology, and morphology of fungi. This review should have a significant impact upon future directions and interpretations of research on pathogenic and nonpathogenic fungi and the development of new principles for disease control.

Additional progress made in the biological control of seedling diseases in cotton - College Station, Texas. A fungus with broad potential for control of seedling diseases was isolated from the surface of healthy cotton plants. Gliocladium virens can be grown in peat moss-broth culture where it forms chlamydospores in the peat. This material can be air-dried, ground to 20 mesh, and stored for months at room temperature without loss of viability. The material may be added dry to the soil with the seed at planting where it suppresses disease production by Rhizoctonia solani and Pythium ultimum.

COTTON NONCOMMERCIAL GERMPLASM RELEASED
(CY 1981)

Name or Designation	Release Agencies	Reason for Release
Auburn OK fg-1 Auburn OK fg-2 Auburn OK fg-3	ARS-USDA and the Alabama Agricultural Experiment Station, Auburn University Auburn, AL	These are okra leaf, frego-bract stocks which are tolerant to the fusarium wilt-root-knot nematode complex and resistant to common races of bacterial blight. The frego-bract traits may impart some resistance to boll weevil. Okra leaf reduces losses from boll rot.
124 flowering germplasm lines involving exotic *G. hirsutum* L. race accessions.	ARS-USDA and the Mississippi Agricultural and Forestry Experiment Station, Mississippi State University, Mississippi State, MS	Broadened germplasm base through conversion of nonflowering exotic race stocks to types which flower in the Cotton Belt. This wild race germplasm is a valuable source of pest resistance.

P U B L I C A T I O N S

Auburn, Alabama

Kappelman, A. J., Jr. 1981. Fusarium wilt resistance of two cotton cultivars from Paraguay. Plant Disease 65: 344-345.

Kappelman, A. J., Jr. and L. S. Bird. 1981. Indirect selection for resistance to the fusarium wilt-root-knot nematode complex in cotton. Crop Sci. 21: 66-68.

Phoenix, Arizona

Chang, C. W. 1981. Identification of glucan synthetase glycosidically bound to amylopectin from cotton leaves. Microchem. J. 26: 86-94.

Feaster, C. V., E. L. Turcotte, and H. H. Ramey, Jr. 1981. Contribution of fiber properties to variations in yarn tenacity for American Pima cotton in 1959 and 1979. Proc. 1981 Beltwide Cotton Prod. Res. Conf., pp. 90-92.

Guinn, G., J. R. Mauney, and K. E. Fry. 1981. Irrigation scheduling and plant population effects on growth, bloom rates, boll abscission, and yield of cotton. Agron. J. 73: 529-534.

Radin, J. W. 1981. Water relations of cotton plants under nitrogen deficiency. IV. Leaf senescence during drought and its relation to stomatal closure. Plant Physiol. 51: 145-149.

Radin, J. W., and R. C. Ackerson. 1981. Water relations of cotton plants under nitrogen deficiency. III. Stomatal conductance, photosynthesis, and abscisic acid accumulation during drought. Plant Physiol. 67: 115-119.

Shafter, California

Benedict, J. H., T. F. Leigh, J. L. Frazier, and A. H. Hyer. 1981. Ovipositional behavior of Lygus hesperus on two cotton genotypes. Annals of the Entomological Society of America 74: 392-394.

Benedict, J. H., T. F. Leigh, A. H. Hyer, and P. F. Wynholds. 1981. Nectariless cotton: Effect on growth, survival, and fecundity of lygus bugs. Crop Sci. 21: 28-30.

DeVay, J. E., and R. H. Garber. 1980. Verticillium wilt of cotton. Chap. 6: 31-37. Perspectives on the biology, ecology, and principal diseases of cotton (edited by DeVay, J. E. and L. S. Bird) for the IPM Book for Cotton, sponsored by U.S. Environmental Protection Agency.

DeVay, J. E., R. H. Garber, A. R. Weinhold, and R. J. Wakeman. 1981. Comparisons of selected fungicide cotton seed treatments against Rhizoctonia solani, Pythium species and Thielaviopsis basicola. Proc. 1981 Beltwide Cotton Prod. Res. Conf., pp. 24-28.

Garber, R. H., and J. E. DeVay. 1980. Seedling Diseases--Chap. 2: 7-13. Perspectives on the biology, ecology, and principal diseases of cotton (edited by J. E. DeVay and L. S. Bird) for the IPM Book for Cotton, sponsored by U.S. Environmental Protection Agency.

Miller, J. H., C. H. Carter, R. H. Garber, and H. B. Cooper. 1981. Response of Acala cotton varieties to preplant trifluralin or layby diuron. Proc. Western Society of Weed Sci. 34: 101-108.

Pullman, G. S., J. E. DeVay, and R. H. Garber. 1981. Soil solarization and thermal death: a logarithmic relationship between time and temperature for soilborne plant pathogens. Phytopathology 71: 959-962.

Pullman, G. S., J. E. DeVay, R. H. Garber, and A. R. Weinhold. 1981. Soil solarization: Effects on Verticillium wilt of cotton and soilborne populations of Verticillium dahliae, Pythium spp., Rhizoctonia solani, and Thielaviopsis basicola. Phytopathology 71: 954-959.

New Orleans, Louisiana

Berlin, J. D., S. Worley, Jr., H. H. Ramey, Jr., and S. S. Linkous. 1981. Measuring the cross-sectional area of cotton fibers with an image analyzer. Textile Res. J. 51: 109-113.

Duckett, K. E., and H. H. Ramey, Jr. 1981. On the radial variation of spiral angle in the cotton fiber. Textile Res. J. 51: 656-664.

Feaster, C. V., E. L., Turcotte, and H. H. Ramey, Jr. 1981. Contribution of fiber properties to variations in yarn tenacity for American Pima cotton in 1959 and 1979. Proc. 1981 Beltwide Cotton Prod. Res. Conf., pp. 90-92.

Ramey, H. H., Jr. 1981. Effects on cotton fiber of treating seed cotton with mercerizing-strength sodium hydroxide. Textile Res. J. 51: 489-492.

Ramey, H. H., Jr., and N. J. Acres. 1980. Regional Cotton Variety Tests. 1977. Science and Education Administration, U.S. Department of Agriculture, 141 pp.

Ramey, H. H., Jr., and N. J. Acres. 1981. Regional Cotton Variety Tests. 1978. Seed Data. Science and Education Administration, U.S. Department of Agriculture, 71 pp.

Ramey, H. H., Jr., N. J. Acres, and M. K. Barringer. 1981. Regional Cotton Variety Tests. 1979. Science and Education Administration, U.S. Department of Agriculture, 144 pp.

Turner, J. H., P. Hoskinson, S. Worley, and H. H. Ramey, Jr. 1980. Response to selective pressure in early generation progenies of Upland cotton (Gossypium hirsutum L.) Euphytica 29: 615-624.

Mississippi State, Mississippi

McCarty, J. C., Jr., J. N. Jenkins, and W. L. Parrott. 1981. Germplasm release of 68 BC_1F_4 noncommercial flowering lines of upland cotton involving 68 Gossypium hirsutum L. race accessions. Miss. Agric. and Forestry Exp. Stn. Res. Report 6(16) 4 pp.

McCarty, J. C., Jr., J. N. Jenkins, and W. L. Parrott. 1981. Germplasm release of 23 BC_1F_4 and 33 BC_1F_4 noncommercial flowering germplasm lines of upland cotton involving Gossypium hirsutum L. race accessions. Miss. Agric. and Forestry Exp. Stn. Res. Report 6(17) 4 pp.

Stoneville, Mississippi

Cathey, G. W., C. D. Elmore, and B. L. McMichael. 1981. Some physiological responses of cotton leaves to foliar applications of potassium 3,4-dichloroisothiazole-5-carboxylate and S,S,S-tributyl phosphorotrithioate. Physiol. Plant. 51: 140-144.

Davis, R. G., L. S. Bird, A. Y. Chambers, R. H. Garber, C. R. Howell, E. B. Minton, R. Sterne, and L. F. Johnson. 1981. Seedling disease complex. Compendium of Cotton Diseases. The Am. Phytopathol. Soc. pp. 13-20.

Leffler, H. R. 1981. Developmental aspects of cotton seed planting quality. Proc. of the 1981 Beltwide Cotton Prod. Res. Conf. pp. 283-286.

Minton, E. B., and J. E. Quisenberry. 1981. Beltwide evaluation of fungicides applied to acid-delinted cottonseed. Agron. J. 73: 684-686.

Minton, E. B., J. A. Pinckard, A. Y. Chambers, R. S. Hussey, J. L. Crawford, R. H. Garber, K. M. El-Zik, J. E. Devay, E. J. Butterfield, and G. S. Pullman. 1981. Crop management for disease control. Compendium of Cotton Diseases. The Am. Phytopathol. Soc. pp. 70-73.

Wanjura, D. F., and E. B. Minton. 1981. Delayed emergence and temperature influences of cotton seedling vigor. Agron. J. 594-597.

Las Cruces, New Mexico

Barrow, J. R. 1981. A new concept in assessing cotton pollen germinability. Crop Sci. 21: 441-443.

Raleigh, North Carolina

Lee, J. A. 1981. A new linkage relationship in cotton. Crop Sci. 21: 346-347.

Lee, J. A. 1981. A genetical scheme for isolating cotton cultivars. Crop Sci. 21: 339-341.

Lee, J. A. 1981. Genetics of D_3 complementary lethality in Gossypium hirsutum and G. barbadense. J. Hered. 72: 299-300.

Florence, South Carolina

Culp, T. W. 1981. Lint yield and fiber quality improvements in PD lines of upland cotton. S.C. Agric. Exp. Stn. Tech. Bull. 1081.

Culp. T. W. 1981. Registration of Pee Dee 4548 germplasm line of cotton. Crop Sci. 21: 992.

Knoxville, Tennessee

Stewart, J. M. 1981. In vitro fertilization and embryo rescue. Envirn. Exp. Bot. 21: 301-315.

Brownsville, Texas

Dilday, R. H., and T. N. Shaver. 1981. Seasonal variation in flowerbud gossypol content in cotton. Crop Sci. 21: 956-960.

College Station, Texas

Anonymous. 1981. Preservation and utilization of germplasm in cotton. 1968-1980. Southern Coop. Ser. Bull. 256, 103 pp.

Beier, R. C., and G. A. Greenblatt. 1981. A novel solvent strategy for SEP-PAK C_{18} elution of hydrophobic compounds: applications to lacinilenes and cadalenes from cotton bract. J. of Liquid Chromatography 4: 515-524.

Bell, A. A. 1981. Biochemical mechanisms of disease resistance. Annual Review of Plant Physiology 32: 21-81.

Bell, A. A., and M. E. Mace. 1981. Biochemistry and physiology of resistance. In: Fungal Wilt Diseases of Plants, eds. M. E. Mace, A. A. Bell, and C. M. Beckman. Academic Press. pp. 431-485.

Cherry, J. P., R. J. Kohel, L. A. Jones, and W. H. Powell. 1981. Cottonseed quality: Factors affecting feed and food uses. Seed and Germination Symposium. Proc. 1981 Beltwide Cotton Prod. Res. Conf., pp. 266-283.

Fowler, S. R., R. L. Ziprin, M. H. Elissalde, and G. A. Greenblatt. 1981. Study on the etiology of byssinosis: Induction of prostaglandin F_2 synthesis in alveolar macrophages by cotton dust extract. Am. Ind. Hyg. Assoc. J. 42: 445-448.

Fryxell, P. A. 1980. How to write and publish a scientific paper by R. A. Day. Syst. Bot. 5: 336 (book review).

Fryxell, P. A. 1980. A new species of Hampea (Malvaceae) from El Salvador. Systematic Bot. 5: 553-555.

Halloin, J. M. 1981. Weathering: Changes in planting seed quality between ripening and harvest. Proc. 1981 Beltwide Cotton Prod. Res. Conf., pp. 286-289.

Mace, M. E., and A. A. Bell. 1981. Flavanol and terpenoid aldehyde synthesis in tumors associated with genetic incompatability in a Gossypium hirsutum x G. gossypioides hybrid. Can. J. Bot. 54: 951-955.

Mace, M. E., A. A. Bell, and C. H. Beckman (eds.) 1981. Reflections. In: Fungal Wilt Diseases of Plants. Academic Press. pp. 601-607.

Mace, M. E., A. A. Bell, and C. H. Beckman (eds.) 1981. Fungal Wilt Diseases of Plants. Academic Press. 640 pp.

Puhalla, J. E., and A. A. Bell. 1981. Genetics and biochemistry of wilt pathogens. In: Fungal Wilt Diseases of Plants, M. E. Mace, A. A. Bell, and C. M. Beckman, (eds.), Academic Press. pp. 145-191.

Stipanovic, R. D., G. A. Greenblatt, R. C. Beier, and A. A. Bell. 1981. 2-Hydroxy-7-methoxycadalene. The precursor of lacinilene C 7-methyl ether in Gossypium. Phytochemistry 20: 729-730.

Lubbock, Texas

Elmore, C. D., and B. L. McMichael. 1980. Proline accumulation by water and nitrogen stressed cotton. Crop Sci. 21: 244-249.

Heald, C. M., W. Birchfield, C. W. Blackmon, R. S. Hussey, C. C. Orr, R. L. Shepherd, J. Veech, and F. H. Smith. 1981. Nematodes. In: Compendium of Cotton Diseases, ed. G. M. Watkins. Am. Phytopathol. Soc., pp. 50-56.

Jordan, W. R., J. E. Quisenberry, and B. Roark. 1981. Contribution of heat tolerance and root growth potential to drought resistance. Proc. 1981 Beltwide Cotton Prod. Res. Conf., pp. 40-41.

Minton, E. B., and J. E. Quisenberry. 1981. Beltwide evaluation of fungicides applied to acid-delinted cottonseed. Agron. J. 73: 684-686.

Orr, C. C., C. M. Heald, W. Birchfield, C. W. Blackman, R. S. Hussey, R. L. Shepherd, and F. H. Smith. 1981. Nematodes. In: Compendium of Cotton Diseases, ed. G. M. Watkins. The Am. Phytopathol. Soc. pp. 50-56.

Peterschmidt, N. A., and J. E. Quisenberry. 1981. Plant water status among cotton genotypes. Proc. 1981 Beltwide Cotton Prod. Res. Conf., pp. 43-44.

Quisenberry, J. E., and R. E. Dilbeck. 1981. Stormproof boll in upland cotton. III. Genotype-environment interaction and genetic analysis. Crop Sci. 21: 511-514.

Quisenberry, J. E., W. R. Jordan, B. A. Roark, and D. W. Fryrear. 1981. Exotic cottons as genetic sources for drought resistance. Crop Sci. 21: 889-895.

LOCATIONS - NRP 20060

AUBURN, ALABAMA

R. L. Shepherd
USDA, ARS
237 Funchess Hall
Auburn University
Auburn, AL 36830
COM: 205/826-4102

PHOENIX, ARIZONA

C. V. Feaster
USDA, ARS
Cotton Research Center
4207 E. Broadway Road
Phoenix, AZ 85040
COM: 602/261-4221

Gene Guinn
USDA, ARS
Western Cotton Research Lab.
4135 E. Broadway Road
Phoenix, AZ 85040
COM: 602/261-3524

SHAFTER, CALIFORNIA

Lyle Carter
USDA, ARS
U.S. Cotton Research Station
17053 Shafter Avenue
Shafter, CA 93263
COM: 805/746-6391

NEW ORLEANS, LOUISIANA

H. H. Ramey, Jr.
USDA, ARS
Southern Regional
Research Center
P.O. Box 19687
1100 Robert E. Lee Blvd.
New Orleans, LA 70179
COM: 504/589-7511

MISSISSIPPI STATE, MISSISSIPPI

J. N. Jenkins
USDA, ARS
Crop Science & Engineering
Research Lab.
P.O. Box 5367
Mississippi State, MS 39762
COM: 601/323-2230

STONEVILLE, MISSISSIPPI

W. R. Meredith
USDA, ARS
Cotton Physiology & Genetics Lab
P.O. Box 225
Stoneville, MS 38776
COM: 601/686-2311

LAS CRUCES, NEW MEXICO

J. R. Barrow
USDA, ARS
P.O. Box 3489
New Mexico State University
Las Cruces, NM 88001
COM: 505/646-4909

RALEIGH, NORTH CAROLINA

J. A. Lee
USDA, ARS
Crop Science Department
North Carolina State University
Raleigh, NC 27650
COM: 919/737-2704

FLORENCE, SOUTH CAROLINA

T. W. Culp
USDA, ARS
Pee Dee Experiment Station
P.O. Box 271
Florence, SC 29503
COM: 803/669-8132

KNOXVILLE, TENNESSEE

J. M. Stewart
USDA, ARS
Plant and Soil Science
Department
University of Tennessee -
Ag Campus
Knoxville, TN 37916
COM: 615/974-7154

BROWNSVILLE, TEXAS

Contact:
R. J. Kohel
College Station, TX

COLLEGE STATION, TEXAS

R. J. Kohel
USDA, ARS
Cotton Genetics Lab.
P.O. Drawer DN
College Station, TX 77840
COM: 713/846-8821, Ext. 311

A. A. Bell
USDA, ARS
National Cotton Pathology
Research Lab.
P.O. Drawer JF
College Station, TX 77840
COM: 713/846-8821, Ext. 232

LUBBOCK, TEXAS

J. E. Quisenberry
USDA, ARS
Texas A&M Agric. Res. and
Ext. Center
Route 3
Lubbock, TX 79401
COM: 806/746-6103

National Research Program 20080

BREEDING AND PRODUCTION - SOYBEANS, PEANUTS, AND OTHER OILSEED CROPS

Oilseed crops are the world's big producers of both fats for human food and protein concentrate animal feeds. In 1981 oilseed crop acreage of 72 million acres was 20 percent of the total crop acreage in the United States. This research program improves agricultural production efficiency by developing new and improved plant genetic resources and cultural and management practices for soybeans, peanuts, sunflower, flax, safflower, and guar. Plant geneticists, agronomists, plant pathologists, plant physiologists, microbiologists, chemists, entomologists, and soil scientists work in a team approach to evaluate and improve oilseeds and to improve cultural methods.

NPS Contact: R. C. Leffel

Technological Objective 1: New and improved genetic populations, breeding lines, and varieties of oilseed crops that combine improved yield potentials and favored quality characters, including reduced contents of undesirable constituents, with better resistance to pests, tolerance to environmental stress, and adaptation for mechanized culture, harvesting, and handling.

Research Locations:

Davis, California
Gainesville, Florida
Tifton, Georgia
Urbana, Illinois
West Lafayette, Indiana
Ames, Iowa
Beltsville, Maryland
Stoneville, Mississippi
Columbia, Missouri
Raleigh, North Carolina
Fargo, North Dakota
Wooster, Ohio
Stillwater, Oklahoma
Brookings, South Dakota
Bushland, Texas
Suffolk, Virginia

Examples of Recent Progress:

SOYBEANS:

'Foster', a high yielding, nematode-resistant soybean developed for the southeastern U.S. - Gainesville, Florida. This variety of early Group VIII Maturity is resistant to soybean cyst nematode race 3, root-knot nematode Meloidogyne incognita, and the foliar diseases of bacterial pustule, powdery mildew, target spot, and frogeye leafspot. No other variety adapted to the lower U.S. latitudes has this combination of disease resistance factors. Under conditions of severe nematode infestations, increased revenue with Foster is as much as $100 per acre.

'Jupiter-R' is more uniform than 'Jupiter' - Gainesville, Florida and Stoneville, Mississippi, developed in cooperation with Rio Farms, Inc., Edcouch, Texas. Jupiter soybean was released in 1971 as an improved agronomic type for tropical latitudes. As Jupiter was grown at latitudes where it was adapted for production, it displayed greater variability in time of flowering, time of maturity, and plant height than is desired in a variety. Jupiter-R is distinguished from the parent variety by greater uniformity and is adapted to the extreme southern latitudes of the U.S.

'Fayette', 'Lawrence', and 'Williams 82' are improved soybeans - Urbana, Illinois. Fayette is the first soybean cyst-resistant variety of Group III Maturity and has resistance to both race 3 and 4 of the soybean cyst nematode. Lawrence is a high yielding, Maturity IV variety with superior lodging resistance. Williams 82 differs from Williams in having a gene for resistance to races 1 to 9 of Phytophthora root rot.

Mexican Bean Beetle-resistant lines released to soybean breeders - Urbana, Illinois; West Lafayette, Indiana; and Beltsville, Maryland. Five improved soybean lines with resistance to this insect and other leaf-feeding insects will facilitate breeders' efforts to incorporate this resistance into varieties adapted to the Midwest. These are earlier lines of Group IV and V Maturity and are agronomically improved when compared with the sources of their insect resistance (PI 171451 and PI 229358).

New race of downy mildew of soybean found - Urbana, Illinois. The occurrence of a new physiological race of Peronospora manchurica, which is virulent to the soybean cultivar 'Union' carrying the gene Rpm, was first detected in the soybean-disease monitoring plots in southern Illinois.

Tolerance to brown spot disease of soybeans exists in soybean cultivars - Urbana, Illinois. Brown spot tolerance (yield of inoculated plot/yield of protected plot x 100) in 37 soybean cultivars from Maturity Groups II and III ranged from 84 to 100 and differences in tolerance were significant.

Soybeans tolerant to aluminum toxicity identified - Beltsville, Maryland. Approximately 4,000 Maturity Group IV and V plant introductions from the USDA soybean germplasm collections were evaluated in the field on an aluminum toxic soil. Ten resistant and ten susceptible lines were tested in soil pot tests and in a solution culture test. Visual appearance of roots in the soil pot test was found to be the most reliable measure of tolerance. Some plant introductions with tolerance superior to the cultivar 'Perry' were identified.

Three major genes for resistance to soybean rust identified - Stoneville, Mississippi and Frederick, Maryland. Three major genes, each giving a specific type of resistance to soybean rust, were identified and the mode of action of the genes determined. Soybean rust is a serious disease of soybeans in Southeast Asia, but is not present in the United States. Resistance to rust is being incorporated into productive germplasm as a protective measure, should the disease be introduced.

High protein soybean germplasm released - Raleigh, North Carolina. A soybean population, NC-1, with seed protein content of 49.4 percent was released as germplasm. Most currently grown soybean cultivars have seed protein levels between 40 and 42 percent. This population is a good source of breeding lines which can be used to develop high protein lines with high yield potential.

Yield increases made in soybeans by using recurrent selection with genetic male sterility - Raleigh, North Carolina. Yield was increased from 2244 kg/ha to 2450 kg/ha by using three cycles of recurrent selection based on S_1 progeny yield performance. A genetic male-sterile trait was shown to be an efficient inexpensive tool for intermating selected progenies. The method resulted in about a 2 percent increase in yield per year. This rate is approximated about twice the rate shown for the more widely used pedigree breeding method.

Resistance to bean pod mottle virus quantified - Raleigh, North Carolina. Results from the 1981 season indicated that resistance in soybean to BPMV should be determined in early-infected plants just before flowering when symptom expression is greatest. Six currently grown cultivars expressed yield reductions of 2 to 12.5 percent (average 7.4 percent) when infected at second trifoliolate stage. This disease is one of the most prevalent diseases in North Carolina.

The enzyme that catalyzes soybean oil synthesis is characterized - Raleigh, North Carolina. Enzymes responsible for oil synthesis have been studied extensively in animal tissues. The corresponding enzyme has never been characterized before in plant tissues. Diacylglycerol acyltransferase was isolated and characterized from developing soybean seed. The purification of this important protein in soybeans has facilitated the evaluation of differences in vegetable oil quantity and quality. Study of the mechanism suggests the nature of product formation in genotypes selected for low linolenic acid content.

'Hobbit' released for highly productive environments - Wooster, Ohio. This determinate Group III variety has yielded 5500 kg/ha (82 bu/A) in highly productive environments in narrow rows at a seeding rate of 300,000 seeds per acre. Hobbit has tolerance to Phytophthora root rot, and its smaller seed has an advantage in stand establishment under adverse environmental conditions.

PEANUTS:

Twenty disease resistant peanut germplasm lines released - Tifton, Georgia. Fourteen germplasm lines designated as Tifrust 1 to Tifrust 14 provide resistance to peanut rust caused by Puccinia arachidis Speg. Six lines designated as CBR-R1 to CBR-R6 provide resistance to Cylindrocladium black rot (CBR). Peanut rust and CBR have increased in severity on peanuts in recent years. These sources of resistance in a variety of plant types offer practical control of the diseases when the genes for resistance are incorporated into superior varieties by peanut breeders.

'Sunbelt Runner' is a high-yielding peanut with performance stability - Tifton, Georgia. This new peanut is 1 to 2 weeks earlier in maturity than the leading variety Florunner and has larger seed than Florunner. The earliness will allow growers to spread their harvest date. The larger seed size aids shellers in meeting export and domestic market demands for Jumbo runner seed.

Peanut oil has potential as a diesel fuel extender - Tifton, Georgia. Eleven peanut cultivars under irrigation averaged 5140 kg/ha seed yield with 51.2 percent oil, for an estimated 2631 kg/ha oil (340 gal/A). Genetic modification of the peanut for maximum energy production is feasible.

'Spanco' is an early-maturing, large-seeded Spanish peanut with good production potential - Stillwater, Oklahoma. Spanco is about 10 days later in maturity than Pronto, but is 10 to 14 days earlier than other current U.S. varieties of peanuts. Extensive testing in Oklahoma indicates that Spanco is superior to present commercial varieties in total pod yield and in dollar return per acre. Spanco will give farmers additional flexibility in planting and harvesting dates.

Good resistance to leafspot diseases found in several peanut accessions - Stillwater, Oklahoma. Several peanut accessions showed good resistance to Cercospora arachidicola under greenhouse test conditions. Two accessions, M-216 and M-280, were obtained by crossing Arachis hypogaea with Arachis sp. and A. chacoense, respectively. Another accession, M-324, was from a cross between an early-maturing A. hypogaea and a colchicine-induced hexaploid hybrid of Chico x A. chacoense. In field plots at Perkins, Oklahoma, several lines of A. hypogaea and M-280 showed resistance to early and late leafspots.

Sclerotinia blight-resistant variety released - Suffolk, Virginia. 'Virginia 81 Bunch' is a high-yielding peanut resistant to Sclerotinia minor, which causes a very destructive disease of peanuts in Virginia. In 1979 peanut losses due to Sclerotinia blight were 13 percent (remotely sensed data). Satisfactory chemical controls are not available. Use of this variety in fields with a history of Sclerotinia blight should reduce infected plants by 50 percent.

SUNFLOWER:

Four sunflower germplasm pools developed and released - Davis, California. Helianthus Germplasm Pools I, II, III, and IV provide increased genetic variability from cultivated and wild sunflowers. Germplasm Pool I was developed from about 10,000 cultivated sunflower breeding lines. Germplasm Pool II is a source of self-compatible, high-oil, inbred lines. Germplasm Pool III provides characteristics of wild H. annuus in 1 to 3 backcrosses to cultivated sunflowers. Germplasm Pool IV is the seed of progeny of 228 accessions of wild H. annuus collected from 14 states and Mexico.

Resistances to Phytophthora root and stalk rots of sunflower identified - Davis, California. Plants of seven wild H. annuus and two H. bolanderi collections were resistant to Phytophthora root rot. Plants of four of the wild H. annuus collections were resistant to Phytophthora stalk rot.

Sclerotinia stalk rot resistance of the wild species H. tuberosus transferred to commercial sunflower - Beltsville, Maryland. This resistance of the hexaploid Jerusalem artichoke was transferred to the diploid commercial sunflower line CMS 89 via three generations of backcrossing. Resistance appears to be conditioned by 3 or 4 independent but complementary dominant genes.

Resistance to new race 3 of downy mildew found - Fargo, North Dakota. More than 125,000 seedlings of 2500 accessions were tested against races 2 and 3 of downy mildew. None of the commercial hybrids or released inbreds with the PL_2 mildew resistance gene was resistant to race 3. Of 680 plant introductions, six open-pollinated varieties had resistance to race 3, and three of them had resistance to both race 2 and 3. Several crosses with wild Helianthus species possessed resistance to race 3 also.

Three fertility restorer lines released - Fargo, North Dakota. RHA 309, RHA 310, and RHA 311 are fertility-restorer nonoilseed lines for use as male parents of hybrids where the female line carries male-sterile cytoplasm. All three lines have an extended period of pollen production and are resistant to race 2 of downy mildew and moderately resistant to rust. RHA 309 and RHA 310 combine well with CMS HA 288 and CMS HA 292. RHA 311 combines well with earlier flowering female parents developed by industry.

Resistance to Sclerotinia stalk rot found - Fargo, North Dakota. Two of the 680 plant introductions were significantly more resistant to this disease than Hybrid 894. Also, USDA inbreds HA 61, RHA 801, HA 304, and HA 124 were highly resistant to the disease. Stalk rot resistance was correlated positively with late maturity.

Role of enzymes for oxygenated fatty acids clarified - Fargo, North Dakota. Lipoxygenase, hydroperoxide isomerase, and hydroperoxide cyclase, the enzymes responsible for the synthesis of three oxygenated metabolites of linoleic and linolenic acids, had very low activities in the mature seed, but increased rapidly three to four days after germination. The activities of isomerase and cyclase were followed in maturing sunflower seed. They reached maximum activity at 21 days after flowering, and declined thereafter. The metabolite, 12-oxo-PDA, produced by hydroperoxide cyclase, retarded senescence in an oat leaf senescence assay, similar to the action of kinetin.

Charcoal-rot resistant lines released for use in hybrid sunflowers - Bushland, Texas. The parental line HA 207 and its male-sterile counterpart CMS HA 207 were developed as resistant to charcoal rot. Hybrids between CMS HA 207 and five fertility restorer lines are about four days earlier than Hybrid 894 and are resistant to charcoal rot, a prevalent disease of cultivated sunflower in the Texas High Plains area in 1981.

FLAX:

Flax line containing multiple rust-resistant genes released - Fargo, North Dakota. 'Flor' carries the genes M^3, P^3, and L^6, each conveying resistance to all known races of flax rust in North America. This is the first variety to be released with the multiple gene complex. It carries greater protection against new races of flax rust than any previous variety grown in North America. Flor is adapted to the North Central flax growing region of the U.S.

SAFFLOWER:

Fourteen Fusarium wilt-resistant safflower germplasm lines released - Davis, California. These lines were derived from safflower introductions resistant to three races of Fusarium wilt. The lines are also resistant to race 4 of the disease, providing resistance to all four known races of Fusarium oxysporum f. sp. carthami.

Virus diseases of safflower identified - Davis, California. Mosaic viruses from safflower were identified as turnip mosaic virus (TuMV) and alfalfa mosaic virus (AMV).

Technological Objective 2: New and improved cultural and management practices that increase oilseed crop yields, minimize production losses, improve quality attributes, and conserve and use scarce resources efficiently.

Research Locations:

Davis, California
Gainesville, Florida
Urbana, Illinois
West Lafayette, Indiana
Ames, Iowa
Beltsville, Maryland
Stoneville, Mississippi
Columbia, Missouri
Raleigh, North Carolina
Wooster, Ohio
Brookings, South Dakota
Suffolk, Virginia

SOYBEANS:

Soybeans have enzymatic capability to evolve gaseous nitrogen oxides - Urbana, Illinois. An enzymatic system exists in soybeans with the potential to evolve predominantly in the form of NO gas, 50 percent of the nitrogen passing through the reductive pathway from NO_3^- to NH_4^+ when analyzed under experimental conditions. The role of gaseous losses of nitrogen oxides under typical growth conditions of soybean is presently unknown and deserves additional exploration.

Glycolytic carbon is partitioned by the enzymes phosphoenolpyruvate carboxylase and pyruvic kinase - Urbana, Illinois. It has been shown by using phosphoenolpyruvate ^{-14}C that the carbon atoms from phosphoenolpyruvate are used to synthesize both alanine and aspartic acid. This implies that in plant tissue the final products of glycolysis (sugar breakdown) should be considered as pyruvate and oxaloacetate rather than just pyruvate, as is often assumed. Thus phosphoenolpyruvate carboxylase is an effective competitor for phosphoenolpyruvate with pyruvate kinase and plays a major role as a biosynthetic enzyme in seed tissue.

Metabolic program for synthesis and degradation of starch seems quite rigidly followed and is independent of harvest date or of attachment to the parent plant in soybeans - Urbana, Illinois. During normal development and maturation soybeans accumulate starch for the first half of development. The starch is subsequently utilized in the second half of development. Seeds of soybeans harvested as detached pods at various stages of development and allowed to dry in intact pods undergo a maturation progress and are viable. After undergoing maturation, seed, at all harvest dates, had a starch content close to that of normally matured seed. By contrast, the soluble sugars were maintained at quite a high level throughout maturation, and these collectively may be important in maintaining a desiccation-resistant structure.

Bacterial tan spot, a new foliar disease of soybeans, described - Ames, Iowa. The casual organism, Corynebacterium flaccumfaciens, long recognized as a pathogen of dry beans, was observed on soybeans in 16 Iowa counties. Soybean cultivars range from resistant to highly susceptible to the bacterium. . The disease is very destructive to highly susceptible soybean cultivars, with yield losses as high as 19 percent. The disease can be controlled by growing resistant cultivars.

Fast-growing rhizobia isolated from soybean root nodules collected in China - Beltsville, Maryland. These new isolates are physiologically distinct from slow-growing soybean rhizobia and are a previously undescribed group of Rhizobium. They form effective nitrogen-fixing symbioses with wild soybean (Glycine soja) and soybean cultivar 'Peking', but are largely ineffective as nitrogen-fixing symbionts with common commercial cultivars of soybeans. Because these new isolates possess the physiological attributes of the fast-growing type of Rhizobium and the symbiotic attributes of the slow-growing Rhizobium, they may represent an important link between these two major groups. They should prove useful in genetic studies of R. japonicum as well as in studies on host-determined factors of nitrogen fixation in soybeans.

New method for screening soybean germplasm for nitrogen fixation - Beltsville, Maryland. The fixed nitrogen products of biological nitrogen fixation are transported mostly as ureides to the vegetative and reproductive parts of plant tops. The relative nitrogen fixation abilities of soybeans can be determined by the measurement of ureide concentration of the uppermost nodes of the plant. This method is new and will be used by soybean breeders and physiologists in large scale nondestructive screening of soybean germplasm to determine variability in capacity to fix nitrogen.

Five-year soybean production systems study completed on problem soil - Columbia, Missouri. Contrary to results and recommendations from Ohio and other states, later June plantings yielded 43 percent more than early May plantings on claypan soils of central Missouri. Row spacings of 38 vs. 76 cm had no effect on soybean yields for the period 1975-79. The conventional tillage treatments yielded 31 percent better than no-till. The use of postemergence herbicide in addition to a preemergence herbicide increased yields 51 percent. Continued early May plantings of soybeans in conventional tillage seedbeds increased weed infestations, whereas weed infestations remained relatively constant for June plantings. Weeds and water were found to be the nongenetic factors limiting yield of soybeans on claypan soils of central Missouri.

Oil content increased by plant growth regulator - Brookings, South Dakota. Chlorflurenol applied to soybeans at R6 stage of growth at rates of 25 or 50 g/ha significantly increased the percent of oil in the seed in all three years in which it was tested. The increase was 0.3 to 1.6 percent oil. Yield of oil per unit area was not always increased because seed yields were sometimes decreased by treatments with the plant growth regulator.

PEANUTS:

Intensive culture of peanuts can reduce yields - Suffolk, Virginia. Irrigation of peanuts increased the incidence of Sclerotinia blight, pod breakdown, and leafspot disease. Yields of irrigated plots were 26 percent less than nonirrigated, possibly because of the increase in Sclerotinia blight. Tillage practices did not influence the incidence of Sclerotinia blight. Peanut yields were not affected by under row ripping or seedbed preparations. Reduced tillage plots yielded 18 percent more than conventionally tilled plots. Implementation of a peanut growth model showed the inadequacy of soil moisture data.

P U B L I C A T I O N S

SOYBEAN

Gainesville, Florida

Akhanda, A. M., G. M. Prine, V. E. Green, and K. Hinson. 1981. Phenology and correlation of growth phases in late-planted soybean in Florida, USA. Indian J. Agric. Sci. 51: 214-220.

Urbana, Illinois

Adams, C. A., T. H. Broman, and R. W. Rinne. 1981. Starch metabolism in developing and germinating soya bean seeds is independent of β-amylase activity. Ann. Bot. (London) 48: 433-439.

Adams, C. A., and R. W. Rinne. 1981. Interactions of phosphoenolpyruvate carboxylase and pyruvate kinase in developing soybean seeds. Plant and Cell Physiol. 22: 1011-1021.

Adams, C. A., and R. W. Rinne. 1981. The occurrence and significance of dispensible proteins in plants. New Phytol. 89: 11-14.

Eskins, K., L. Harris, and R. L. Bernard. 1981. Genetic control of chloroplast pigment development in soybeans as a function of leaf and plant maturity. Plant Physiol. 67: 759-762.

Hildebrand, D. F., J. E. Harper, and T. Hymowitz. 1981. Effects of nitrate level on nitrogen metabolismand soya bean. Ann. Bot. (London) 48: 307-315.

Nissley, C. R., R. L. Bernard, and C. N. Hittle. 1981. Variation in photoperiod sensitivity for flowering and maturity among soybean strains of Group III maturity. Crop Sci. 21: 833-836.

Pataky, J. K., and S. M. Lim. 1981. Effects of row width and plant growth habit on Septoria brown spot development and soybean yield. Phytopathology 71: 1051-1056.

Pataky, J. K., and S. M. Lim. 1981. Effects of Septoria brown spot on the yield components of soybeans. Plant Disease 65: 588-590.

Pataky, J. K., and S. M. Lim. 1981. Efficacy of benomyl for controlling Septoria brown spot of soybeans. Phytopathology 71: 438-442.

Paulsen, M. R., W. R. Nave, and L. E. Gray. 1981. Soybean seed quality as affected by impact damage. Transactions ASAE 24: 1577-1582.

Paulsen, M. R., W. R. Nave, T. L. Mounts, and L. E. Gray., 1981. Storability of harvest-damaged soybeans. Transactions ASAE 24: 1583-1589.

Wolf, W. J., F. L. Baker, and R. L. Bernard. 1981. Soybean seed-coat structural features: pits, deposits, and cracks. Scanning Electron Microscopy 1981, III: 531-544.

West Lafayette, Indiana

Abney, T. S., F. A. Laviolette, and J. R. Wilcox. 1981. Indiana soybean disease and crop condition survey. 1981. Purdue Univ. AES Sta. Bull. 352. 6 pp.

Moreira, M. A., W. C. Mahoney, B. A. Larkins, and N. C. Nielsen. 1981. Comparison of the antigenic properties of glycin peptides. Arch. Biochem. Biophys. 210: 643-646.

Moreira, M. A., M. A. Hermodson, B. A. Larkins, and N. C. Nielsen. 1981. Comparison of the primary structure of the acidic polypeptides of glycinin. Arch. Biochem. Biophys. 210: 633-642.

Staswick, P. E., M. A. Hermodson, and N. C. Nielsen. 1981. Purification and characterization of the complexes of acidic and basic subunits of glycinin. J. Biol. Chem. 256: 8752-8755.

Tumer, N. E., V. H. Thanh, and N. C. Nielsen. 1981. Purification and characterization of mRNA from soybean seeds. J. Biol. Chem. 256: 8756-8760.

Wilcox, J. R., K. L. Athow, F. A. Laviolette, T. S. Abney, and T. L. Richards. 1981. Beeson 80 and Williams 79 soybeans in Indiana. Purdue Univ. AES Sta. Bull. 313. 2 pp.

Wilcox, J. R., K. L. Athow, F. A. Laviolette, T. S. Abney, and T. L. Richards. 1981. Century and Nebsoy soybeans in Indiana. Purdue Univ. AES Stn. Bull. 312. 2 pp.

Wilcox, J. R., K. L. Athow, F. A. Laviolette, T. S. Abney, and T. L. Richards. 1981. Pella and Will soybeans in Indiana. Purdue Univ. AES Stn. Bull. 314. 2 pp.

Wilcox, J. R., K. L. Athow, F. A. Laviolette, T. S. Abney, and T. L. Richards. 1981. Performance of public soybean varieties in Indiana. Purdue Univ. AES Sta. Bull. 317. 5 pp.

Wilcox, J. R., and T. Sediyama. 1981. Interrelationships among height, lodging and yield in determinate and indeterminate soybeans. Euphytica 30: 323-326.

Ames, Iowa

Dunleavy, J. M. 1981. Downy mildew of soybeans. In: D. M. Spencer (ed.), The Downy Mildews. Academic Press, New York, NY. pp. 515-529.

Fehr, W. R., A. F. Schmitthenner, J. B. Bahrenfus, C. S. Schoener, A. K. Walker, and H. Tachibana. 1981. Registration of Vickery soybean. Crop Sci. 21: 475.

Sadanaga, K., and R. Grindeland. 1981. Natural cross-pollination in diploid and autotetraploid soybean. Crop Sci. 21: 503-506.

Tachibana, H., L. Card, R. C. Clark, and W. R. Fehr. 1981. Registration of a germplasm line of soybean, A3. Crop Sci. 21: 353.

Beltsville, Maryland

Devine, T. E., and B. H. Breithaupt. 1981. Frequence of nodulation response alleles, Rh_2 and Rj_4, in soybean plant introduction and breeding lines. U.S. Dept. Agric., Tech. Bull. No. 1628.

Devine, T. E., B. H. Breithaupt, and L. D. Kuykendall. 1981. Tests for diffusible compound endowing rj_1-incompatible strains of Rhizobium japonicum with the ability to nodulate the rj_1rj_1 soybean genotype. Crop Sci. 21: 696-699.

Keyser, H. H., P. Van Berkum, and D. F. Weber. 1981. Nitrogenase activity and hydrogen evolution by Rhizobium japonicum in symbiosis with siratro and cowpea. In: A. H. Gibson and W. E. Newton (eds.), Current Perspectives in Nitrogen Fixation. Australian Academy of Sciences, Canberra. p. 374.

Kuykendall, L. D. 1981. Mutants of Rhizobium that are affected in legume interaction and nitrogen fixation. In: A. Atherly, (ed.), The Biology of the Rhizobiaceae. Academic Press, New York, NY. pp. 299-309.

Lim, S. T., S. L. Uratsu, D. F. Weber, and H. H. Keyser. 1981. Hydrogen uptake activity of Rhizobium japonicum strains forming nodules in soybean production areas of the U.S.A. In: A. H. Gibson and W. E. Newton (eds.), Current Perspectives in Nitrogen Fixation. Australian Academy of Sciences, Canberra. p. 379.

Lim, S. T., S. L. Uratsu, D. F. Weber, and H. H. Keyser. 1981. Hydrogenase activity of Rhizobium japonicum strains forming nodules in soybean production areas of the U.S.A. In: J. M. Lyons (ed.), Genetic Engineering of Symbiotic Nitrogen Fixation. Plenum Press, New York, NY. pp. 159-171.

Munns, D. N., K. G. Cassman, and H. H. Keyser. 1981. Selection of naturally occurring stress tolerant Rhizobium. In: J. M. Lyons (ed.), Genetic Engineering of Symbiotic Nitrogen Fixation. Plenum Press, New York, NY. pp. 181-191.

Munns, D. N., and H. H. Keyser. 1981. Response of Rhizobium strains to acid and aluminum stress. Soil Biol. and Biochem. 13: 115-118.

Orellana, R. G. 1981. Resistance to bud blight in introductions from the germplasm of wild soybean. Plant Disease 65: 594-595.

Yaklich, R. W., and P. B. Cregan. 1981. Moisture migration in soybean pods. Crop Sci. 21: 791-793.

Stoneville, Mississippi

Epps, J. M., L. D. Young, and E. E. Hartwig. 1981. Evaluation of nematicides and a resistant cultivar for control of soybean cyst nematode Race 4. Plant Disease 65: 665-666.

Hartwig, E. E. 1981. Breeding productive soybean cultivars resistant to the soybean cyst nematode for southern United States. Plant Disease 65: 303-307.

Heatherly, L. G. 1981. Evaluation of seeding rates for soybeans in the Delta of Mississippi. Miss. Agric. and For. Exp. Stn. Res. Rep. 6(10). 4 pp.

Heatherly, L. G. 1981. Soybean response to tillage of Sharkey clay soil. Miss. Agric. and For. Exp. Stn. Bull. 892. 6 pp.

Heatherly, L. G., and L. H. Ginn. 1981. A portable system for furrow irrigation of small plots. Soil. Sci. Soc. Am. J. 45: 999-1000.

Heatherly, L. G., and C. W. Jordan. 1981. Effects of row spacing on yield of soybeans on heavy clay soils in the Delta of Mississippi. Miss. Agric. and For. Exp. Stn. Res. Rep. 5(19). 4 pp.

Keeling, B. L., E. E. Hartwig, and E. L. Jackson. 1981. Response of soybean strains to artificial inoculation with Nematospora coryli. Crop Sci. 21(1): 73-75.

Columbia, Missouri

Ocumpaugh, W. R., A. G. Matches, and V. D. Luedders. 1981. Sod-seeded soybeans for forage. Agron. J. 73: 571-574.

Raleigh, North Carolina

Burton, J. W., and C. A. Brim. 1981. Recurrent selection in soybeans. III. Selection for increased percent oil in seeds. Crop Sci. 21: 31-34.

Burton, J. W., and C. A. Brim. 1981. Registration of two soybean germplasm populations (Reg. No. CP40 and GP 41). Crop Sci. 21: 801.

Wilson, R. F. 1981. Aspects of glycerolipid metabolism in soybeans. Crop Sci. 21: 519-524.

Wilson, R. F. 1981. Root lipid composition and metabolism in genetic male-sterile soybeans. Crop Sci. 21: 69-73.

Wilson, R. F., J. W. Burton, and C. A. Brim. 1981. Progress in the selection for altered fatty acid composition in soybeans. Crop Sci. 21: 788-791.

Wooster, Ohio

Cooper, R. L. 1981. Development of short-statured soybean cultivars. Crop Sci. 21: 127-131.

Cooper, R. L. 1981. Registration of Elf soybean (Reg. No. 150). Crop Sci. 21: 633-634.

Cooper, R. L., R. J. Martin, A. K. Walker, and A. F. Schmitthenner. 1981. Registration of Amcor soybean (Reg. No. 149). Crop Sci. 21: 633.

Cooper, R. L., R. J. Martin, A. K. Walker, and A. F. Schmitthenner. 1981. Registration of Gnome soybean (Reg. No. 151). Crop Sci. 21: 634.

Brookings, South Dakota

Dybing, C. D., and C. Lay. 1981. Field evaluations of morphactins and other growth regulators for senescence delay of flax, soybean, wheat, and oats. Crop Sci. 21: 879-884.

Dybing, C. D., and C. Lay. 1981. Yields and yield components of flax, soybean, wheat, and oats treated with morphactins and other growth regulators for senescence delay. Crop Sci. 21: 904-908.

PEANUT:

Tifton, Georgia

Branch, W. D., and R. O. Hammons. 1981. Digenic inheritance for the flop trait in peanuts. Crop Sci. 21: 385-386.

Gaines, T. P., and R. O. Hammons. 1981. Mineral composition of peanut seed as influenced by cultivar and location. Peanut Sci. 8: 16-20.

Hammons, R. O. 1981. Arachis hypogaea L. In: J. A. Duke (ed.), Handbook of Legumes of World Economic Importance. Plenum Press, New York, NY. pp. 18-22.

Hammons, R. O. 1981. Breeding peanuts for disease resistance: Rust and leafspot. In: J. C. Wynne and T. A. Coffelt (eds.), Proc. of Peanut Breeding Symposium, APRES, Richmond, VA. pp. 52-58.

Hammons, R. O. 1981. Genetic vulnerability. In: The Oil Crops of China. Chinese Academy of Agric. Sciences, Inst. of Oil-bearing Crops, Wuhan. pp. 1-5.

Hammons, R. O. 1981. Peanut varieties: Potential for fuel oil. In: 1981 Proc. APRES 13: 12-20.

Hammons, R. O. 1981. Research and extension inputs resulting in high yields of groundnuts in the USA. In: ICRISAT 1980 Proc. International Workshop on Groundnuts. Patancheru, A.P., India. pp. 33-39.

Hammons, R. O. 1981. Rust resistant peanuts released to breeders. Peanut J. and Nut World 60: 18-19.

Hammons, R. O. 1981. Six peanut germplasm lines resistant to Cylindrocladium black rot. Peanut J. and Nut World 60: 10-12.

Hammons, R. O., D. K. Bell, and E. K. Sobers. 1981. Evaluating peanuts for resistance to Cylindrocladium black rot. Peanut Sci. 8: 117-120.

Hammons, R. O., and W. D. Branch. 1981. An F_2 yield trial in peanuts. Peanut Sci. 8: 53-56.

Stillwater, Oklahoma

Banks, D. J., and K. Eskins. 1981. Analysis of normal peanut chloroplast pigments by liquid chromatography. Peanut Sci. 8: 40-42.

Ketring, D. L., and A. M. Schubert. 1981. Reproducing of peanuts treated with a cytokinin-containing preparation. Agron. J. 73: 350-352.

Melouk, H. A. 1981. Effect of cyhexatin (plictran) on growth, conidial germination and sporulation of Cercospora arachidicola. Peanut Sci. 8: 11-12.

Suffolk, Virginia

Coffelt, T. A., D. M. Porter, and K. H. Garren. 1981. Breeding for resistance to Cylindrocladium black rot and Sclerotinia blight in peanuts. In: Proc. Peanut Breeding Symposium, APRES, Richmond, VA; NC State Univ. Res. Rep. No. 80. pp 44-48.

Hallock, D. L., and D. M. Porter. 1981. Survey of plant nutrient effects on Sclerotinia blight in peanuts. Peanut Sci. 8: 48-52.

Porter, D. M. 1981. Sclerotinia blight of groundnut: a disease of major importance in the USA. ICRISAT, Proc. 1980 International Workshop Groundnuts. Patancheru, A.P., India. pp. 177-185.

Porter, D. M., and R. K. Lankow. 1981. Growth of Sclerotinia minor on media containing chlorothalonil and benomyl. Plant Disease 65: 591-594.

SUNFLOWER:

Davis, California

Beard, B. H. 1981. The Sunflower Crop. Scientific American 244: (May) 150-161.

Chandler, J. M., and B. H. Beard. 1981. Embryo culture: A tool to facilitate crossing sunflower. The Australian Sunflower. April 1981.

Klisiewicz, J. M. 1981. Reaction of sunflower and safflower germplasm to Verticillium dahliae. Plant Disease 65: 237-239.

Beltsville, Maryland

Yang, S. M., and C. A. Thomas. 1981. Comparison of techniques for inoculating sunflower heads with three species of Rhizopus. Phytopathology 71: 458-460.

Fargo, North Dakota

Lulai, E. C., C. W. Baker, and D. C. Zimmerman. 1981. Metabolism of linoleic acid by barley lipoxygenase and hydroperoxide isomerase. Plant Physiol. 68: 950-955.

Miller, J. F., G.N. Fick, D. E. Zimmer, and W. W. Roath. 1981. Registration of three nonoilseed sunflower parental lines. Crop Sci. 21: 638.

Schneiter, A. A., and J. F. Miller. 1981. Description of sunflower growth stages. Crop Sci. 21: 901-903.

Vick, B. A., and D. C. Zimmerman. 1981. Lipoxygenase, hydroperoxide isomerase, and hydroperoxide cyclase in young cotton seedlings. Plant Physiol. 67: 92-97.

Zimmerman, D. C. 1981. Sunflower - a new major oilseed crop for the United States. Amer. Oil Chem. Soc., Monograph No. 9, New Sources of Fats and Oils. pp. 25-36.

Bushland, Texas

Rogers, C. E., T. E. Thompson, and G. J. Seiler. 1981. Sunflower species of the United States. Kays Press. Fargo, ND. National Sunflower Association.

Seiler, G. J., L. Cuk, and C. E. Rogers. 1981. New and interesting distribution records for Helianthus paradoxus Heiser (Asteraceae). Southwestern Nat. 26: 431-432.

FLAX:

Brookings, South Dakota

Dybing, C. D., and C. Lay. 1981. Flax. In: T. A. McClure and E. S. Lipinsky (eds.), CRC Handbook of Biosolar Resources. II. Resource Materials. CRC Press,Inc., Boca Raton, FL. pp. 71-85.

Fargo, North Dakota

Feng, P., B. A. Vick, and D. C. Zimmerman. 1981. Formation of gamma-ketols from 13- and 9-hydroperoxides of linolenic acid by flaxseed hydroperoxide isomerase. Lipids 16: 377-379.

Miller, J. F., J. J. Hammond, and T. J. Gulya. 1981. Cooperative flax trials in the spring flax region - 1980. U.S. Dep. Agric. ARM-NC-18. 13 pp.

Statler, G. D., J. J. Hammond, and J. F. Miller. 1981. The development of new races of flax rust to identify multiple gene combinations in flax. N.D. Farm Res. 39: 5-7.

SAFFLOWER:

Davis, California

DaVia, D. J., P. F. Knowles, and J. M. Klisiewicz. 1981. Evaluation of the world safflower collection for resistance to Phytophthora. Crop Sci. 21: 226-229.

Heaton, T. C., and J. M. Klisiewicz. 1981. A disease resistant safflower alloploid from Carthamus tinctorius L. X C. lanatus L. Can. J. Plant Sci. 61: 219-224.

Beltsville, Maryland

Calders, G., B. Prescott, C. A. Thomas, and P. J. Baker. 1981. Characterization of a polysaccharide from Carthamus tinctorius that cross reacts with type III pneumococcal polysaccharide. J. Gen. Appl. Microbiol. 27: 157-172.

Thomas, C. A. 1981. Inheritance of resistance to lettuce mosaic virus in safflower. Phytopathology 71: 817-818.

GUAR:

Bushland, Texas

Stafford, R. E., and C. R. Lewis. 1981. Registration of five guar germplasm lines. (Reg. No's. GP-33 to GP-37). Crop Sci. 21: 147-148.

Davis California	Dr. J. N. Rutger Rm 215 Hunt Hall University of California Davis, CA 95616	FTS: 453-2460
Gainesville, Florida	Dr. M. H. Gaskins Dept of Agronomy-Bldg 164 University of Florida Gainesville, FL 32611	FTS: 946-7250
Tifton, Georgia	Dr. R. O. Hammons Georgia Coastal Plain Expt Sta P O Box 748 Tifton, GA 31793	(912) 386-3561
Urbana, Illinois	Dr. W. R. Nave 226 Agric Engineering Bldg University of Illinois 1208 W Peabody Dr Urbana, IL 61801	FTS: 958-5530
	Dr. D. B. Peters S-216 Turner Hall University of Illinois 1102 S Goodwin Urbana, IL 61801	FTS: 958-5540
	Dr. L. M. Wax N-325 Turner Hall University of Illinois 1102 S Goodwin Urbana, IL 61801	FTS: 958-5541
Lafayette, Indiana	Dr. J. R. Wilcox 2-318 Lilly Hall Life Sciences Bldg Purdue University W. Lafayette, IN 47907	(317) 494-8074
Ames, Iowa	Dr. M. D. Simons 313 Bessey Hall Iowa State University Ames, IA 50011	FTS: 865-3122
Beltsville, Maryland	Dr. A. G. Gillaspie Rm 201 Bldg 004 BARC-West Beltsville, MD 20705	FTS: 344-3601
	Dr. G. W. Schaeffer Rm 116 Bldg 011A BARC-West Beltsville,MD 20705	FTS: 344-2103

Stoneville, Mississippi	Dr. T. C. Kilen Delta States Research Center P O Box 225 Stoneville, MS 38776	FTS: 497-2110
Columbia, Missouri	Dr. M. R. Gebhardt Agric Engineering Bldg T-12 University of Missouri Columbia, MO 65211	FTS: 276-5353
	Dr. E. J. Peters 216 Waters Hall University of Missouri Columbia, MO 65211	FTS: 276-5357
Raleigh, North Carolina	Dr. R. F. Wilson 4124 Williams Hall North Carolina State Univ Raleigh, NC 27655	FTS: 672-4248
Fargo, North Dakota	Dr. D. C. Zimmerman Dept of Agronomy, 354A Ladd North Dakota State Univ Fargo, ND 58105	FTS: 783-5455
Wooster, Ohio	Dr. R. L. Cooper Rm 209 Williams Hall Ohio Agric R&D Center Wooster, OH 44691	(216) 264-1021
Stillwater, Oklahoma	Dr. D. J. Banks Plant Science Res Facility P O Box 1029 Stillwater, OK 74076	FTS: 728-4124
Brookings, South Dakota	Dr. C. D. Dybing Rm 153 Plant Science Bldg South Dakota State Univ Brookings, SD 57006	(605) 688-5156
Bushland, Texas	Dr. C. E. Rogers Conservation & Production Res Lab P O Drawer 10 Bushland, TX 79012	FTS: 735-6743
Suffolk, Virginia	Dr. D. M. Porter P O Box 7098 Holland Station Suffolk, VA 23437	FTS: 827-6289

National Research Program 20090
BREEDING AND PRODUCTION - SUGAR CROPS

This National Research Program involves research in breeding and production of sugarcane, sugarbeets, and sweet sorghum. New hybrids and breeding lines are developed to improve yield, pest resistance, and drought, cold, and salt tolerance. Cultural and management practices are developed that will improve sugar and sirup yields and reduce production costs. Plant pathologists, geneticists, physiologists, and agronomists work as teams within commodities to accomplish the mission. Much of the research is cooperative with State agricultural research stations and industry.

Technological Objective: Develop new and improved breeding lines and hybrids that combine high-yielding potential and favored quality characters with better pest resistance, drought-cold-salt tolerance, and adaptation to mechanized culture, harvesting, handling, and storage.

NPS Contact: Howard J. Brooks

Research Locations:

Salinas, California
Fort Collins, Colorado
Canal Point, Florida
Aiea, Hawaii
Houma, Louisiana
Beltsville, Maryland
East Lansing, Michigan
Meridian, Mississippi
Fargo, North Dakota
Logan, Utah

Examples of recent progress:

Sugarbeets:

Release of a sugarbeet germplasm line resistant to Heterodera schachtii - Salinas, CA. A sugarbeet germplasm line, H770, resistant to Heterodera schachtii was developed. The line is being released to the U.S. sugarbeet industry as a source material for sugarbeet nematode resistance breeding. Based on greenhouse tests, more than 95% of progeny were resistant when H770 was used as the female parent. This is the first nematode-resistant germplasm line to be released.

Release of first male-sterile Rhizoctonia-resistant sugarbeet - Fort Collins, CO. The world's first cytoplasmic male-sterile (CMS), monogerm, rhizoctonia root rot resistant sugarbeet was released and registered. This CMS germplasm (FC 708 CMS) and its maintainer (type 0) equivalent (FC 708) provide the first opportunity for private sugarbeet breeders to incorporate rhizoctonia resistance directly into the female parent of hybrids. This resistant CMS germplasm has the potential to be combined with susceptible pollinators known to have good combining ability to produce hybrids with moderate levels of resistance or to be combined with resistant pollinators previously released to produce hybrids with the highest available level of resistance.

Technique to select for resistance to southern root rot developed - Beltsville, MD. A technique to select for resistance to southern root rot, Sclerotium rolfsii, was developed. Progenies of selected plants exhibit greater resistance than their ancestors in nursery and inoculation chamber tests. Resistant varieties would permit extension of the range of sugarbeets to southern United States where roots could be left in the ground until the factory would process them. This could be of major importance in fuel alcohol production by supplying sugarbeets to distilleries on a year-round schedule.

Germplasm developed to reduce sugarbeet root maggot damage - Logan, UT. The sugarbeet root maggot is a major insect pest that affects sugarbeets in the United States and Canada. Approximately 38 percent of the U. S. acreage is subject to damage and it is estimated that the insect causes the loss of 530,000 tons annually due to this insect. Recurrent selection for six cycles has resulted in germplasm that has 36 percent less root maggot damage than the parent population. This germplasm should prove to be an effective means of developing more productive varieties for root maggot-infested locations.

Sugarcane:

High yield sugarcane clone released - Canal Point, FL. A new sugarcane clone, CP 73-1547, was released to the sugarcane industry for commercial production. CP 73-1547 produced 21 and 19 percent more indicated tons of sugar per hectare at early and late harvests, respectively, than the most widely grown commercial clones. The new clone has adequate resistance to sugarcane mosaic, leaf scald, eye spot, and rust, and has an intermediate reaction to smut. CP 73-1547 should make a significant contribution to the sugarcane industry, especially when planted in areas of low smut incidence.

Evidence for three components of sugarcane smut resistance - Canal Point, FL. The appearance of sugarcane smut in the United States has retarded sugarcane variety improvement and has emphasized the need for a more efficient screening procedure. Information bearing on the development of a screening method was provided by a study of the nature of resistance. This study showed that there is a mechanical component and a component of resistance, and provided statistical evidence for a third unknown component.

Successful anther culture is a major step toward genetic engineering of sugarcane Aiea, HI. The new anther culture program allows the production of haploid cell lines and plants. Successful directed transfer of genetic information from a plant or microorganism into another plant species (genetic engineering) requires the receptor plant cells to contain only a single set of chromosomes (haploid). This success removes a significant barrier to utilization of biotechnology for sugarcane crop improvement.

Bacterial counts method provides a significant step toward screening for ratoon stunting disease (RSD) injury - Houma, LA and Beltsville, MD. Yield reduction data on 20 sugarcane clones for 3 years in a replicated yield test in Louisiana showed that yield effects were related to the number of RSD bacteria in stalk juice. The 4 clones with a history of RSD tolerance had fewer bacteria and less loss of cane tonnage and sugar per hectare than the 4 highly susceptible clones. Bacterial counts can be useful in identifying clones that are most tolerant or intolerant to RSD injury.

Sugarcane smut found in Louisiana - Houma, LA. Sugarcane smut was found in 8 of 17 sugarcane-growing parishes of Louisiana. The State's leading commercial clone, CP 65-357, was heavily infected in some fields. Two more commercial clones were also infected but 4 other commercial clones appear to be highly resistant. Yield losses were not extensive in 1981 but spread could bring significant losses in the future.

High yield mosaic-resistant sugarcane clone released - Houma, LA. A new sugarcane clone, CP 73-351, was released to the sugarcane industry for commercial production. CP 73-351 is equal to the leading clone in sugar per hectare in plant cane and higher in the first and second ratoon crops. CP 73-351 is the first modern commercial clone to show some field resistance to sugarcane mosaic virus strain H.

Sweet Sorghum:

Sweet sorghum cultivar released with potential as energy source - Meridian, MS. M 81E is a new sweet sorghum cultivar for sirup and fermentable sugar production. The sirup from M 81E has mild sorghum flavor, amber color, and excellent quality. The new cultivar is well adapted to growing conditions in the southeastern part of the United States.

New race of sorghum rust may be present in Louisiana - Meridian, MS. A possible new race of sorghum rust is infecting Wray sweet sorghum in Louisiana. This cultivar is highly resistant to the rust races found in Mississippi.

Technological Objective 2: Develop new and improved cultural and management practices to increase sugar and sirup yields, minimize production losses, improve quality attributes, and efficiently conserve scarce resources.

Research Locations:

Salinas, California
Fort Collins, Colorado
Canal Point, Florida
Aiea, Hawaii
Houma, Louisiana
Beltsville, Maryland
East Lansing, Michigan
Meridian, Mississippi
Fargo, North Dakota
Logan, Utah

Examples of recent progress:

Sugarbeets

Sulfur was not effective for control of Rhizoctonia root rot in 1981 - Fort Collins, CO. Contrary to 1980 results, flowable sulfur at 3 rates and 2 methods of application failed to control rhizoctonia root rot in field-grown sugarbeet. Greenhouse tests point to an indirect effect of sulfur on the pathogen via some other biotic system. Such a system either was not present or not operative in the 1981 test. Use of sulfur currently does not seem economically feasible as a control of this disease.

Serological assay method may reduce the need for insecticide spray treatments - Logan, UT. A very sensitive serological assay (enzyme-linked immunosorbent assay) was adapted for use in detecting beet curly top virus in its beet leafhopper vector. The assay was sufficiently sensitive to detect virus in the extract from a single leafhopper. Assays previously requiring 2 weeks can now be done in 24 hours. This method is being used to identify field populations of beet leafhoppers that have high potential for causing curly top disease in commercial crops. Monitoring of leafhopper populations should result in considerable savings because of the reduced need for insecticide spray treatments.

Rapid sugarbeet improvement is possible with new physiological selection techniques - Logan, UT. Sugarbeet improvement has been slow because of a negative correlation that exists between root yield and sugar content. Opposite effects of root cell size on yield and sugar content were discovered to be the main cause of this negative relationship. Measuring cell size in a breeding program is impractical; therefore, ARS scientists have investigated alternate, easily measured characters that identify relative cell size. It was found that the hypocotyl diameter of 6-day-old plants gives a relative measure of cell size and ultimately sugar content. Varieties with the smallest hypocotyl diameter at 6 days of age were the highest in sugar content at harvest time. This selection criteria, coupled with hypocotyl diameter of older seedlings, should identify superior lines for root yields and sugar content. These techniques should significantly accelerate the development of improved sugarbeet germplasm.

U. S. commercial sugarbeet varieties have good potential for alcohol fuel production - Logan, UT. Fodder beet hybrids have been reported in the public press and from New Zealand research to be an excellent crop for alcohol fuel production. However, field experiments during the past 2 years at many locations have shown that fodder beets are not superior to current U. S. sugarbeet hybrid varieties. Fodder beets have higher root yield but far less sugar content, resulting in approximately equal fermentable sugar yield to that of sugarbeets. The higher cost of harvesting and transporting the weight mass and the disease susceptibility of fodder beets indicate that sugarbeet would now be a more economical fuel crop than fodder beet. Field experiments have demonstrated that current sugarbeet hybrids will yield 700 to 900 gallons per acre of fuel alcohol.

Sugarcane

Record sugarcane yields were obtained by broadcast planting - Houma, LA. Increased yields have been obtained in the past by closer row spacing. A new spacing treatment, broadcast planting, gave record yields (26.3 tons/hectare) for replicated plot work in Louisiana. Plots were planted on a flat field instead of the usual raised rows and the planting rate was about twice the usual amount of seedcane. Harvesting was done by combine. This study indicates that the biological potential exists to more than double sugarcane yields in Louisiana.

Sugarcane smut isolates evaluated in greenhouse tests - Beltsville, MD. Seven sugarcane clones were injected with smut spores from Argentina, Florida, Hawaii, Taiwan, and Zimbabwe and were grown in a containment greenhouse at Frederick, Maryland. After 7 months, 6 races could be differentiated on 5 of the clones. These results indicate that evaluation can be done under greenhouse conditions.

Sweet Sorghum

Separation of groups of strains of sugarcane mosaic virus (SCMV) by inclusion, morpholgy, and serology - Beltsville, MD. Based on the morphology of the pinwheel inclusions produced in Rio sorghum, the strains of sugarcane mosaic virus were divided into 3 groups: those that form (1) predominatley or only sheet lamination (SCMV-A, -B, -D strains); (2) circular laminations (SCMV-H -I strain); (3) circular and sheet laminations (SCMV-E strain), -K). Enzyme-linked immunosorbent assays also provide similar separations with the exception of SCMV-K strain which is more closely related to SCMV-A than to SCMV-E. These procedures provide a more rapid separation method than the use of differential hosts.

P U B L I C A T I O N S

Salinas, California

Esau, K., and L. L. Hoefert. 1981. Beet yellow stunt virus in the phloem of Sonchus oleraceus L. J. Ultrastr. Res. 75:326-338.

Gildow, F. E., and James E. Duffus. 1981. Identification of beet western yellows virus associated with accessory glands of the aphid vector. Phytopathology 71:876.

McFarlane, J. S. 1981. Fusarium stalk blight resistance in sugarbeet. J. Amer. Soc. Sugar Beet Technol. 21:175-183.

Yu, M. H., and A. E. Steele. 1981. Host-parasite interaction of resistant sugarbeet and Heterodera schachtii. J. Nematol. 13:206-212.

Yu, M. H. 1981. Sugarbeets homozygous for nematode resistance and transmission of resistance to their progenies. Crop Sci. 21:714-717.

Fort Collins, Colorado

Hecker, R. J., and E. G. Ruppel. 1981. Registration of FC 708 and FC 708 CMS sugarbeet germplasm (Reg. Nos. GP 63 and GP 64). Crop Sci. 21:802.

Hecker, R. J., and S. S. Martin. 1981. Effect of sugarbeet sample preparation and handling on sucrose, nonsucroses and purity analyses. J. Amer. Soc. Sugar Beet Technol. 21:184-197.

Ruppel, E. G. 1981. A proposed list of common names for diseases of beet. Phytopathol. News. In Plant Dis. 65:624-625.

Ruppel, E. G. 1981. Controlling preharvest fungal diseases of sugarbeet, pp. 501-504. In Vol. 11, Proc. Symposia IX Intern. Cong. Plant Prot., Washington, D.C., Aug. 5-11, 1979. Amer. Phytopathol. Soc.

Smith, G. A. 1981. New sugarbeet line bred to resist both leafspot and curly top. Sugar Y Azucar, 76:22.

Smith, G. A. and E. E. Schweizer. 1981. Variety X herbicide interaction. Sugro Info. 3:1-6.

Steinkamp, M. P., S. S. Martin, L. L. Hoefert, and E. G. Ruppel. 1981. Ultrasctructure of lesions produced in leaves of Beta vulgaris by cercosporin, a toxin from Cercospora beticola. Phytopathology 71:1272-1281.

Canal Point, Florida

Dean, J. L. 1981. Red rot on rust-infected sugarcane leaf blades in Florida. Sugarcane Pathol. Newsl. 27:32-34.

Glaz, B. 1981. Florida's 1981 sugarcane variety census. Sugar Y Azucar 76(12): 37, 38, 40.

Purdy, L. H., and J. L. Dean. 1981. A system for recording data about the sugarcane rust/host interactions. Sugarcane Pathol. Newsl. 27:35-40.

Tai, P. Y., J. D. Miller, and J. L. Dean. 1981. Inheritance of resistance to rust in sugarcane. Field Crops Res. 4:261-268.

Tai, P.Y., J. D. Miller, B. S. Gill, and V. Chew. 1980. Correlations among characters of sugarcane in two intermediate selection stages. Proc. Int. Soc. Sugar Cane Technol. 17:1119-1128.

Aiea, Hawaii

Kaufman, P. B., N. S. Ghosheh, M. Lee, T. J. Carlson, J. D. Jones, W. Rigot, W. C. Bigelow, S. Kraus, and P. H. Moore. 1981. Effect of gibberellic acid on silica content and distribution in sugarcane. Plant Physiol. 68:314-317.

Houma, Louisiana

Benda, G. T. A. 1980. Sugarcane mosaic and yield of single plants of sugarcane. Proc. Int. Soc. Sugar Cane Technol. 17:1528-1536.

Benda, G. T. A., H. P. Fanguy, J. E. Irvine, and R. D. Breauz. 1981. Field planting of short sugarcane seed pieces in Louisiana. Proc. Am. Soc. Sugar Cane Technol. 9(NS):40-43.

Breaux, R. D. 1981. Defuzzing sugarcane spikelets with a sample seed scarifier. Proc. Am. Soc. Sugar Cane Technol. 9(NS):47-50.

Breaux, R. D., H. P. Fanguy, and N. I. James. 1981. Registration of CP 72-356 sugarcane. Crop Sci. 21:797.

Dunckelman, P. H. 1981. Advancement of new basic sugarcane breeding lines. Proc. Am. Soc. Sugar Cane Technol. 9(NS):33-36.

Fanguy, H. P., and R. D. Breaux. 1981. Registration of CP 72-370 sugarcane. Crop Sci. 21:798.

Fanguy, H. P., and L. L. McCormick. 1981. The Louisiana sugarcane variety census for 1980. Sugar Bull. 59(15):13-14.

Irvine, J. E. 1981. Variations in non-sucrose solids in sugarcane. I. Potassium. Proc. Am. Soc. Sugar Cane Technol. 9(NS):58-61.

Irvine, J. E. 1981. Field origin of dextran and other substances affecting sugarcane crystallization. Sugar y Azucar 76(6):43, 46-47.

Irvine, J. E. 1981. Sugarcane. CRC Handbook of Biosolar Resources. Vol. 11. Resource Materials. p 211-229.

Irvine, J. E., and G. T. A. Benda. 1980. Sugarcane spacing. 11. Effects of spacing on the plant. Proc. Int. Soc. Sugar Cane Technol. 17:357-367.

Irvine, J. E., G. T. A. Benda, and C. A. Richard. 1980. Sugarcane spacing. 1. Historical and theoretical aspects. Proc. Int. Soc. Sugar Cane Technol. 17:350-356.

Irvine, J. E., C. A. Richard, D. D. Garrison, W. R. Jackson, R. J. Matherne, C. Camp, and C. Carter. 1980. Sugarcane spacing. 111. Development of production techniques for narrow rows. Proc. Int. Soc. Sugar Cane Technol. 17:368-376.

Jackson, W. R., K. P. Bischoff, C. A. Richard, and D. D. Garrison. 1981. Sugarcane variety outfield experiments during 1979. Sugar Bull. 59(14):6-7, 10, 12-13.

Koike, H. 1980. Evidence of resistance in Saccharum spontaneum and Saccharum related genera to sugarcane mosaic virus H and I. Proc. Int. Soc. Sugar Cane Technol. 17:1523-1527.

Koike, H. 1981. Mosaic: An extraordinary disease problem. Sugar J. 43(10):19.

Koike, H. 1981. Disease resistance testing of some U.S. sugarcane varieties in Taiwan. Sugar Bull. 59(20:13-15.

Koike, H. 1981. Mosaic and ratoon stunting diseases: Individual and combined effects on yields of two commercial varieties. Sugar Bull. 59(17):10,12,13.

Koike, H., D. Fontenot, K. Damann, and R. Schlub. 1981. Smut of sugarcane in Louisiana: A first report. Plant Dis. 65(12):1018.

Koike, H., and R. W. Millhollon. 1980. Influence of diseases and herbicides on sugarcane growth in the greenhouse. Proc. Int. Soc. Sugar Cane Technol. 17:1433-1437.

Legendre, R. L. 1981. Preliminary investigations on the effect of harvesting systems on field losses and cane quality in Louisiana. Proc. Am. Soc. Sugar Cane Technol. 9(NS):62-65.

Legendre, B. L. 1981. Criteria for evaluating milling quality of potential varieties in Louisiana. Proc. Am. Soc. Sugar Cane Technol. 8(NS):104-106.

Legendre, B. L. 1981. Maturity studies of commercial sugarcane varieties in Louisiana. Proc. Amer. Soc. Sugar Cane Technol. 9(NS):105

Legendre, B. L., and G. T. A. Benda. 1981. Single plants for testing glyphosine effects in sugarcane. Proc. Plant Growth Regulator Society of America 8:169.

Martin, F. A., B. L. Legendre, G. M. Dill, G. D. Dimarco, and R. J. Steib. 1981. Chemical ripening of Louisiana sugarcane. Sugar J. 43(10):20-22.

Nagatoma, S., and P. H. Dunckelman. 1980. Relationship of pollen and pistil characteristics to setting of true seeds in sugarcane crosses. Proc. Int. Soc. Sugar Cane Technol. 17:1216-1235.

Beltsville, Maryland

Coe, G. E. 1981. Registration of sugarbeet line SP 8030-0. Crop Science 21:478.

Coe, G. E. 1981. Registration of sugarbeet parental lines SP6926-0 and SP6926-01. Crop Science 21:637-638.

Gillaspie, A. G., Jr., C. T. Chen, R. G. Mock, and R. W. Harris. 1980. Sugarcane mosaic virus in Taiwan. Proc. Int. Soc. Sugar Cane Technol. 17:1505-1509.

Gillaspie, A. G., Jr., M. J. Davis, R. Harris, and R. H. Lawson. 1981. Isolation and pathogenicity of the ratoon stunting disease bacterium. Int. Sug. J. 83:324-326.

Gillaspie, A. G., Jr., C. A. Thomas, and B. Prescott. 1981. Inhibition of sugarcane mosaic virus symptoms on Sorghum by microbial and plant polysaccharides and their antigenic relationship. Phytopathol. Z. 102:107-113.

East Lansing, Michigan

Potter, J. S., and C. L. Schneider. 1981. Sugarbeet diseases of the North Central United States. North Central Reg. Ext. Publ. No. 140: 4pp. Ilus.

Potter, J. S., and C. L. Schneider. 1981. Control of Cercospora leaf spot and Rhizoctonia crown rot diseases of sugarbeet with fungicides applied by sprinkler irrigation. J. Amer. Soc. Sugar Beet Technol. 21(1):50-55.

Schneider, C. L., R. L. Sims, and H. S. Potter. 1981. Tests of fungicides for control of sugarbeet crown rot in 1979. In Fungicide and Nematicide Tests 36:55.

Meridian, Mississippi

Broadhead, D. M. 1981. Sorghum research at the U. S. Sugar Crops Field Station. Sugar J. 44:7.

Broadhead, D. M., K. C. Freeman, and N. Zummo. 1981. Registration of Wray sweet sorghum. Crop Sci. 21:987.

Broadhead, D. M., K. C. Freeman, and N. Zummo. 1981. M 81E, a new variety of sweet sorghum. MAFES Research Highlights 45(1).

Zummo, N. 1981. Pest Management Systems for Sorghum Diseases. Chapter in Handbook of Pest Management in Agriculture Vol. 3., pp. 563-574. CRC Press., Inc., Boca Raton, Florida.

Zummo, N., W. R. Findley, K. C. Freeman, and M. J. Bitzer. 1981. Resistance of sweet sorghum cultivars and lines to maize dwarf mosaic in Kentucky, Ohio, and Mississippi. Plant Dis. 65:24-242.

Logan, Utah

Doney, D. L., R. E. Wyse, and J. C. Theurer. 1981. The relationship between cell size, yield, and sucrose concentration of the sugarbeet rot. Can. J. Plant Sci. 61:447-453.

Theurer, J. C., D. L. Doney, and J. Gallian. 1981. Fodder beet - potential alcohol fuel crop. Utah Sci. 42:63-67.

PRINCIPAL CONTACTS - NRP 20090

Sugarbeets

SALINAS, CA 93901

Dr. James E. Duffus
U. S. Agric. Research Station
P. O. Box 5098

FTS: 468-2253

FORT COLLINS, CO 80523

Dr. Richard J. Hecker
Crops Research Laboratory
Colorado State University

FTS: 323-5206

BELTSVILLE, MD 20705

Dr. Gerald E. Coe
Building 009, BARC-W

FTS: 344-3619

EAST LANSING, MI 48823

Dr. George J. Hogaboam
P. O. Box 1633

FTS: 375-7456

FARGO, ND 58102

Dr. William M. Bugbee
Department of Plant Pathology
North Dakota State University

FTS: 783-5182

LOGAN, UT 84321

Dr. J. Clair Theurer
Crops Research Laboratory

(801) 750-3057

Sugarcane

CANAL POINT, FL 33438

Dr. Jimmy D. Miller
U.S. Sugarcane Field Station
Star Route Box 8

(305) 924-5227

AIEA, HI 96701

Dr. Paul H. Moore
HSPA Experiment Station
P.O. Box 1057

(808) 487-5561

HOUMA, LA 70360

Dr. James E. Irvine
U. S. Sugarcane Laboratory
P. O. Box 570

(504) 872-6316

BELTSVILLE, MD 20705

Dr. A. Graves Gillaspie
Room 201, B-004
BARC-W

FTS: 344-3350

Sweet Sorghum

MERIDIAN, MS 39301

Mr. Dempsey M. Broadhead
U. S. Sugar Crops Field Station
Route 10, Box 152

(601) 482-0611

National Research Program 20100

BREEDING AND PRODUCTION - FORAGE CROPS FOR HAY, PASTURES AND OTHER USES, INCLUDING TURF

This National Research Program outlines a research program on crop production efficiency to develop new knowledge and to increase crop and livestock productivity. Forage crops for hay, pasture, silage, and other uses, including turf, and grass and legume seed production represent a resource of major economic significance in the United States.

NPS Contact: G. E. Carlson

Technological Objective 1: New and improved genetic populations, breeding lines, and cultivars of forage crops with improved yield, special use characteristics, quality, pest resistance, and tolerance to environmental stress.

Research locations:

Palmer, Alaska
Tifton, Georgia
Watkinsville, Georgia
Manhattan, Kansas
Lexington, Kentucky
Beltsville, Maryland (PGGI)
Beltsville, Maryland (PPHI)
St. Paul, Minnesota
Mississippi State, Mississippi
Columbia, Missouri
Lincoln, Nebraska
Reno, Nevada
Oxford, North Carolina
Mandan, North Dakota
Philadelphia, Pennsylvania
University Park, Pennsylvania
College Station, Texas
Temple, Texas
Prosser, Washington
Madison, Wisconsin

Examples of Recent Progress:

Near-isogenic host populations estimate disease effect on yield--Tifton, GA. Near-isogenic populations developed from large F_2 populations of crosses between resistant and susceptible plants were used to estimate the effect of three foliage diseases on pearlmillet forage yields. These studies showed that redspot did not affect forage yield, Cercospora leaf spot reduced forage yields 20-25 percent, and brown mottle reduced second and third harvest yields 23 and 30 percent, respectively. Thus, there is no need to breed for red spot resistance. Tests with near-isogenic populations require much less time than

tests with near-isogenic inbred lines to indicate which diseases cause losses that warrant control by breeding or other methods.

New arrowleaf clover lines have improved tolerance to 2,4-D--Tifton, GA. Broadleaf weeds may reduce yields of arrowleaf clover by 10-40 percent. One cycle of selection identified arrowleaf clover lines that recover after treatment with 2,4-D at twice the rate that killed other varieties. Development of arrowleaf clover that is resistant to 2,4-D would permit effective weed control at about $5/acre and alleviate a potential loss of $15-50/acre.

New technique permits screening for disease resistance in pearl millet in the greenhouse--Tifton, GA. Rust, Puccinia substriata, and leaf spot, Piricularia grisea, are the two most destructive diseases of pearl millet in the United States. With a new technique, disease spores can be collected in the field, dried quickly, and stored at -73 C. This unlimited supply of viable inoculum is available, and breeding lines can be rapidly screened in greenhouses for resistance to both of those diseases.

Interspecific crosses of annual and perennial alfalfa species are successful--Manhattan, KS. M. sativa, perennial, and M. scutellata, annual, crosses produced a perennial mixoploid hybrid alfalfa. The primary shoot was hexaploid, and the secondary shoot was tetraploid. Seed was not produced from the hexaploid by either selfing or backcrossing. Backcross seed was produced from a cross of the tetraploid sector with M. sativa. That cross gives geneticists a new source of genes for improving alfalfa.

Sensitive assay detects diseased tall fescue seeds--Lexington, KY. An enzyme-linked immunosorbent assay (ELIA) was developed for detecting the endophytic fungus, Epichloe typhina, in tall fescue. This assay readily detects a single diseased tall fescue seed in a sample of 20 seeds. Because of its high sensitivity, the assay is suitable for use in seed certification.

Perloline, an alkaloid in tall fescue, is toxic to cattle--Lexington, KY. Two lines of tall fescue, one with high and one with low perloline content, were fed to young cattle under high temperature conditions. Signs of summer toxicosis in temperature-stressed cattle fed the high-perloline forage indicated that perloline is a harmful component of tall fescue. A recently developed tall fescue variety, low in alkaloid and free of the endophytic fungus, should enhance animal gains on tall fescue.

Alfalfa seedlings "immunized" against lethal infection of race 2 of anthracnose fungus--Beltsville, MD. Seedlings of alfalfa cultivar Arc are highly resistant to race 1 of Colletotrichum trifolii, the anthracnose fungus, but are susceptible to race 2 of the same fungus. If Arc seedlings are exposed to inoculation of race 1 for as little as 1 hour prior to inoculation with race 2, the seedlings are immunized. Immunization becomes maximum between 24 and 48 hours after exposure to race 1.

Experimental sugarbeet hybrid selected for photosynthate partitions shows improved sugar yield--Beltsville, MD. A sugarbeet hybrid derived from parents that were selected for high taproot to leaf weight ratio (TLWR) was compared in the field with an unselected hybrid. The high TLWR hybrid produced 15% more

recoverable sugar per acre than the unselected control in five tests with sugar industry cooperators. Those results confirm observations that selecting for specific physiological traits can improve yield.

New reed canarygrass variety, MN-76, provides superior ruminant animal gains--St. Paul, MN. MN-76 was selected for low alkaloid content. In a 2-year study, steers grazing MN-76 gained about 90 percent as much as steers grazing smooth bromegrass (alkaloid-free). Weight gain of steers was depressed when the alkaloid content in reed canarygrass was at or about 0.3-0.4 percent (dry weight). Thus, MN-76, in which alkaloid never exceeds 0.25 percent (dry weight), is a biologically superior grass that improves lamb gains (from previous work) and sometimes improves steer gains in comparison with gains of animals fed cultivars of reed canarygrass not selected for low alkaloid content.

Viral and root diseases interact in arrowleaf clover--Mississippi State, MS. Dual infection of arrowleaf clover by bean yellow mosiac virus and Phytophthora root rotting diseases was more damaging than infection by either the virus or the fungus. Damage was most severe following simultaneous dual inoculation or prior inoculation with the virus and less severe following prior inoculation of the fungus. The interaction between the virus and the fungus contributes significantly to the decline and premature death of arrowleaf clover.

Rhizobium strain selection increases biological dinitrogen fixation in clovers--Mississippi State, MS. Yields of clover ranged from 520 to 52100 kg/ha/yr with N-2 fixation rated from 46 to 418 kg/N/ha/yr among two cultivars and 15 strains of Rhizobium trifolii. The uninoculated control averaged N-2 fixation rates of 21 kg/N/ha/yr. These results indicate that selections of rhizobia are important in clover production, and that, initially, yield and N_2 fixation rates can be increased more rapidly by selecting for highly effective and adapted rhizobia than through genetic manipulation of the host plant.

Plant selection improves biological dinitrogen fixation in crimson clover--Mississippi State, MS. Selected progenies of crimson clover were assayed for nitrogen fixation and compared to a random sample of the original population. Nitrogen fixation was 9.4 percent higher by the selected population than by the original population. Thus, the genotype of crimson clover has a direct and measurable effect upon symbiotic nitrogen fixation. An 8.4 percent increase in nitrogen fixation represents savings in nitrogen costs of fertilizer of about $5/acre or $2.5 million for 500,000 acres of crimson clover.

New forage produces higher daily gain of steers--Raleigh, NC. Pennisetum flaccidum produces steer daily gains that are 0.2-0.3 kg higher than do conventional tall fescue-coastal Bermudagrass systems. Stands have persisted well when grazed continuously throughout the season. These responses support laboratory quality estimates. This new forage, when grazed or used as a stored feed, offers producers improved mid-summer calf and steer daily gains.

Video imaging has potential for accurately measuring amount of leaf spot diseases--University Park, PA. Illusions cause inaccuracies in current visual methods for estimating severity of plant diseases. Estimates were biased upward

by the number of spots contributing to the total and were more marked at lowest level of diseases. The consequence of this is that present methods underestimate crop yield losses and the rate of development of disease epidemics. New video imaging technology coupled with computer analyses has the potential for improving objectivity and accuracy of the measurement of leaf spot diseases.

New procedures developed for analyzing data from diverse germplasm trials--University Park, PA. Procedures were developed for combining information from a series of germplasm trials. With these procedures, combined analysis of two or more germplasm trials can be combined even if entries in the trials in the series are not identical, as long as the trials have some common entries. The procedures will be useful in regional or national assessment of performance and adaptation of germplasm from various plant development programs.

Rare sexual plants derived from wild apomictic strains of bufflegrass--College Station, TX. For hybridization and improvement of apomictic species, sexual plants are essential for use as female parents, but they are extremely rare in nature. In the past only a few sexual plants were available for bufflegrass improvement, but others now have been identified and recovered from an African collection. These plants will be useful in further hybridization work and represent a wide range of new germplasm that holds great promise for improving bufflegrass.

Kleingrass germplasm found with resistance to seed shattering--Temple, TX. Seed shattering is an important problem in kleingrass varieties, and previous attempts to find resistance to seed shattering failed. Kleingrass introduced from South Africa has greater seed retention, or resistance to shattering, than currently available varieties.

Forage quality of lovegrass is improved--Temple, TX. Weeping lovegrass and an African lovegrass provide germplasm that could improve the forage quality of those grasses which are both valuable forages in the semi-arid and arid rangelands of the United States. Incorporation of germplasm that would improve the digestibility of the forage would be important in improving productivity and performance of livestock.

Technological Objective 2: New and improved cultural and management practices that increase forage crop yields, minimize production and utilization losses, improve feed quality, conserve and use scarce resources efficiently, and enhance environmental quality.

Research Locations:

Palmer, Alaska
Booneville, Arkansas
Tifton, Georgia
Watkinsville, Georgia
Peoria, Illinois
St. Paul, Minnesota
Mississippi State, Mississippi

Columbia, Missouri
Clay Center, Nebraska
Reno, Nevada
Raleigh, North Carolina
El Reno, Oklahoma
University Park, Pennsylvania
Prosser, Washington
Madison, Wisconsin

Examples of Recent Progress:

Mode of action identified of toxic chemical in crown vetch--University Park, PA. A natural constituent, 3-nitropropanoic acid (NPA), of crown vetch inhibits a mitochondrial enyzme that is crucial to respiration. Experiments with mice showed that NPA lowered levels of enzyme activity and demonstrated for the first time the principal site and mechanism of NPA toxcitity in non-ruminant animals.

Sterile culture chambers developed for root studies--University Park, PA. In a new technique, plants are grown by a slant-board culture method within a chamber that maintains a sterile environment for the study of root diseases. With the technique, studies under sterile and non-sterile conditions can be compared. This technique will greatly enhance basic studies on root diseases and facilitate selection of resistant genotypes.

Rapid assessment of forage quality now possible--University Park, PA. With near-infrared reflectance spectroscopy, forages can be tested for their contents of crude protein, fiber, moisture, and for their digestibility in less than two minutes per sample. The technology enables evaluation of forage quality in farm feeding operations and formulation of rations based on quality of the forage. Thus, efficiency of nutrient utilization can be improved. The new technology also shows great promise for helping plant breeders to select plants for improving the quality of forage.

Forage legumes replace nitrogen fertilizer in feed production systems--University Park, PA. During the second year after seeding, alfalfa planted with either orchardgrass or perennial ryegrass produced as much feed as either grass alone when fertilized with 200-400 kg/ha/yr. Alfalfa apparently produces more crude protein per acre than does either red clover or birdsfoot trefoil. As the price of nitrogen fertilizers increases, further use of adapted alfalfa could reduce forage production costs.

Technological Objective 3: New and improved cultural and management practices that increase forage crop and turfgrass seed yield, reduce production losses, and improve seed quality.

Research Locations:

Palmer, Alaska
Tifton, Georgia
St. Paul, Minnestoa
Stillwater, Oklahoma
Corvallis, Oregon

Prosser, Washington
Madison, Wisconsin

Examples of Recent Progress:

Aerated steam eradicates a fungal disease of tall fescue seed--Corvallis, OR. A sequence of aerated steam treatments eradicated Epichloe typhina in tall fescue seed. This seedborne disease is transmitted to the seedling. Diseased plants produce an alkaloid, loline, that is implicated in the reduced performance of animals eating tall fescue either as pasture or hay. Once plants are free of disease, they may remain free for several years. Thus, this will have significant impact on increasing the production of meat and milk from livestock eating tall fescue.

Technological Objective 4: Turfgrass cultivars and genetic populations with increased pest resistance, tolerance to environmental stress, and improved agronomic characteristics.

Technological Objective 5: Improved cultural and management practices for turfgrasses that reduce the costs of maintenance, increase ground cover value, provide greater persistence, and improve aesthetics.

Research Locations:

Palmer, Alaska
Tifton, Georgia
Lexington, Kentucky
Beltsville, Maryland (PGGI)

Name or Designation	Release Agencies	Reason for Release
CULTIVAR RELEASED		
Verde kleingrass	TX-AES; USDA-SCS & ARS	Larger seed and seedling vigor.
Lometa indiangrass	USDA-SCS; USDA-ARS: TX-AES	Adaptation and production.
Tifway II bermudagrass	GA-AES; USDA-SEA	Desirable traits.
GERMPLASMS RELEASED		
Alfalfa		
NMP-46, NMP-47, and NMP-50	USDA-ARS; NV-AES	Breeding and experimental purposes; resistant to blue alfalfa aphid.
NMP-8 CLS_5	USDA-ARS; NV-AES	Breeding and experimental.
KS145	KA-AES; USDA-ARS	Breeding and experimental.
LAH-PGL	USDA-ARS	Resistant to alfalfa aphid.
W10	USDA-ARS; WA-AES	Breeding & resistance to anthracnose.
NCMP1, NCMP2, NCMP10, and NCWMP22	NC-AES; USDA-SEA	Multiple pest resistance.
Others		
AF-7 tall fescue	USDA-ARS; AL-AES	Large root diameter.
MO-20 birdsfoot trefoil	MO-AES; USDA-ARS	Pasture-type trefoil.
WH-1 blue lupine	USDA-SEA; GA-AES	Superior winter hardiness.

P U B L I C A T I O N S

Palmer, Alaska

Brundage, A. L., R. L. Taylor, and V. L. Burton. 1981. A changing pattern of small grain silage mixtures in Alaska. Agroborealis. 13:4-5.

Klebesadel, L. J., and S. H. Restad. 1981. Agriculture and wildlife: Are they compatible in Alaska? Agroborealis. (11):15-22.

Tifton, Georgia

Burton, G. W. 1981. Meeting human needs through plant breeding: past progress and prospects for the future. Chapter 11:433-456. In Plant Breeding II. K. J. Frey, ed. Iowa State University Press.

Burton, G. W. 1981. CSSA past history and future opportunities. Crop Sci. 21(1):1-3.

Burton, G. W. 1981. A gene for early maturity and photoperiod insensitivty in pearl millet. Crop Sci. 21(2):317-318.

Burton, G. W. 1981. Registration of pearl millet inbreds Tift 23DBE, Tift 23DAE, and Tift 756 (PL 6 and PL 11). Crop Sci. 21(5):804.

Burton, G. W. 1981. Nutrient composition of forage crops. Agri. Res. Ser. ARM-S-21, Nov.

Burton, G. W. 1981. Meeting human needs through plant breeding: past progress and prospects for the future. Chapter 11. In K. J. Frey (ed.) Plant Breeding II. Iowa State University Press. pp. 453-456.

Burton, G. W., and H. D. Wells. 1981. Use of near-isogenic host populations to estimate the effect of three foliage diseases on pearl millet forage yield. Phytopathology 71(3):331-333.

Demski, J. W., M. A. Khan, H. D. Wells, and J. D. Miller. 1981. Peanut mottle virus in forage legumes. Plant Disease 65:359-362.

Duke, J. A., M. B. Forde, J. D. Miller, C. F. Reed, and J. K. P. Weder. 1981. Lotus corniculatus L. In Handbook of Legumes of World Economic Importance. Plenum Press. pp. 125-129.

Duke, J. A., M. B. Forde, J. D. Miller, and C. F. Reed. 1981. Lotus tenius Wald & Kit ex Willd. In Handbook of Legumes of World Economic Importance. Plenum Press. pp. 129-130.

Duke, J. A., M. B. Forde, J. D. Miller, and C. F. Reed. 1981. Lotus uliginosus Schkurh. In Handbook of Legumes of World Economic Importance. Plenum Press. pp. 130-132.

Fincher, G. T., W. G. Monson, and G. W. Burton. 1981. Effects of cattle feces rapidly buried by dung beetles on yield and quality of Coastal bermudagrass. Agron. J. 73(5):775-779.

Hanna, W. W. 1981. Method of reproduction in napiergrass and in the 3x and 6x alloploid hybrids with pearl millet. Crop Sci. 21(1):123-126.

Hanna, W. W., and G. W. Burton. 1981. Use of mutagens to induce and transfer apomixis in plants. Proc. from Symposium on Induced Mutations - a Tool in Plant Research, IAEA, Vienna, Austria, March 9-13, 1981, IAEA-SM-251/38:497-500.

Hanna, W. W., and G. W. Burton. 1981. Use of mutagens to induce and transfer apomixis in plants. Proc. Symposium on Induced Mutations - a tool in Plant Research, IAEA, Vienna, Austria, March 9-13, 1981, IAEA-SM-251/38:497-500.

Hanna, W. W., W. G. Monson, and T. P. Gaines. 1981. IVDMD, total sugars, and lignin measurements on normal and brown Midrib (bmr) sorghums at various stages of development. Agron. Journal 73:1050-1052.

Martin, P. B., W. W. Hanna, J. C. Johnson, Jr., et al. 1980. Insect pests, insect damage, and phytotoxicity in insecticide-treated and untreated sorghum possessing a brown-midrib character. Sorghum Newsletter 23:99-100.

Martin, P. B., W. W. Hanna, P. R. Utley, et al. 1980. Lesser cornstalk borers and fall armyworms on insecticide-treated and untreated sudangrasses possessing a bloom and bloomless character. Sorghum Newsletter 23:93-94.

Miller, J. D., and H. D. Wells. 1981. Registration of Tifhardy-1 Desmodium canum germplasm. Crop Sci. 21-476.

Monson, W. G. 1981. Nutrient composition of forage crops: effects of agronomic practices. USDA, ARS, ARM-S-21:11-15.

Wells, H. D., and J. D. Miller. 1982. Registration of WH-1 blue lupine germplasm. Crop Sci. 21-992.

Wiseman, B. R., and W. W. Hanna. 1980. Leaf-feeding damage by fall armyworm on six isogenic brown midrib sorghums. Sorghum Newsletter 23:91.

Yates, I. E., J. D. Robbins, and W. W. Hanna. 1981. Polypeptides in ovaries from sexual and apomictic Panicum maximum Jacq. Jour. of Heredity 72:368-369.

Watkinsville, Georgia

Belesky, D. P., S. R. Wilkinson, R. N. Dawson, and J. E. Elsner. 1981. Forage production of a tall fescue sod intercropped with sorghum x sudangrass and rye. Agron. J. 73:657-660.

Stuedmann, J. A., S. R. Wilkinson, J. C. McCampbell, and R. L. Wilson, Jr. 1981. Winter stocking-summer finishing systems using rye, Kentucky-31 tall fescue and Coastal bermudagrass pastures. J. Anim. Sci. 52-945-953.

Manhattan, Kansas

Elgin, J. H., Jr., D. K. Barnes, T. H. Busbice, et al. 1981. Anthracnose resistance means increased alfalfa yields. Crop Sci. 21:457-460.

Horber, E. K., E. L. Sorensen, and K. J. R. Johnson. 1981. Resistance to alfalfa weevil and potato leafhopper increased by glandular and simple hairs. Report of the Twenty-seventh Alfalfa Improvement Conference, ARM-NC-19, p. 51.

Johnson, K. J. R., E. L. Sorensen, and E. K. Horber. 1981. Behavior of adult alfalfa weevils (Hyperapostica Gyl.) on resistant and susceptible Medicago species in free-choice preference tests. J. Environ. Entomol. 10:582-585.

Kreitner, G. L., and E. L. Sorensen. 1981. Glandular secretory system of annual and perennial Medicago species. Report of the Twenty-seventh Alfalfa Improvement Conference, ARM-NC-19, p. 50.

Othman, R. B., E. L. Sorensen, G. H. Liang, et al. 1981. Density and distribution of erect glandular hairs on annual Medicago species. Bot. Gaz. 142:237-241.

Sorensen, E. L., N. Sangduen, and G. H. Liang. 1981. Transfer of glandular hairs from diploid M. prostrata to tetraploid M. sativa. Report of the Twenty-seventh Alfalfa Improvement Conference, ARM-NC-19, p. 53.

Sorensen, E. L., D. L. Stuteville, and E. K. Horber. 1981. Registration of K78-10 Alfalfa germplasm. Crop Sci. 21:476.

Stuteville, D. L., and E. L. Sorensen. 1981. Effect on downy mildew resistance of selecting for saponin content in alfalfa. Report of the Twenty-seventh Alfalfa Improvement Conference, ARM-NC-19, p. 36.

Triebe, D. C., C. E. Meloan, and E. L. Sorensen. 1981. The chemical identification of the glandular hair exudate from Medicago scutellata. Report of the Twenty-seventh Alfalfa Improvement Conference, ARM-NC-19, p. 52.

Lexington, Kentucky

Buckner, R. C., P. B. Burrus, II, P. L. Cornelius, et al. 1981. Genetic variability and heritability of certain forage quality and mineral constituents in Lolium-Festuca hybrids derivatives. Crop Sci. 21:419-423.

Hemken, R. W., J. A. Boling, L. S. Bull, R. H. Hatton, et al. 1981. Interaction of environmental temperature and anti-quality factors on the severity of summer fescue toxicosis. J. of An. Sci. 52:710-714.

Beltsville, Maryland

Elgin, J. H., Jr., D. K. Barnes, T. H. Busbice, et al. 1981. Anthracnose resistance increases alfalfa yields. Crop Sci. 21:457-460.

Hill, R. R., Jr., and J. H. Elgin, Jr. 1981. Effect of the number of parents on performance of alfalfa synthetics. Crop Sci. 21:298-300.

Hart, R. H., A. J. Thompson, III, J. H. Elgin, Jr., et al. 1981. Forage yield and quality of quaker comfrey, alfalfa, and orchardgrass. Agron. J. 73:737-743.

Murray, J. J. 1981. Turfgrass Research at Beltsville. Proc. of Mass. 50th Anniversary Turf Conf. Springfield, Mass. March 3-5, 1981. p. 4854.

O'Neill, N. R. and J. J. Murray. 1981. Method for screening tall fescue for resistance to Drechslera dictyoides. Proc. of IV International Turfgrass Res. Conf., Guelph, Canada. p. 551.

Ostazeski, S. A., and J. H. Elgin, Jr. 1981. Protection of race 2 of Colletotrichum trifolii in alfalfa hypodermically inoculated with mixtures of race 1 and race 2 conidia. Phytopathology 71:770.

Ostazeski, S. A., and J. H. Elgin, Jr. 1981. Hypodermic inoculations of Colletotrichum trifolii in alfalfa: Rapid race identification and host reaction determination for anthracnose isolates. Phytopathology 71:247.

Portz, H. L., J. J. Murray, and D. Y. Yeam. 1981. Zoysiagrass (Zoysia japonica Steud.) establishment by seed. Proc. of 4th International Turfgrass Research Conf., Guelph, Canada. p. 113-122.

Ratcliffe, R. H., and J. J. Murray. 1981. Report on Kentucky bluegrass greenbug and hairy chinch bug resistance in cool-season turfgrass species. Ann. Plant Resist. to Insects Newsletter 7:31.

Yeam, D. Y., J. J. Murray, and H. L. Portz. 1981. Physiology of seed germination in zoysiagrass (Zoysia japonica Steud.). Proc. of 4th International Turfgrass Research Conf. Guelph, Canada. p. 467-476.

St. Paul, Minnesota

Brick, M. A., and D. K. Barnes. 1981. Inheritance and ontogeny of a lobed-cambium trait in alfalfa roots. J. Hered. 72:419-422.

Brick, M. A., D. K. Barnes, and C. P. Vance. 1981. Inheritance and identification of a carotenoid pigment in orange alfalfa roots. Crop Sci. 21:748-750.

Dowdy, R. H., C. E. Clapp, G. C. Marten, et al. 1981. Wastewater crop management studies in Minnesota. In F. M. D'Itri (ed.) Vegetation management for land treatment of municipal wastewater. Ann Arbor Publishers, Ann Arbor, MI. pp. 35-47.

Elgin, J. H., Jr., D. K. Barnes, T. H. Busbice, et al. 1981. Anthracnose resistance increases alfalfa yields. Crop Sci. 21:457-460.

Frosheiser, F. I., R. H. Morrison, and R. E. Welty. 1981. Anthracnose of alfalfa observed in Minnesota. Plant Disease 65:844-845.

McGraw, R. L., and L. J. Elling. 1980. Winter hardiness in birdsfoot trefoil. Progress Report--Clovers and special purpose legumes research. Vol. 13:15.

McGraw, R. L., C. P. Vance, and L. J. Elling. 1980. Nodulation of two birdsfoot trefoil varieties in the seeding year. Progress Report--Clovers and special purpose legumes research. Vol. 13:16-17.

Hijano, E. H. 1981. Effect of spring black stem on yield, and growth of alfalfa in the greenhouse. Plant Dis. 65:725-726.

Marten, G. C. 1981. Chemical, in vitro, and nylon bag procedures for evaluating forage in the USA. In J. L. Wheeler and R. D. Mochrie (eds.) Forage Evaluation: Concepts and Techniques. CSIRO and Am. Forage and Grassl. Coun., Melbourne. pp. 39-55.

Marten, G. C. 1981. Effect of deleterious compounds on animal preference for forage and on animal performance. In J. L. Wheeler and R. D. Mochrie (eds.) Forage Evaluation: Concepts and Techniques. CSIRO and Am. Forage and Grassl. Coun., Melbourne. pp. 225-236.

Marten, G. C., R. M. Jordan, and A. W. Hovin. 1981. Improved lamb performance associated with breeding for alkaloid reduction in reed canarygrass. Crop Sci. 21:295-298.

Marten, G. C., D. R. Linden, W. E. Larson, et al. 1981. Maize culture in reed canarygrass sod to renovate municipal wastewater effluent. Agron. J. 73:293-297.

Peterson, M. A., and D. K. Barnes. 1981. Inheritance of ineffective nodulation and non-nodulation traits in alfalfa. Crop Sci. 21:611-616.

Vance, C. P., and L. E. B. Johnson. 1981. Nodulation: A plant disease perspective. Plant Dis. 65:118-124.

Walgenbach, R. P., G. C. Marten, and G. R. Blake. 1981. Release of soluble protein and nitrogen in alfalfa. I. Influence of growth temperature and soil moisture. Crop Sci. 21:843-849.

Walgenbach, R. P., and G. C. Marten. 1981. Release of soluble protein and nitrogen in alfalfa. II. Influence of potassium and nitrogen fertilizer on three cultivars. Crop Sci. 21:852-855.

Walgenback, R. P., and G. C. Marten. 1981. Release of soluble protein and nitrogen in alfalfa. III. Influence of shading. Crop Sci. 21:859-862.

Mississippi State, Mississippi

Ellsbury, M. M., and M. W. Nielson. 1981. Comparative host plant range studies of the blue alfalfa aphid, Acyrthosiphon kondoi Shinji, and the pea aphid, Acyrthosiphon pisum (Harris) (Homoptera: Aphididae). USDA, TBN 1639. 14 pp.

Gibson, P. B., O. W. Barnett, M. R. McLaughlin, et al. 1981. Effects of three viruses on growth of white clover. Plant Disease 65:50-51.

Hagedorn, C., and B. A. Caldwell. 1981. Characterization of diverse Rhizobium trifolii isolates. Soil Sci. Soc. Amer. J. 45:513-516.

McLaughlin, M. R., O. W. Barnett, P. M. Burrows, et al. 1981. Improved ELISA conditions for detection of plant viruses. J. Virol. Methods 3:13-25.

Columbia, Missouri

Beuselinck, P. R. 1980. Forage legume improvement progress report; clovers and special purpose legume research, pp. 26-28.

Beuselinck, P. R., and J. D. Baldridge. 1981. Registration of MO-20 Birdsfoot trefoil germplasm. Missouri Agric. Exp. Stn. Journal Series 8917.

Ocumpaugh, W. R., A. G. Matches, and V. D. Luedders. 1981. Sod-seeded soybeans for forages. Agron. Jour. 7:71-74.

Lincoln, Nebraska

Brown, D. E., W. R. Kehr, and G. R. Manglitz. 1981. Isolation requirements for foundation alfalfa seed fields. Crop Sci. 21:628-629.

Elgin, J. H., Jr., D. K. Barnes, T. H. Busbice, et al. 1981. Anthracnose resistance increases alfalfa yields. Crop Sci. 21:457-460.

Gorz, H. J., F. A. Haskins, K. P. Vogel, et al. 1981. Development and evaluation of high- and low-HCN-p populations of Greenleaf sudangrass. Sorghum Newsletter 24:29.

Haskins, F. A., and H. J. Gorz. 1981. Hydrocyanic acid potential of seedlings of various Sorghum species. Sorghum Newsletter 24:28-29.

Haskins, F. A., and H. J. Gorz. 1981. Hydrocyanic acid potential of sorghum seedlings from A & B lines. Sorghum Newsletter 24:29.

Kehr, W. R. 1980. Advances in alfalfa breeding. 4th Latin American Congress on Genetics, Sept. 27, 1979. National University of Cuyo, Mendoza, Argentina. Actas, IV Congr. Latinoam. Genetica 2:465-472.

Kehr. W. R. 1981. Collecting alfalfa seed in the Andes of Chile. Proc. 17th Central Alfalfa Improvement Conference. E. Lansing, Michigan. p. 11.

Kehr, W. R., G. R. Manglitz, and R. L. Ogden. 1981. Registration of Perry alfalfa. Crop Sci. 21:349.

Manglitz, G. R., D. L. Keith, and W. R. Kehr. 1981. Alfalfa weevil--two strains worry Nebraska producers. Neb. Agr. Exp. Stn. Farm, Ranch and Home Quarterly 28:8-11.

Pedersen, J. F., H. J. Gorz, F. A. Haskins, et al. 1981. Variability of quality traits in forage sorghum hybrids. Sorghum Newsletter 24:28.

Vogel, K. P., H. J. Gorz, and F. A. Haskins. 1981. Heritability estimates for forage yield, in vitro dry matter digestibility, protein content, and heading date in indiangrass. Crop Sci. 21:35-38.

Vogel, K. P., H. J. Gorz, and F. A. Haskins. 1981. Heritability estimates for height, color, erectness, leafiness, and vigor in indiangrass. Crop Sci. 21:734-736.

Vogel, K. P., F. A. Haskins, and H. J. Gorz. 1981. Divergent selection for in vitro dry matter digestibility in switchgrass. Crop Sci. 21:39-41.

Reno, Nevada

McCoy, T. J., R. L. Phillips, and H. W. Rines. 1982. Cytogenetic variation in tissue culture regenerated plants of Avena sativa; high frequency of partial chromosome loss. Can. J. Genet. Cytol. 24:37-50.

Rines, H. W., and T. J. McCoy. 1981. Tissue culture initiation and plant regeneration in hexaploid Avena species. Crop Sci. 21:837-842.

Oxford, North Carolina

Frosheiser, F. I., R. H. Morrison, and R. E. Welty. 1981. Anthracnose of alfalfa in Minnesota. Plant Disease 65:884-885.

Welty, R. E., R. Y. Gurgis, and D. E. Rowe. 1981. Occurrence of race 2 of Colletotrichum trifolii in North Carolina and evaluation of alfalfa cultivars and breeding lines for resistance to race 1 and 2. Plant Disease 66:48-51.

Welty, R. E. 1981. Additional hosts of Colletotrichum trifolii. Phytopathology 71:264.

Welty, R. E., C. C. Van Dyke, and W. A. Cope. 1981. Uromyces trifolii-repentis var. trifolii-repentis on Trifolium repens in North Carolina. Phytopathology 71:772.

Raleigh, North Carolina

Burns, J. C. 1980. Transfer of principles in grazing experimentation to forage-animal demonstrations. Proc. 37th So. Pasture and Forage Crop Improvement Conf., 129-135.

Burns, J. C., and R. D. Mochrie. 1980. Methods to determine or estimate voluntary intake in grazing livestock. Proc. 37th So. Pasture and Forage Crop Improvement Conf., 127-128.

Moore, J. E., J. C. Burns, A. C. Linnerud, et al. 1980. Relationships between the properties of southern forages and animal response--preliminary report on regional project S-45. Proc. 37th So. Pasture and Forage Crop Improvement Conf., 19-36.

Rakes, A. H., J. C. Burns, and D. G. Davenport. 1981. How a haylage-pasture program compared with double-cropped silage. Hoards Dairyman. May 10, p. 732.

Mandan, North Dakota

Barker, R. E., A. W. Hovin, I. T. Carlson, et al. 1981. Genotype-environment interaction for forage yield of reed canarygrass clones. Crop Sci. 21:567-571.

Frank, A. B. 1981. Effect of leaf age and position on photosynthesis and stomatal conductance of forage grasses. Agron. J. 73:70-74.

Stillwater, Oklahoma

Fermanian, T. W., R. M. Ahring, and W. W. Huffine. 1981. The isolation of a toxin from spring dead spot areas in bermudagrass (Cynodon L. C. Rich) turf. Proc. IV Intl. Turfgrass Soc. Res. Conf., pp. 433-441.

Moffett, J. O., A. Stoner, L. N. Standifer, et al. 1981. Effect of moving, confinement to ramadas and Wardecker waterers on mortality of honey bees (Hymenoptera, Apidae) exposed to insecticides sprayed on cotton. J. Kans. Entomol. Soc. 54:381-386.

Moffett, J. O., D. R. Rodney, and C. W. Shipman. 1981. Influences of pollen source and time of bloom on fruit set of Fairchild Tangerine. J. Ariz.-Nev. Acad. Sci. 16:43-45.

Stoner, A., J. O. Moffett, W. T. Wilson, et al. 1981. Apis mellifera: effective management of 1- and 2-queen colonies on bee losses caused by spraying insecticides on cotton. Ga. J. Entomol. Soc. 16:323-331.

Waller, G. D., and J. O. Moffett. 1981. Pollination of hybrid cotton on the Texas High Plains: nectar production and honey bee visits. Proc. Beltwide Cotton Prod. Res. Conf. 33:85-87.

University Park, Pennsylvania

Berg, C. C., G. M. Wood, A. W. Hovin, et al. 1981. Floral induction and forage yield and quality of sparse-flowering orchargrass synthetics. Crop Sci. 21:677-680.

DeVos, D. A., R. R. Hill, Jr., R. W. Hepler, et al. 1981. Inheritance of low temperature sprouting ability in F_1 tomato crosses. J. Amer. Soc. Hort. Sci. 106:352-355.

Douglas, S. M., R. T. Sherwood, and F. L. Lukezic. 1981. Effect of susceptibility and adult plant resistance on primary penetration by Erysiphe graminis F. sp. avenae. Phytopathology 71:871.

Gustine, D. L. 1981. Evidence for sulfhydryl involvement of phytoalexin accumulating in Trifolium repens callus tissue cultures. Plant Physiol. 68:1323-1326.

Hill, R. R., Jr., and J. H. Elgin, Jr. 1981. Effect of the number of parents on performance of alfalfa synthetics. Crop Sci. 21:298-300.

Leath, K. T. 1981. Pest management systems for alfalfa diseases. In D. Pimental (ed.) Handbook of Pest Management, Vol. III. CRC Press, Boca Raton, Fl. pp. 293-302.

Leath, K. T., and O. W. Barnett. 1981. Viruses infecting red clover in Pennsylvania. Plant Dis. 65:1016-1017.

Pederson, G. A., R. R. Hill, Jr., and K. T. Leath. 1980. Host-pathogen variability for Fusarium-caused root rot in red clover. Crop Sci. 20:787-789.

Rowe, D. E., and R. R. Hill, Jr. 1981. Inter-population improvement procedures for alfalfa. Crop Sci. 21:392-397.

Shenk, J. S., I. Landa, M. R. Hoover, et al. 1981. Description and evaluation of a near infrared reflectance spectro-computer for forage and grain analysis. Crop Sci. 21:355-358.

Stutz, J. C., and K. T. Leath. 1981. Pathogenicity of Fusarium roseum 'Acuminatum' and 'Avenaceum' in roots of alfalfa, red clover, and crownvetch. Phytopathology 71:906-907.

Templeton, W. C., Jr., 1981. The interaction of nutrition, environment and grazing management on livestock production data. In Fred W. Knapp (ed.) Systems Approach to animal Health and Production Univ. Kentucky. pp. 166-167.

Wedin, W. F., H. J. Hodgson, J. E. Oldfield, et al. 1980. Feed production. In Wilson G. Pond, et al (eds.) Animal Agriculture: Research to Meet Human Needs in the 21st Century. Westview Press, Boulder, Colo. pp. 153-191.

College Station, Texas

Bashaw, E. C. 1981. Chromosomal and cytoplasmic manipulations. Discussion Section. Chapter 4. In K. F. Fry (ed.) Plant Breeding II. Iowa State University Press, Ames, Iowa. pp. 139-140.

Bashaw, E. D. 1981. Cloning plants through seed. Chapter 3. In Yearbook of Agriculture. U.S. Govt. Printing Office, Washington, D.C. pp. 77-79.

Tang, C. Y., K. F. Schertz, and E. C. Bashaw. 1980. Apomixis in sorghum lines and their F_1 progenies. Bot. Gaz. 141:294-299.

Temple, Texas

Burson, B. L. 1981. Cytogenetic relationships between Paspalum jurgensii and P. intermedium, P. vaginatum, and P. setraceum var. ciliatifolium. Crop Sci. 21:515-519.

Burson, B. L. 1981. Genome relations among four diploid Paspalum species. Bot. Gaz. 142:592-596.

Tischler, C. R., and P. W. Voigt. 1981. Non-genetic factors affecting primary root absence in lovegrass and kleingrass. Crop Sci. 21:427-430.

Voigt, P. W., F. P. Horn, and C. L. Dewald. 1981. Forage quality response of four lovegrasses to stage, interval, and season of harvest. Agron. J. 73:877-884.

Prosser, Washington

Berg, C. C., G. M. Wood, A. W. Hovin, and C. M. Rincker. 1981. Floral induction and forage yield and quality of sparse flowering orchardgrass synthetics. Crop. Sci. 21:677-680.

Christen, A. A., and R. N. Peaden. 1981. Verticillium wilt in alfalfa. Plant Disease 65:319-321.

Inserra, R. N., J. H. O'Bannon, and G. S. Santo. 1980. The effect of Meloidogyne hapla on growth of alfalfa seedlings. Nematologica 26:379-381.

O'Bannon, J. H., and G. S. Santo. 1981. The influence of volcanic ash on infectivity and reproduction of two species of Meloidogyne. J. Nematol. 13:409-412.

Rincker, C. M. 1981. Long-term subfreezing storage of forage crop seeds. Crop Sci. 21:424-427.

Santo, G. S., and J. H. O'Bannon. 1981. Effect of soil temperatures on the pathogenicity and reproduction of Meloidogyne chitwoodi and M. hapla. J. Nematol. 13:483-486.

Santo, G. S., and J. H. O'Bannon. 1981. Pathogenicity of the Columbia root-knot nematode (Meloidogyne chitwoodi) on wheat, corn, oat and barley. J. Nematol. 13:548-550.

Madison, Wisconsin

Hofer, U. A., R. R. Smith, and M. Collins. 1981. Variation of plant growth, nodulation and nitrogen-fixation in Arlington red clover as affected by potassium fertilization. Progress Report--Clover and special purpose legumes research, Vol. 14:84.

Taylor, N. L., and R. R. Smith. 1981. Red clover, Trifolium pratense L. In T. A. McLuse and E. S. Lipenski (eds.) CRC Handbook of Biosolar, Vol. II. Resource Materials. pp. 11-21.

NRP 20100 Principal Contacts

Location	Principal Contact
Palmer, Alaska	Dr. Roscoe Taylor Institute of Agricultural Sciences University of Alaska P.O. Box AE Palmer, Alaska 99645 907/745-3257
Booneville, Arkansas	Dr. James R. Gifford South Central Small Farms Research Center Route 2, Box 144-A, Hwy. 23S Booneville, Arkansas 72927 501/675-3834
Tifton, Georgia	Dr. Glenn W. Burton Forage and Turf Research Georgia Coastal Plain Experiment Station Tifton, Georgia 31793 912/386-3353
Watkinsville, Georgia	Dr. Stanley R. Wilkinson Southern Piedmont Conservation Research Laboratory Highway 53, P.O. Box 555 Watkinsville, Georgia 30677 8-250-2425
Peoria, Illinois	Dr. L. H. Princen Northern Regional Research Center 1815 North University Street Peoria, Illinois 61604 8-360-4297
Manhattan, Kansas	Dr. Edgar L. Sorensen Department of Agronomy Room 208, Dickens Hall Kansas State University Manhattan, Kansas 66506 8-752-4277
Lexington, Kentucky	Dr. Robert C. Buckner Grass and Turf Research Agronomy Department University of Kentucky Lexington, Kentucky 40506 8-355-2769
Beltsville, Maryland	Dr. James H. Elgin, Jr. Field Crops Laboratory, PGGI Room 335, Building 001 Beltsville Agricultural Research Center Beltsville, Maryland 20705 8-344-3330

	Dr. William J. VanDerWoude Light and Plant Growth Laboratory (PPHI) Building 046-A Beltsville Agricultural Research Center Beltsville, Maryland 20705 8-344-3295
St. Paul, Minnesota	Dr. Gordon C. Marten 1509 Gorthar Avenue, Room 404 University of Minnesota St. Paul, Minnesota 55108 612-373-1679
Mississippi State, Mississippi	Dr. William E. Knight Plant Science Laboratory P.O. Box 272 Mississippi State, Mississippi 29762 601/325-2311
Columbia, Missouri	Dr. Elroy J. Peters Room 210, Waters Hall University of Missouri Columbia, Missouri 65201 8-276-3218
Lincoln, Nebraska	Dr. Herman J. Gorz 362D Plant Science University of Nebraska Lincoln, Nebraska 68583 8-622-1566
	Dr. Melvin K. McCarty 362E Plant Science University of Nebraska Lincoln, Nebraska 68583
Reno, Nevada	Dr. Billy D. Thyr College of Agriculture, Room 323A University of Nevada Reno, Nevada 89557 8-470-5336
Oxford, North Carolina	Dr. Will A. Cope Tobacco Research Laboratory Route 2, Box 16-G Oxford, North Carolina 27565 919/693-5151
Raleigh, North Carolina	Dr. Joseph C. Burns North Carolina State University P.O. Box 5155 Raleigh, North Carolina 27607 919/737-2657

Mandan, North Dakota	Dr. Al Frank Northern Great Plains Research Laboratory P.O. Box 459 Mandan, North Dakota 58554 701/663-6445
El Reno, Oklahoma	Dr. Floyd Horn Southwestern Livestock and Forage Research Station P.O. Box 1199 El Reno, Oklahoma 73036 8-736-5028
Stillwater, Oklahoma	Dr. Ken Starks Department of Agronomy Oklahoma State University Stillwater, Oklahoma 74074 8-728-4189
Corvallis, Oregon	Dr. Ron Welty Department of Agricultural Engineering Oregon State University Corvallis, Oregon 97331 8-420-4815
University Park, Pennsylvania	Dr. W. C. Templeton, Jr. U.S. Regional Pasture Research Laboratory University Park, Pennsylvania 16802 8-727-4605
College Station, Texas	Dr. Elixis C. Bashaw Department of Soil and Crop Sciences Texas A. & M. University College Station, Texas 77843 8-527-1252
Temple, Texas	Dr. Paul W. Voigt Grassland, Soil and Water Research Laboratory P.O. Box 748 Temple, Texas 76501 8-736-1201
Prosser, Washington	Dr. J. H. O'Bannon Irrigated Agricultural Research and Extension Center P.O. Box 30 Prosser, Washington 99350 509/786-03454 Ext. 192
Madison, Wisconsin	Dr. Richard R. Smith Department of Agronomy University of Wisconsin Madison, Wisconsin 53706 8-364-5242

Dr. Raymond J. Bula
U.S. Dairy Forage Research Center
1925 Linden Drive West
University of Wisconsin-Madison
Madison, Wisconsin 53706 8-364-5242

National Research Program 20110

IMPROVED VEGETATION AND MANAGEMENT PRACTICES FOR RANGE

This National Research Program involves research to develop new and improved technology to increase productivity through improved vegetation and management practices for range; to conserve, protect, and improve our Nation's range resources; and to enhance the multiple use of those resources. An interdisciplinary team approach of both Federal and State researchers is dedicated to this effort.

NPS Contact: G. E. Carlson

Technological Objective 1: Acquire, describe, and evaluate new germplasm; and develop and test improved cultivars of grasses, legumes, shrubs, and forbs with increased ease of establishment, productivity, forage quality, persistence, improved seed qualities and tolerance to grazing, and with reduced losses from antiquality constituents, pests, and environmental hazards.

Research Locations:

Tucson, Arizona
Fort Collins, Colorado
Dubois, Idaho
Mandan, North Dakota
Woodward, Oklahoma
Burns, Oregon
Logan, Utah
Cheyenne, Wyoming

Examples of Recent Progress:

Seed weight, a heritable trait, is related to emergence of blue grama seedlings--Ft. Collins, CO. It is important that seedlings be able to emerge from deep planting because moisture is generally more favorable than in shallow planting. Difference among blue grama progenies in percent emergence from a depth of 4 cm was positively associated with seed weight. One cycle of selection for seed weight improved emergence 18 percent. Thus, under marginal soil moisture conditions in the field, heavier seed should give better emergence than lighter seed.

Rate of root growth is heritable in blue grama--Ft. Collins, CO. Rate of adventitious root growth is critical in seedling establishment because soil surface dries nearly as rapidly as roots extended into the soil. Rate of adventitious root growth differed significantly among blue grama progenies and was positively related to rates of the parents. Thus, it should be possible to develop germplasm with improved adventitious root growth that would enhance establishment capabilities in semi-arid rangelands.

Superior taxonomic system developed for wheatgrasses and their relatives--Logan, UT. A taxonomic system should reflect biological relationships; however, the traditional classification of the perennial grasses of the Triticeae tribe does not group these species according to this relationship. Cytogenetic data gathered over the past 20 years now show a true genetic relationship among grasses of the Triticeae. A superior system of classification has been developed whereby generic boundaries have been realigned so that closely related species are in the same genus.

Annual Medicago species hold promise for use in the intermountain areas--Logan, UT. Annual Medicago species are important in agricultural systems in Mediterranean climates but are not used extensively in the United States. A collection of nearly 600 accessions representing 34 species was assessed for agronomic adaptation and nitrogen-fixing ability. Some Medicago species establish particularly well and exhibit excellent agronomic performance.

New interspecific grass hybrid responds favorably to selection--Logan, UT. Germplasm of a cross between quackgrass and bluebunch wheatgrass was released to plant breeders and other scientists. The hybrid population shows excellent potential for genetic improvement. Results indicate that seed and forage yield can be improved from 25 to 50 percent during each cycle of selection. Significant differences have been found in palatability and resistance to destructive pests. This new germplasm should make a significant contribution to the productivity of the western range.

Promising clones of blue grama identified--Cheyenne, WY. High yield and high digestibility are among the most desirable characteristics of a forage grass. In a 4-year study of 15 blue grama clones, Clone 11 was as digestible as the alfalfa-grass hay used as a standard in the digestibility determinations. Clone 8 had long leaves, fairly fine stems, high density, the tallest vegetative growth (18 cm vs. the average of 13 cm), and the highest forage yield of any of the clones. Clones 8 and 11 should be useful as parents of an improved variety of blue grama.

Technological Objective 2: Develop range improvement practices for increasing productivity of rangeland.

Research Locations:

Tucson, Arizona
Fort Collins, Colorado
Dubois, Idaho
Miles City, Montana
Reno, Nevada
Las Cruces, New Mexico
Mandan, North Dakota
Woodward, Oklahoma
Burns, Oregon
Temple, Texas
Logan, UT
Cheyenne, WY

Examples of Recent Progress:

Summer transplants are successful in southeastern Arizona--Tucson, AZ. Perennial grasses transplanted in the summer have a greater survival rate than corresponding winter transplants. Average transplant survival was 70 percent in summer and less than 20 percent in winter. Transplanting was correlated with peak rainfall probability periods, and no additional water was supplied.

Yield and survival of range plants predicted from easily measured plant growth traits--Miles City, MT. Winter injury to seedlings of Russian wild ryegrass, crested wheatgrass, and pubescent wheatgrass was inversely related to plant size. As plant size increased, winter damage decreased. Spring and fall growth were directly related to both seedling size and winter injury. Growth and summer survival were good for seedlings that had many early-spring leaves and were subtantially poorer for plants that emerged in the spring from late autumn seeding. These results should be useful in developing the range model.

Comprehensive management and research plan completed for the Saval project--Reno, NV. This plan combines range improvement practices and four kinds of grazing management systems. The evaluation of grazing treatments is significant because it involves an interdisciplinary, basic and applied, and long-term research approach. The research will answer questions about how various resources react and interact to grazing management. The results, which will be applicable to millions of acres of rangeland, will be evaluated in terms of market and non-market economic values.

Wind-blown materials from Great Basin playas affect surrounding rangelands--Reno, NV. Large amounts of material are aerially deposited on desert lands downwind from playas. Lesser amounts are deposited on upland areas. Material deposited combines sodium and boron in quantities sufficient to influence plant growth.

Understanding basic genetics and physiological traits could improve four-wing salt bush--Las Cruces, NM. Four-wing salt bush is important for revegetating rangelands that have been cleared of brush, but survival of seedlings is poor. Research indicates that different genotypes inhabit different soil types. In addition the diploid, tetraploid, and hexaploid genotypes grow at different rates and have different palatabilities. The diploid genotype occurs on sandy soils, the hexaploid on clay, and the tetraploid on soils with intermediate texture. Possibly, seedling survival and palatability could be enhanced by selecting genotypes for specific range sites.

Creosote bush intercepts significant rainfall--Las Cruces, NM. The average rainfall interception of creosote bushes was 1.2 g/cm^2 of crown canopy. The annual rainfall in the southwestern U.S. is produced from storms of small amounts. Thus, interception by desert shrubs is important since a high percentage of precipitation in these storms is lost due to interception and subsequent evaporation.

Honey mesquite becomes dominant on black grama grassland--Las Cruces, NM. In 1935, the vegetation of a black grama grassland was mapped. When, in 1980, the vegetation was again mapped, mesquite had gained dominance, and many new mesquite dunes had formed. Black grama and 75 percent of the perennial forb species had disappeared. These well-documented vegetation changes emphasize the need for mesquite control to return range to a productive state.

Soil water relationships in mesquite dune lands--Las Cruces, NM. In soils from dunes and interdunes of mesquite-dominated rangeland, pH, electrical conductivity, organic matter content, and bulk density were similar. However, dune soils were coarser, had higher hydrologic conductivity rates, lower temperatures, and lower water retention and availability than interdune soils. Interdune soils had greater evaporative potential but during two growing seasons consistently showed greater water availability than dune soils. The relatively poor water status of dune soils shows that every effort should be made to prevent the establishment of mesquite and the formation of dunes.

Russian wildrye responds well to nitrogen fertilization--Mandan, ND. Russian wild rye, a cool-season grass, provides excellent fall and winter pastures in the Northern Great Plains. Recent studies show that Russian wildrye responds to nitrogen fertilization rates of 90 lb/acre, more than double previously accepted rates. Clipping Russian wildrye, even very lightly, in the spring reduces fall growth by 50 percent or more. Thus, farmers and ranchers who use Russian wildrye primarily for fall and winter grazing should not use it earlier in the season.

Hydrophylic polymer unsuited as germination medium for grasses but improves soil tilth--Logan, UT. A hydrophylic polymer that is promoted as beneficial to seedling establishment actually delayed germination and emergence of grass seedlings in the greenhouse. When media were allowed to dry, however, the period of green growth of grasses was 14 days longer than in soil without the polymer. This polymer might be used to help establish seedlings in soils that form crusts.

Technological Objective 3: Develop grazing (forage-livestock) management systems that convert range forage more efficiently to animal products and are consistent with improvement, conservation, and multiple use of range ecosystems.

Research Locations:

Fort Collins, Colorado
Dubois, Idaho
Miles City, Montana
Reno, Nevada
Las Cruces, New Mexico
Mandan, North Dakota
El Reno, Oklahoma
Woodward, Oklahoma
Burns, Oregon
Cheyenne, Wyoming

Examples of Recent Progress:

Spayed heifers fed growth stimulants gained fast--Fort Collins, CO. On rangelands, heifers neutered by the K-R technique were usually free of stress symptoms after 48 hours. Forty days after spaying, heifers treated with growth stimulant had recovered from initially lower weight gains and outgained intact ones. Spayed heifers not treated with growth stimulants gained less throughout the summer than those left intact. Gain responses of feedlot heifers to spaying and growth stimulants were similar to those of heifers on range. Spayed heifers could be pastured with steers without affecting gains of either. These findings will allow cattlemen to increase the efficiency of producing beef from heifers and will allow greater flexibility in managing cattle.

Name or Designation	Release Agencies	Reason for Release
CULTIVAR RELEASED		
Saltalk alkali sacaton	USDA-SCS; OK-AES; TX-AES; USDA-ARS	Soil stabilization and range forage

P U B L I C A T I O N S

Fort Collins, CO

Bowman, R. A., and W. J. McGinnies. 1981. Tall wheatgrass and Russian wildrye growth on Natrustoll horizons treated with phosphate and calcium amendments. Agron. J. 73:933-936.

Duke, J. A., and C. E. Townsend. 1981. Trifolium medium L. (Zigzag Clover). In James A. Duke. Handbook of Legumes of World Economic Importance. Plenum Press, N.Y. pp. 248-249.

Herbel, C. H., P. L. Sims, W. A. Laycock, et al. 1981. Range Research, an assessment of current problems and a strategy for the future: A summary of range research by SEA-AR in the 17 western states. Agricultural Research, Science and Education Administration, U.S. Department of Agriculture. 232 p.

Laycock, W. A., and P. W. Conrad. 1981. Responses of vegetation and cattle to various systems of grazing on seeded and native mountain rangelands in Eastern Utah. J. Range Manage. 34:52-58.

Townsend, C. E. 1981. Breeding cicer milkvetch for improved forage yield. Crop Sci. 21:363-366.

Townsend, C. E. 1981. Astragalus cicer L. (Cicer Milkvetch). In James A. Duke, Handbook of Legumes of World Economic Importance. Plenum Press, N.Y. pp. 22-24.

Townsend, C. E. 1981. Vernalization and photoperiod requirements for maximum flowering of cicer milkvetch. Crop Sci. 21:917-921.

Townsend, C. E., and A. M. Wilson. 1981. Seedling growth of cicer milkvetch as affected by seed weight and temperature regime. Crop Sci. 21:405-409.

Wilson, A. M. 1981. Air and soil temperature effects on elongation of adventitious roots in blue grama seedlings. Agron. J. 73:693-697.

Wilson, A. M., R. L. Cuany, J. G. Fraser, et al. 1981. Relationships among components of seed yield in blue grama. Agron. J. 73:1058-1062.

Dubois, Idaho

Harniss, R. O., S. J. Harvey, and R. B. Murray. 1981. A computerized bibliography of selected sagebrush species (Genus Artemisia) in western North America. USDA-FS General Tech. Rpt. INT-102. 107 p.

Reno, Nevada

Brown, J. C. 1980. Climate. In J. A. Young and R. A. Evans (eds.) Physical, biological, and cultural resources of the Gund Research and Demonstration Ranch, Nevada. USDA/SEA, ARM-W-11/June 1980.

Herbel, C. H., P. L. Sims, W. A. Laycock, et al. 1981. Range research, an assessment of current problems and a strategy for the future: a summary of range rasearch by SEA-AR in the 17 western states. Agricultural Research, Science and Education Administration, U.S. Department of Agriculture. 232 p.

Young, J. A., and Task Force Members of CAST (Council for Agricultural Science and Technology). 1981. Scientific aspects of the welfare of food animals. CAST Report No. 91. pp. 1-54.

Young, J. A. 1981. Chukar partridge. Rangelands 3:166-168.

Young, J. A., and R. A. Evans. 1981. Germination of seeds of antelope bitterbrush, desert bitterbrush, and cliff rose. USDA/ARS ARR-W-17. 39 pp.

Young, J. A., and R. A. Evans. 1980. Germination of desert needlegrass seeds. J. Seed Technology 5:40-46.

Young, J. A., R. A. Evans, and R. E. Eckert, Jr. 1981. Temperature profiles for germination of bluebunch and beardless wheatgrasses. J. Range Manage. 34:84-89.

Young, J. A., R. A. Evans, R. E. Eckert, Jr., et al. 1981. Germination--temperature profiles for Idaho and sheep fescue and Canby bluegrass. Agronomy J. 73:716-720.

Young, J. A., R. A. Evans, B. L. Kay, et al. 1981. Collecting, processing, and germinating seeds of western wildland plants. USDA/ARS ARM-W-3/Revised.

Young, J. A., R. A. Evans, C. A. Raguse, et al. 1981. Germinable seeds and periodicity of germination in annual grasslands. Hilgardia 49:1-37.

Young, J. A., R. A. Evans, R. Stevens, et al. 1981. Germination of Kochia prostrata seeds. Agronomy J. 73:957-961.

Young, J. A., and R. A. Evans. 1981. Germination of Great Basin wildrye seeds collected from native stands. Agronomy J. 73:917-920.

Las Cruces, New Mexico

Anderson, D. M. 1981. Application of current livestock/range knowledge, an emphasis needed for the future, p. 535-542. In J. L. Wheeler and R. D. Mochrie, eds. Forage Evaluation--Concepts and techniques. CSIRO, Melbourne, Australia.

Anderson, D. M. 1981. Manipulating rangeland forage quality with the grazing animal. p. 313-328. In J. L. Wheeler and R. D. Mochrie, eds. Forage Evaluation--concepts and techniques. CSIRO, Melbourne, Australia.

Anderson, D. M., J. A. Landt, and P. H. Salazar. 1981. Electronic weighing, identification and subdermal body temperature sensing of range livestock, p. 373-382. In J. L. Wheeler and R. D. Mochrie, eds. Forage Evaluation--concepts and techniques. CSIRO, Melbourne, Australia.

Gibbens, R. P., and T. N. Bilan. 1981. The binary search for accuracy in plant symbols. J. Range Manage. 34:239.

Hedrick, W. W., J. L. Schuster, F. Busby, et al. 1981. Rangeland conservation needs, technology, and policy alternatives. In Soil and Water Resources: Research priorities for the nation. Soil Sci. Soc. Amer., Inc., Madison, WI. pp. 127-140.

Herbel, C. H., R. P. Gibbens, and J. M. Tromble. 1981. Improving production from arid rangelands of the south-western United States. Proc., XIII Intl. Grassl. Cong. I:625-628. Leipzig, GDR.

Herbel, C. H., R. F. Barnes, H. F. Heady, et al. 1981. Range research in the Soviet Union. Rangelands 3:61-63.

Reitzel, J. A., and C. A. Davis. 1981. Final Report: Effects of mesquite control on bird populations on the Jornada Experimental Range, southern New Mexico. Dept. of Fishery and Wildlife Sciences, New Mexico State University, Las Cruces. 47 p.

Sisson, W. B. 1981. Photosynthesis, growth, and ultraviolet irradiance absorbance of Cucurbita pepo L. leaves exposed to ultraviolet-B radiation (280-315 nm). Plant Physiol. 67:120-124.

Sisson, W. B., J. A. Booth, and G. O. Throneberry. 1981. Absorption of SO_2 by pecan (Carya illinoesis (Wang) K. Koch) and alfalfa (Medicago sativa L.) and its effect on net photosynthesis. J. Exp. Bot. 3:523-534.

Mandan, North Dakota

Hofmann, L., R. E. Ries, and R. J. Lorenz. 1981. Livestock and vegetative performance on reclaimed and nonmined rangeland in North Dakota. J. of Soil and Water Cons. 36:41-44.

Krupinsky, J. M., R. E. Barker, and P. A. Donald. 1981. Nematodes associated with a germplasm collection of blue grama and western wheatgrass in western North Dakota and South Dakota. Phytopathology 71:233.

Woodward, Oklahoma

Berg, W. A., and C. M. Smith (co-chairmen). 1981. Drastically disturbed lands conservation needs, technology and policy alternatives. In W. E. Larson et al (eds.) Soil and Water Resources: Research Priorities for the Nation. Soil Sci. Soc. Am., Madison, Wisconsin. pp. 173-184.

Berg, W. A. 1981. Book Review. The Restoration of Land by A. D. Bradshaw and M. J. Chadwick. J. Envir. Quality 10:562-3.

Dewald, C. L., and P. L. Sims. 1981. Seasonal vegetative establishment and shoot reserves of eastern gamagrass. J. Range Manage. 34:300-304.

Kilkelly, M. K., H. P. Harbert, and W. A. Berg. 1981. Field studies on Paraho retorted oil shale lysimeters. EPA 600/7-81-131. NTIS order number PB 81 234742. 86 p.

Voigt, P. W., F. P. Horn, and C. L. Dewald. 1981. Forage quality responses of four lovegrasses to stage, interval, and season of harvest. Agron. J. 73:877-884.

Burns, Oregon

Britton, C. M., R. G. Clark, and F. A. Sneva. 1981. Will your sagebrush range burn? Rangelands 3:207-208.

Britton, C. M., and F. A. Sneva. 1981. Effects of tebuthiuron of western Juniper. J. Range Manage. 34:30-32.

Britton, C. M., and F. A. Sneva. 1981. Effects of fire on herbaceous yield of sagebrush-bunchgrass range. In 1981 research in rangeland management. OSAES Spec. Rep. 620.

Temple, Texas

Hauser, V. L. 1981. Planting germinated grass seed. Trans. of ASAE 24. 1127-1130.

Logan, Utah

Asay, K. H., and D. R. Dewey. 1981. Registration of Agropyron repens X A. spicatum germplasms RS-1 and RS-2 (Reg. No. GP11 and GP12). Crop Sci. 21:351.

Caldwell, M. M., J. H. Richards, D. A. Johnson, et al. 1981. Coping with herbivory: Photosynthetic capacity and resource allocation in two semiarid Agropyron bunchgrasses. Oecologia 50:14-24.

Dewey, D. R. 1980. Cytogenetics of Agropyron drobovii and five of its interspecific hybrids. Bot Gaz. 141:469-478.

Dewey, D. R. 1981. Cytogenetics of Agropyron ferganense and its hybrids with six species of Agropyron, Elymus, and Sitanion. Amer. J. Bot. 68:216-225.

Dewey, D. R. 1981. Genomic and phylogenetic relationships among North American perennial Triticeae. In J. R. Estes, et al (eds.) Grasses and Grasslands: Systematics and Ecology. Univ. of Oklahoma Press. Norman, OK. pp. 51-88.

Johnsen, T. N., Jr., and F. B. Gomm. 1981. Forage plantings on six Arizona pinyon-juniper subtypes. J. Range Manage. 34:131-136.

Johnson, D. A., M. D. Rumbaugh, and K. H. Asay. 1981. Plant improvement for semiarid rangelands: Possibilities for drought resistance and nitrogen fixation. Plant and Soil 58:279-303.

Johnson, D. A., and M. D. Rumbaugh. 1981. Nodulation and acetylene reduction by certain rangeland legume species under field conditions. J. Range Manage. 34:178-181.

Lavin, F., T. N. Johnsen, Jr., and F. B. Gomm. 1981. Mulching, furrowing, and fallowing of forage plantings on Arizona pinyon-juniper ranges. J. Range Manage. 34:171-177.

Rumbaugh, M. D., and D. A. Johnson. 1981. Screening Medicago sativa L. germplasm for seedling drought resistance. Crop Sci. 21:709-713.

Rumbaugh, M. D., and D. A. Johnson. 1981. Screening alfalfa germplasm for seedling drought resistance. Crop Sci. 21:709-713.

Rumbaugh, M. D., D. A. Johnson, and G. A. VanEpps. 1981. Forage diversity increases yield and quality. Utah Sci. 42:114-117.

Cheyenne, Wyoming

Hart, R. H., A. J. Thompson III, J. H. Elgin, Jr., et al. 1981. Forage yield and quality of Quaker comfrey, alfalfa, and orchardgrass. Agron. J. 73:737-743.

NRP 20110 Principal Contacts

Location	Principal Contact
Tucson, Arizona	Dr. Howard L. Morton 2000 East Allen Road Tucson, Arizona 85719 8-762-6881
Fort Collins, Colorado	Dr. William A. Laycock Crops Research Laboratory, Room 28 Colorado State University Fort Collins, Colorado 80523 8-323-5227
Dubois, Idaho	Dr. R. Murray (Acting) U.S. Sheep Experiment Station Dubois, Idaho 83423 208/374-5306
Miles City, Montana	Dr. R. Bellows LARRS, Route 1, Box 3 Miles City, Montana 59301 406/232-4970
Reno, Nevada	Dr. Raymond A. Evans Renewable Resource Center University of Nevada 920 Valley Road Reno, Nevada 89512 8-470-5607
Las Cruces, New Mexico	Dr. Carlton H. Herbel Jornada Experimental Range P.O. Box 3JER, NM State University Las Cruces, New Mexico 88003 8-571-8332
Mandan, North Dakota	Dr. Al Frank Northern Great Plains Res. Lab. P.O. Box 459 Mandan, North Dakota 58554 701/663-6445
El Reno, Oklahoma	Dr. Floyd P. Horn Southwestern Livestock and Forage Research Station P.O. Box 1199 El Reno, Oklahoma 73036 8-736-5028
Woodward, Oklahoma	Dr. Phillip Sims U.S. Southern Great Plains Field Station 2000 - 18th Street Woodward, Oklahoma 73801 405/256-7449

Location	Principal Contact
Burns, Oregon	Dr. Robert Raleigh Squaw Butte-Harney Experiment Station P.O. Box 833 Burns, Oregon 97720 503/573-2064
Logan, Utah	Dr. D. R. Dewey Crops Research Laboratory Utah State University, UMC 63 Logan, Utah 84322 8-750-3078
Cheyenne, Wyoming	Dr. Richard H. Hart USDA High Plains Grassland Research Station 8408 Hildreth Road Cheyenne, Wyoming 82001 8-328-2434

National Research Program 20160

INTRODUCTION, CLASSIFICATION, MAINTENANCE, EVALUATION, AND DOCUMENTATION OF PLANT GERMPLASM

Research is directed to provide breeders and other applied plant scientists with the genetic resources needed for improving crop plants in terms of their reaction to environmental stresses such as insect and disease pests, adverse weather, and moisture supplies, and in terms of compositional characteristics and nutritional factors. It also provides for a continuing evaluation of new plant resources that have the potential of becoming viable new crops which can provide raw materials needed for changing industrial and medical technologies or to meet national requirements for strategic materials.

NPS Contact: Quentin Jones

Technological Objective 1: Expanded collections and improved maintenance, evaluation, and distribution of plant germplasm as sources of useful genetic material to improve existing crops and develop new crops.

Research Locations:

Davis, California
Indio, California
Fort Collins, Colorado
Washington, D.C.
Miami, Florida
Experiment, Georgia
Savannah, Georgia
Ames, Iowa
Beltsville, Maryland
Glenn Dale, Maryland
Geneva, New York
Mayaguez, Puerto Rico
Pullman, Washington
Sturgeon Bay, Wisconsin

Selected Examples of Recent Progress:

Germplasm repository - Indio, California. The date palm repository was moved to the Imperial Valley Conservation Research Center, Brawley. It is established in rows 13 to 25 of Block L 1. As of December 1981, tree development was good; only a few replacements will be required in 1982. A comprehensive report on the repository was prepared and distributed to appropriate ARS offices. Clonal date palm material was distributed to domestic and foreign tissue culture laboratories for development of commercial methods for rapid propagation of palms.

Electrophoretic procedures determine changes in genetic characteristics of a seed lot - Fort Collins, Colorado. Polyacrylamide electrophoresis of seed proteins can be used to characterize the genetic uniformity or variability of a seed lot. Changes in the genetic composition of a seed lot resulting from deterioration, multiplication, or any other source can be determined through sequential electrophoretic examinations over time. Such determinations will greatly assist in the continued maintenance of genetic integrity of the base collection of plant germplasm held as viable seeds.

Increase the seed and evaluate new plant introductions for desirable characteristics - Experiment, Georgia. The bacterium that causes severe damage on certain PI's of muskmelon was identified as Pseudomonas pseudoalkaligenes subsp. citrulli.

A new hydrocarbon producing plant species was introduced from Brazil - Miami, Florida. Copaifera langsdorfii has received considerable attention since Melvin Calvin reported in 1979 having seen it yield a sap that was put directly into diesel engine tanks as fuel.

Unadapted exotic germplasm was transferred into backgrounds of use to plant breeders - Ames, Iowa. Dr. E. E. Gerrish, Cargill, Inc., Grinnell, Iowa, developed five maize synthetics by transferring a broad base of exotic tropical germplasm, unadapted to the Cornbelt, into backgrounds of adapted cornbelt lines. Ten to twenty-five-pound lots of seed of each line were given to the NC Regional Station in 1981 for preservation and distribution. This represents one of the first accomplishments to transfer germplasm from exotic unadapted material into lines of immediate use to plant breeders and to make it available through the North Central Regional Plant Introduction Station.

The 203 Triticeae collections acquired from China in 1980 were established in the field in 1981 - Logan, Utah. Chromosome counts were made on more than half of those collections. A diploid (2n=14) narrow-spiked crested wheatgrass (Agropyron mongolicum) was discovered. This diploid explains the wide variation found in crested wheatgrass polyploids. Another 47 collections were obtained from foreign sources, primarily China and Mexico. The collections from Mexico resemble Agropyron trachycaulum, and it is the first Agropyron collection in the NPGS from Mexico.

Dedication and initiation of operation at the Northwest Plant Germplasm Repository marks the beginning of a new program in the National Plant Germplasm System - Corvallis, Oregon. This is the first of the planned repositories for fruit and nut clonal stocks which previously had not been adequately maintained. It should serve as an impetus for both the conservation and utilization of these stocks in research programs in this country.

Plant Introductions make important contributions to breeding progress - Experiment, Georgia; Ames, Iowa; Geneva, New York; and Pullman, Washington. Described below are examples of PI's, as reported by cooperators, that are considered to have made important contributions to plant breeding progress and to U.S. agriculture.1/

1/ A more complete listing can be obtained from the minutes of the annual technical committee meetings of the four Regional Plant Introduction Station Projects W-6, NC-7, S-9, and NE-9.

• Oregon State University released 'Oregon Sugarpod II' edible pea pod, which shows resistance to powdery mildew; and 'Oregon 605' processing pea, which is resistant to enation mosaic-red clover mosaic virus complex. Both releases include PI 140295 in their parentage.

• Safflower PI 249081 showed resistance to the mild strain of Verticillium dahliae.

• Tepary bean PI's 321638 and 310801 were included in a study of rooting depth. Both lines showed water extraction to at least 180 cm.

• Bean PI 165078 has been used in crosses to develop a bright white seed coat that is resistant to seed coat cracking.

• Corn PI 270297, an inbred line from Argentina, 41:2504B (Amargo) and received from the Corn Insects Research Laboratory, Ankeny, IA, is reported to have the highest level of European corn borer (1st brood) resistance known and good 2nd brood resistance. (F. F. Dicke, 1981 Acc. Perf. Rep., Pioneer Hi-Bred International, IA).

• Sunflower PI's 175733 (Turkey), 291411 (Hungary), 296292 (S. Africa), 343793 (Iran), and 413116 (California) were selected as being resistant to injury from the herbicide Diclofop at 2.2 kg/ha postemergence.

• Five sunflower accessions were found with appreciable levels of resistance against a composite of races 2 and 3 of sunflower downy mildew, PI's 343794, 372257, 376215, 376216, and 377530. (T. Gulya, 1981 Acc. Perf. Rep., ND).

• Five bean introductions, PI 209488, 209492, 309758, 312068, 313454, showed resistance to Aphanomyces root rot in 1981 tests. (C. R. Grau, 1981 Acc. Perf. Rep., WI).

• Pisum sativum PI's 193586 and 193835 from Ethiopia were released as germplasm with resistance to pea seedborne mosaic virus. See 1971 Crop Sci. 11:945-956, 1973 Phytopathology 63:1130-1133, Crop Sci. 15:447-448, and registered in Nov. 1971. (E. I. Gritton, 1981 Acc. Perf. Rep. WI).

• Tomato, PI 270188, cv. "Globelle" from Ohio, and Tomato, PI 370082 "Bay State" (originally from Canada), contains the gene cf-2 for resistance to Cladosporiumn fulvum, confirmed in 1981 tests. (E. A. Kerr, 1981 Acc. Perf. Rep., Canada).

• Watermelon, PI 244019, was resistant to anthracnose under very severe disease conditions. This disease causes an estimated $7.5 million in annual losses to the U.S. Watermelon crop.

SUMMARY OF PLANT GERMPLASM
INTRODUCTION AND USE
1981

	Acquired in CY 1981	Currently held	To users in CY 1981
Principal Centers:			
Office of Plant Introduction Beltsville, MD Foreign Exchange Domestic Exchange	12,792	1/	152,287
National Seed Storage Laboratory, Fort Collins, CO Base Collection, Long-Term	46,357 2/	164,099	1,234 3/
Working (Active) Collections:			
Regional Plant Introduction Station, Experiment, GA	7,405	47,250	21,522
Regional Plant Introduction Station, Ames, IA	1,020	23,020	16,000
Regional Plant Introduction Station, Geneva, NY	500	16,000	4,000
Regional Plant Introduction Station, Pullman, WA	471	26,995	4,053
Subtropical Horticultural Research Station, Miami, FL	1,146	6,576	3,603
Small Grains Collection, Beltsville, MD	288	85,288	102,400
Clonal Repositories			
Northwest Plant Germplasm Repository Corvallis, OR	1,700	1,700 4/	

1/ The Office of Plant Introduction does not "hold" germplasm, rather it provides a national focal point and clearing house for exchange of plant germplasm with foreign countries.

2/ Includes 38,667 samples from the Small Grains Collection, Beltsville, MD. and 1,987 corn samples from CIMMYT.

3/ NSSL distributes samples only when it is the sole source.

4/ Dedicated on April 15, 1981.

Technological Objective 2: New and improved knowledge of the chemical, biological, and agronomic potentials of selected plant species as new crop sources of industrial oils, waxes, gums, fibers, of food and feed proteins, and licit and illicit narcotic drugs and other medicinals.

Research Locations:

Flagstaff, Arizona
Savannah, Georgia
Peoria, Illinois
Bloomington, Indiana
Ames, Iowa
Beltsville, Maryland
Corvallis, Oregon
Islamabad, Pakistan
Philadelphia, Pennsylvania
Mayaguez, Puerto Rico
College Station, Texas
Chiang Mai, Thailand
Pullman, Washington

Selected Examples of Recent Progress:

Active constituents from plant extracts with confirmed biological activities were isolated and characterized - Peoria, Illinois. A total of eight biologically active maytansinoids have been isolated from Trewia nudiflora seed; the structure of three of these has been reported previously. Three additional maytansinoids have been fully characterized, and these represent a new class of maytansinoids with two fused macrocyclic rings; in addition to the usual 19-membered ring, there is a 12-membered ring which is a novel feature. In addition to potent antitumor activity in experimental systems, these maytansinoids exhibit several pest control activities.

Biological activity in extracts of seed and other plant parts was detected through both in-house screening and outside cooperators - Peoria, Illinois. During the past year, 80 new extracts have been prepared, submitted to National Cancer Institute contractors, and are in varying stages of bioassay. Of these, three have shown preliminary anti-leukemic (PS) activity, not yet confirmed.

Technological Objective 3: Increased understanding of the taxonomic relationships, geographical and ecological distribution, and centers of diversity of crop plants and their wild relatives to promote the systematic assembly of germplasm for crop improvement.

Research Locations:

Washington, D.C.
Beltsville, Maryland

Selected Examples of Recent Progress:

Exotic weed alert computer system - Beltsville, Maryland. The exotic weed alert computer system identified 51 exotic weeds and provided justification to declare these as such by publication in the Federal Register so they can be added to the Federal Noxious Weed Act. Seventeen other weeds are under review for publication in Federal Register. APHIS can now, based on this work, prevent importation of these weeds into the U.S., and can quarantine domestic areas of infestation.

PUBLICATIONS

Fort Collins, Colorado

Bass, L. N. 1981. Storage conditions for maintaining seed quality. In: Finney, E., Handbook of Transportation and Marketing in Agriculture, Vol. II, Field Crops: 239-321.

Fujigaki, J., and T. Tsuchiya. 1981. A new type of trisomic for chromosome 6 (metatrisomic 6A) in barley. Barley Genet. Newsletter 11:28-29.

Murata, M., E. Roos, and T. Tsuchiya. 1981. Chromosome damage induced by artificial seed aging in barley. I. Germinability and frequency of aberrant anaphases at first mitosis. Can. J. Genet. Cytol. 23:267-280.

Roos, E. E., and P. C. Stanwood. 1981. Effects of low temperature, cooling rate and moisture content on germination of lettuce (Lactuca sativa L.) seed. J. Am. Soc. Hort. Sci. 106:30-34.

Singh, R. J., and T. Tsuchiya. 1981. Ring chromosomes in barley (Hordeum vulgare L.). Chromosoma (Berl.) 82:133-141.

Singh, R. J., and T. Tsuchiya. 1981. Identification and designation of barley chromosomes by Giemsa banding technique: a reconsideration. Z. Pflanzenzuecht. 86:336-340.

Singh, R. J., and T. Tsuchiya. 1981. Cytological study of the telocentric chromosome in seven monotelotrisomics in barley. Bot. Gaz. 142:267-273.

Stanwood, P. C., and L. N. Bass. 1981. Seed germplasm preservation using liquid nitrogen. Seed Sci. & Technol. 9:423-437.

Tsuchiya, T. 1981. Allelism testing in barley, III. Further results on the allelic relationships of three uzu genes. J. Hered. 72:455-458.

Washington, D. C.

Dudley, T. R. 1981. Taxonomic and Nomenclatural Notes of the Flora of Isla de los Estados (Staten Island), Tierra del Fuego, Argentina. Rhodora 83 (836): 477-519.

Dudley, T. R. 1981. Preliminary Report of the Sino-American Botanical Expedition to Western Hubei Province, People's Republic of China - 1980. American Association of Botanic Gardens and Arboreta Bulletin 15(3): 73-77.

Dudley, T. R. 1981. A New Viburnum for Bulgaria. Fragmenta Floristica et Geobotanica 27(1-2): 163-164.

Dudley, T. R. 1981. Plant Exploration in the People's Republic of China - 1980. Proceedings of the 58th Meeting of the Holly Society of America, Mobile, Alabama, November, p. 8-10.

Mazzeo, P. M. 1981. Ferns and Fern Allies of Shenandoah National Park. Shenandoah Natural History Association, Luray, Va., 2nd ed., 55 pp., illus.

Miami, Florida

Soderholm, P. K. 1981. Catalog of Plant Germplasm Available from the Subtropical Horticulture Research Unit, Miami, Florida. USDA, ARS, Agricultural Reviews and Manuals, ARM-S-19/Oct. 81.

Experiment, Georgia

Adamson, W. C., and J. E. O'Bryan. 1981. Inheritance of photosensitivity in roselle, Hibiscus sabdariffa. J. Hered. 72:443-444.

Demski, J. W., and G. Sowell Jr. 1981. Resistance to peanut mottle virus in n Arachis spp. Peanut Sci. 8:43-44.

Sowell, G., Jr. 1981. Additional sources of resistance to gummy stem blight of muskmelon. Plant Disease 65:253-254.

Sowell, G., Jr. 1981. A bacterial disease causing severe damage to susceptible plant introductions of muskmelon. Plant Disease 65(7):609-610.

Sowell, G., Jr. 1981. Examples of disease resistance in a vegetable germplasm collection. Plant Genetic Resources Newsletter 46:37-39.

Peoria, Illinois

Ahmad, M. U., S. K. Hussain, and S. M. Osman. 1981. Ricinoleic acid in Phyllanthus niruri seed oil. J. Am. Oil Chem. Soc. 581:673.

Carlson, K. D., W. E. Schneider, S. P. Chang, and L. H. Princen. 1981. Vernonia galamensis seed oil: A new source for epoxy coatings. In: "New Sources of Fats and Oils." AOCS Monograph, Chapter 21, pp. 297-318.

Galsky, A. G., R. Kozimor, D. Piotrowski, and R. G. Powell. 1981. The crown-gall potato disk bioassay as a primary screen for compounds with antitumor activity. J. Nat. Cancer Inst. 67(3):689-692.

Gardner, H. W., and R. Kleiman. 1981. Degradation of linoleic acid hydroperoxides by a cysteine-$FeCl_2$ catalyst as a model for similar biochemical reactions. II. Specificity in Formation of Fatty Acid Epoxides. Biochim. Biophys. Acta 665:113-125.

Grove, M. D., R. D. Plattner, and D. Weisleder. 1981. Ammoniation products of an aflatoxin model coumarin. J. Agric. Food Chem. 29(6):1161-1164.

Hagemann, J. W., J. A. Rothfus, and M. A. Taylor. 1981. Comparison of sperm whale oil with three potential replacements on a mini four-ball wear tester. Lubr. Eng. 37:145-152.

Jacobson, M., M. M. Crystal, and R. Kleiman. 1981. Effectiveness of several polyunsaturated seed oils as boll weevil feeding deterrents. JAOCS 58(11): 982-983.

McLaughlin, J. L., R. W. Miller, R. G. Powell, and C. R. Smith, Jr. 1981. 19-Hydroxybaccatin III, 10-deacetylcephalomannine, and 10-deacetyltaxol: New antitumor taxanes from Taxus wallichiana. J. Nat. Prod. 44(3)312-319.

Miller, R. W., R. G. Powell, C. R. Smith, Jr., E. Arnold, and J. Clardy. 1981. Antileukemic alkaloids from Taxus wallichiana Zucc. J. Org. Chem. 46(7): 1469-1474.

Payne-Wahl, K. L., and R. Kleiman. 1981. Trans-2-hexadecenoic acid in Aster scaber seed oil. J. Nat. Prod. 44(2):190-192.

Powell, R. G., D. Weisleder, and C. R. Smith, Jr. 1981. Novel maytansinoid tumor inhibitors from Trewia nudiflora: Trewiasine, dehydrotrewiasine, and demethyltrewiasine. J. Org. Chem. 46(22):4398-4403.

Powell, R. G., and C. R. Smith, Jr. 1981. An Investigation of the antitumor activity of Sesbania drummondii. J. Nat. Prod. 44(1):86-90.

Spencer, G. F. 1981. Dammarenediol II esters from Cacalia atriplicifolia L. seed oil. J. Nat. Prod. 44(2):166-168.

Spencer, G. F., and J. L. Flippen-Anderson. 1981. Isolation and X-ray structure determination of a new neolignan from Clerodéndron inerme seeds. Phytochemistry 20(12):2757-2759.

Ames, Iowa

Bhella, H. S., and G. A. White. 1981. Ornamental plant introductions 1977. Plant Prop. 27(1):3-5.

Ellis, M. D., G. S. Jackson, W. H. Skrdla, and H. C. Spencer. 1981. Use of honey bees for controlled interpollination of plant germplasm collections. HortScience 16(4):488-491.

Wilson, F. D., B. W. George, and R. L. Wilson. 1981. Lint yield and resistance to pink bollworm in early-maturing cotton. Crop Sci. 21:213-216.

Wilson, R. L., and K. J. Starks. 1981. Effects of culture-host preconditioning on greenbug response to different plant species. Southwestern Entomol. 6:229-232.

Beltsville, Maryland

Campbell, T. A. 1981. Agronomic potential of Stokes aster. In: Pryde, E. H., L. H. Princen, and K. D. Mukherjee (ed.) New sources of fats and oils. American Oil Chemists Society Monograph 9.

Duke, J. A., and R. M. Polhill. 1981. Seedlings of the Leguminosae. pp. 941-950. In Advances in Legume Systematics. 2 Vols. Royal Botanic Gardens, Kew. 1049 pages.

Duke, J. A. 1981. Handbook of Legumes of World Economic Importance. Plenum Press, New York. 345 pp.

Gunn, C. R. 1981. Seeds of Leguminosae. In: Polhill, R. M., and P. H. Raven, Advances in Legume Systematics. Int. Leg. Conf., Kew, Proc. 2:913-925.

Lersten, N. R., and C. R. Gunn. 1981. Seed morphology and testa topography in Cicer (Fabaceae: Faboideae). Syst. Bot. 6:223-230.

Nasir, Y. J. 1981. Olacaceae Fl. Pak. 136:1-3.

Patterson, D. T., E. E. Terrell, and R. Dickens. 1981. Cogongrass in Mississippi. Miss. Agric. and Forestry Exp. Sta. Research Report 6(7):1-4.

Perdue, R. E., Jr. 1981. Maytenus buchananii, source of maytansine. Am. Soc. Pharmacognosy Newsletter 18:8-10.

Terrell, E. E., and W. P. Wergin. 1981. Epidermal features and silica deposition in lemmas and awns of Zizania (Gramineae). Amer. Jour. Bot. 68:697-707.

Waterworth, H. E. 1981. Scionwood of pear cultivars and species available from the U.S. Plant Introduction Station. Fruit Vars. Journal 35:71-74.

Waterworth, H. E. 1981. Our Plant's Ancestors Immigrated Too. BioScience 31:698.

Glenn Dale, Maryland

Waterworth, H. E. 1981. Control of plant diseases by exclusion: Quarantine and disease free stocks. Chapter in: Pest Management, CRC Press.

Waterworth, H. E. 1981. Bean Mild Mosaic Virus, Plant Virus Description #231, CMI/AAB. England, 4 pp.

Waterworth, H. E. 1981. Cucumoviruses, Part I. Biology. In: Hdbk. of Plant Virus Infections and Comparative Diagnosis. Elsevier/North Holland Press.

Geneva, New York

Alconero, R., and B. Fiori. 1981. Evaluation of Perennial Trifolium species for disease and insect resistance at NE Reg. Pl. Intr. Station, Prog. Rept. of Clovers and Special Purpose Legume Res., P. 45, Univ. of Wisconsin, Madison.

Dolan, D. D., W. R. Sherring, R. Alconero, and B. Fiori, 1981. Evaluation of forage introductions, 1980. 44th Annual Report of Forage Research in Northeastern United States. 44:3-4 July.

Dolan, D. D. 1981. What's New in Plants. The Grower 15(6):4 (June).

Dolan, D. D., and W. R. Sherring. 1981. Progress in the evaluation and use of plant germplasm in the Northeast, 1965-73. New York State Agricultural Experiment Station Special Report #41, November.

Mayaguez, Puerto Rico

Martin, F. W., and R. Ruberte. 1981. Growing Food in Containers in the Tropics. Agricultural Reviews and Manuals S-13. USDA,SEA,AR, Southern Region, New Orleans, LA 14 pp.

Martin, F. W., and H. Delpin. 1981. Frijol Alada. Agricultura de las Americas, March:22-25.

Martin, F. W., C. Daloz, and M. del C. Velez. 1981. Vegetables for the hot, humid tropics. Part 8. Vegetable corns, Zea mays. SEA, USDA, 14 pp.

Martin F. W., and R. Ruberte. 1981. Variability in okra seed quality. J. Agr. Univ. P. R. 65:205-212.

Pullman, WA

Davis, A. M. 1981. The oxalate, tannin, crude fiber and crude protein composition of young plants of some Atriplex species. J. Range Mgt. 34:329-331.

Davis, A. M. 1981. Lupinus mutabilis Sweet: A potential food, oil, and protein source. In: Pryde, E. H., L. H. Princen, and K. D. Mukherjee (eds.), New Sources of Fats and Oils. American Society of Oil Chemists, Champaign, IL. 340 pp.

Kaiser, W. J. 1981. Diseases of chickpea, lentil, pigeon pea, and tepary bean in continental United States and Puerto Rico. Econ. Botany 35:300-320.

Kaiser, W. J. 1981. Control of Ascochyta blight through clean seed. In: Proceedings of Workshop on Ascochyta Blight and Winter Sowing of Chickpeas. The International Center for Agricultural Research in the Dry Areas, Aleppo, Syria. May 4-7, 1981.

Kaiser, W. J. 1981. Control of seedborne infection/infestation by chemicals and thermotherapy. In: Proceedings of Seminar on Quarantine of Seed for Developing Countries of Africa and Asia. New Delhi, India. November 19-December 2, 1980.

Kaiser, W. J. 1981. Distribution of some major seedborne pathogens; impact on quarantine precautions. In: Proceedings of Seminar on Quarantine for Seed for Developing Countries of Africa and Asia. New Delhi, India. November 19-December 2, 1980.

Pesho, G. R., S. E. Brauen, and R. L. Goss. 1981. European crane fly: larval infestations in grass cultivars. Jour. Econ. Ent. 74(2):230-233.

Russo, M., A. A. Kishtah, and M. A. Tolba. 1981. A disease of lentil caused by bean yellow mosaic virus in Egypt. Plant Dis. 65:611-612.

INDIO, CA 92201

J. B. Carpenter, Location Leader
U.S. Date & Citrus Station
44-455 Clinton Street
714-347-3414

DAVIS, CA 95616

D. E. Parfitt
Germplasm Repository
Pomology Department
University of California
916-752-6504

FORT COLLINS, CO 80523

L. N. Bass, Research Leader
National Seed Storage Laboratory
Colorado State University
FTS: 323-5205

G. N. Hersh
Director, Laboratory for Information Sciences in Agriculture
(GRIP Project)
301 Aylesworth
Colorado State University
Fort Collins, CO 80523
303-491-5863

WASHINGTON, D.C. 20002

H. M. Cathey, Director
U.S. National Arboretum
3501 New York Avenue, NE
202-472-9242

MIAMI, FL 33158

D. H. Spalding, Research Leader
Subtropical Horticulture Research
13601 Old Cutler Road
FTS: 350-5820

EXPERIMENT, GA 30212

G. R. Lovell, Location Leader
Regional Coordinator S-9
Regional Plant Introduction Station
404-228-7255

PEORIA, IL 61604

E. B. Bagley, Chief
Horticultural & Specialty Crops Lab
Northern Regional Research Center
1815 North University Street
FTS: 360-4270

URBANA, IL 61801

R. L. Bernard
Corn genetic stocks, soybean curator
Department of Agronomy
160 Davenport Hall
University of Illinois
FTS: 958-9124

BLOOMINGTON, IN 47401

P. G. Mahlberg
Department of Plant Sciences
138 Jordan Hall
Indiana University
812-227-5980

AMES, IA 50011

W. H. Skrdla, Research Leader
Regional Coordinator NC-7
Regional Plant Introduction Station
Iowa State University
FTS: 865-3265

BELTSVILLE, MD 20705

J. A. Duke, Chief
Economic Botany Laboratory
Building 001, BARC-West
FTS: 344-4419

W. M. Porter, Acting Chief
Germplasm Resources Laboratory
Building 001, BARC-West
FTS: 344-2020

R. E. Perdue, Jr., Chief
Plant Exploration & Taxonomy Laboratory
Building 265, BARC-East
FTS: 344-2431

BELTSVILLE, MD 20705 (Cont'd)

W. A. Gentner
Chemical Practices for the Control
of Narcotic Plants
Weed Science Laboratory
Building 050, Room 116, BARC-W
FTS: 344-3537

GLENN DALE, MD 20769

B. J. Parliman, Acting Location Leader
U.S. Plant Introduction Station
P.O. Box 98
FTS: 344-3003

MERIDAN, MS 39762

K. C. Freeman
Sweet Sorghum Curator
U.S. Sugarcane Field Station
Route 10, Box 152
601-482-0611

GENEVA, NY 14456

D. D. Dolan, Research Leader
Regional Coordinator NE-9
Regional Plant Introduction Station
NYS Agricultural Experiment Station
315-787-2244

R. Alconero, Location Leader &
Research Leader, Pest Resistance in
Vegetable, Forage, & Ornamental
Introductions
Regional Plant Introduction Station
NYS Agricultural Experiment Station
315-787-2368

Corvallis, OR 97331

O. Jahn, Research Leader
Northwest Plant Germplasm Repository
33447 SE Peoria Road
FTS: 420-4448

ISLAMABAD, PAKISTAN

Cooperative with:
U.S. Department of State
American Embassy

PHILADELPHIA, PA 19118

D. D. Bills, Chief
Plant Science Laboratory
Eastern Regional Research Laboratory
600 E. Mermaid Lane
FTS: 489-6579

MAYAGUEZ, P.R. 00708

A. Sotomayor-Rios, Location Leader
Mayaguez Institute of Tropical
Agriculture
P.O. Box 70
FTS-OP: 967-1221 (ask for Puerto Rico Opr.

COLLEGE STATION, TX 77843

C. L. Nessler
Department of Biology
Texas A&M University
213-845-3116

CHIANG MAI, THAILAND

J. Bond, Agric. Research Officer
USDA, ARS
U.S. Embassy, Box C
APO San Francisco 96346

LOGAN, UT 84322

D. R. Dewey, Research Leader
Forage & Range Research Unit
Crops Research Laboratory
Utah State University - UMC 63
801-750-3078

PULLMAN, WA 99164

S. M. Dietz, Research Leader
Regional Coordinator W-6
Regional Plant Introduction Station
Room 59 Johnson Hall
Washington State University
509-335-1502

STURGEON BAY, WI 54235

R. E. Hanneman, Jr.
Coordinator IR-1
Peninsula Branch Experiment Station
Route 2
414-743-5406 (summer only)
Substation of MADISON, WI 53706
Rm. 108 Horticulture Building
University of Wisconsin
FTS: 262-1492

National Research Program 20170
PHYSIOLOGICAL AND BIOCHEMICAL TECHNOLOGY TO IMPROVE CROP PRODUCTION

National Research Program 20170 involves research elucidating the basic function of plants at the physiological and biochemical level. New data yielded by this research will establish advanced agricultural technology focused on field and horticultural crops. Among the major emphases of this National Research Program are photosythetic efficiency and biological conversion of solar energy by plants, biological nitrogen fixation and utilization of nutrients, environmental stress damage to plants, and molecular biology to increase crop production efficiency.

NPS Contact: Gerald Still

Technological Objective 1: Improve biological conversion of solar energy for increased crop production by increasing the efficiency of photosynthesis, translocation and associated metabolism.

Research Locations:

Phoenix, Arizona
Albany, California
Athens, Georgia
Peoria, Illinois
Urbana, Illinois
Beltsville, Maryland
Ithaca, New York
Raleigh, North Carolina
Lubbock, Texas
Logan, Utah

Examples of Recent Progress:

Carbohydrates and polyols from bolls of three Pima and two upland cotton varieties extracted and determined by HPLC - Phoenix, Arizona. Rapid chromatographic techniques have been developed to analyze simultaneously soluble sugars and starch from cotton tissue by high performance liquid chromatography (HPLC). By the techniques used, no statistical difference was found between the carbohydrate content of bolls from upland or pima varieties older than 7 days post anthesis. Cotton bolls on the same plant which differ in age also have been found to have a relatively constant content of extractable sugars, suggesting that boll sink strength either does not vary with boll age or is not reflected in soluble carbohydrate content.

Uptake kinetics have been determined for glucose, fructose, sucrose, and raffinose into cotton leaf discs, cultured root tips and cotton embryos - Phoenix, Arizona. For leaf and root tissues, sucrose and raffinose accumulation was found to exceed that of glucose and fructose and to be "nonsaturable" up to very high levels of external sugar, but sensitive to metabolic inhibitors. Similarity in the kinetic patterns for these two tissues suggests that similar cellular sugar accumulation mechanisms exist in both cotton sink (embryo, root tip) and source (leaf disc) tissues. The "unsaturability" of the accumulation pattern and its sensitivity to metabolic inhibitors imply that there is a

involvement of metabolic energy and that a varying affinity accumulation mechanism is involved in both the loading and unloading of photosynthate in cotton plants.

Ammonia accumulation in leaf material is not caused by photorespiration - Albany, California. The findings indicate that using methione sulfoximine to C_3, a rapid buildup of ammonia occurred. Accumulation of ammonia was shown not to be a result of photorespiration process but was probably due to blockage of the synthesis of glutamine. This finding was extended during the year to C_4 plants.

Pearl millet fertility barriers to sorghum pollen characterized - Athens, Georgia. The influence of gynoecium age in pearl millet [Pennisetum typhoides (Burmf.) Stapf & C. E. Hubb.] was studied with respect to pollen growth of pearl millet and sorghum [Sorghum bicolor (L.) Moench]. Protogynous pearl millet gynoecia are receptive to germination of pearl millet and sorghum pollen immediately upon stigma emergence from the floret. Pearl millet pollen tubes grow normally and seed set is effected. Sorghum pollen tube growth is generally inhibited before reaching the micropyle. After anther exsertion from the floret, the internal environment of the gynoecium becomes inhibitory to pearl millet pollen, and less inhibitory to sorghum pollen. Sorghum pollen tubes grow progressively further into the pearl millet style after pollination of successively older gynoecia.

Bicarbonate control of light reactions in photosynthesis - Peoria, Illinois. In collaboration with the University of California, work during the past year demonstrated a very slow chlorophyll a fluoresence decay component, which is enhanced two- or threefold by bicarbonate depletion. It corresponds to a retarded $Q^-B \rightarrow QB^-$ reaction, which is one of the first steps in electron transfer from photolysis of water. The discovery that low bicarbonate levels inhibit Q^- reoxidation without affecting photosystem II reaction centers, suggests a control mechanism that can balance reducing power and ATP output of the light reactions. This site of action, at a primary quinone charge carrier, is where many herbicides are believed to act.

Corn yield is possibly linked to chloroplast structure - Peoria, Illinois. Chlorophyll b/a and xanthophyll/carotene ratios in low-yielding corn varieties of the 1930's are lower than those in contemporary high-yielding varieties. High chlorophyll b/a and xanthophyll/carotene ratios are associated with increased light-harvesting pigment and grana formation. Such changes can be related through the work of others with spinach and algae to increased levels of photosystem II relative to photosystem I.

Potential reduction in photorespiration - Urbana, Illinois. Photosynthesis, the process by which plant leaves convert atmospheric carbon dioxide into the carbohydrates needed for crop growth and seed production, can be increased by nearly 50% if an associated process known as photorespiration occurs because the same enzyme that captures atmospheric carbon dioxide to start photosynthesis also starts photorespiration by reacting with atmospheric oxygen. Thus to reduce photorespiration it is necessary to increase the efficiency of this enzyme, known by the acronym Rubisco, so that it will be more reactive with carbon dioxide and less reactive with oxygen. Although it had been concluded by many researchers that such changes could not occur in this enzyme, we have shown that considerable

variation in Rubisco exists, and that through evolution the photorespiration activity of this enzyme has gradually decreased to its current level. To exploit this demonstrated potential for change, we have developed two complementary procedures to create plants with increase efficiency in the Rubisco enzyme, and thus reduced photorespiration. In the first procedure, we have constructed plant strains in which photorespiration has become a lethal process. We can now directly screen the descendants of these strains for survivors, which will have reduced photorespiration. In the second procedure, using algae, we have created strains in which Rubisco is defective so the algae cannot grow in the light. We now search for descendants of these strains which have regained the ability to grow in the light. In such descendants at least some of the Rubisco activity has been restored, and the enzyme is then examined to determine whether its photorespiration activity is more or less than in the normal Rubisco.

Site of chilling injury identified - Urbana, Illinois. The intolerance of thermophilic crops to chilling night temperatures has a profound effect on the practice of agriculture. Understanding the fundamental basis for the difference between chilling tolerance and chilling intolerance is an essential step toward the ultimate goal of reducing the constraints that chill sensitivity places on agriculture. It nas been discovered that the severe inhibition of photosynthesis by chilling temperatures in thermophilic crops is largely accounted for by impaired activity of the chloroplasts. There are accompanying effects of chilling on the plant, the most notable being the partially impaired exchange of CO_2 and water vapor between the leaves and the atmosphere, but we were able to demonstrate that these accompanying effects are ancillary to the inhibition of photosynthesis and not the basis for the inhibition. Our findings localize the basis of the inhibition of photosynthesis by chilling to a single cellular organelle, the chloroplast. Our research is currently directed at discovering exactly which chloroplast activities are impaired and the molecular alterations which are responsible. The fact that the cause of chilling inhibition of photosynthesis is localized to a single organelle rather than being the result of a general deterioration of plant function gives promise of eventually implementing the developing technology of molecular engineering to bring about relatively small alterations in the genetic complement of thermophilic plants that will protect them from the devastating effects of cool temperatures.

A key photosynthetic enzyme, RuBP carboxylase is found to be light activated - Beltsville, Maryland. Evidence for reversible light-activation of the key photosynthetic enzyme ribulose 1,5-biphospnate (RuBP) carboxylase/oxygenase was obtained with mesophyll protoplasts isolated from barley leaves. The carboxylase in intact protoplasts deactivated 50% in 20 minutes when dark-incubated in air-equilibrated solution. Light fully reactivated the enzyme at low CO_2. Although the activity of RuBP carboxylase in intact protoplasts exceeded the light-saturated rate of CO_2 fixation, these and other results suggest that light-activation of this enzyme may be involved in the control of photosynthesis.

Humidity is evaluated as a limiting factor in field photosynthesis - Beltsville, Maryland. Net photosynthesis rates of upper canopy leaves of field-grown soybeans were substantially increased by raising the humidity around them above ambient levels, whereas plants with C_4 photosynthetic pathway showed essentially no effect of increased humidity. This work identifies humidity as an

important factor limiting net photosynthesis in soybeans, and a way in which other species have overcome this limitation.

Adaptation to shortened daylength by C-3 plants is providing an important tool for examination of mechanisms of metabolic adaptations associated with limited light energy input - Beltsville, Maryland. Because shortened daylength limited translocation of photosynthatate (sucrose) it would appear the phloem loading of sucrose was restricted; and, therefore, shortened daylength adaptation will provide a tool for indepth examination of phloem loading mechanisms. In addition, adaptation by C-3 plants to shortened daylength resulted in maintenance of higher activities of several Calvin cycle enzymes and ADP-glucose pyrophosphorylase over a longer period of growth compared with enzyme activities of counterpart acclimates adapated to longer daylength. This activity difference should provide a tool for examination of controls on photosynthetic enzyme activity in relation to photosynthate production and allocation.

Control and significance of starch/sucrose formation in leaves elucidated - Raleigh, North Carolina. Partitioning of photosynthetically fixed carbon between starch and sucrose is controlled within the mesophyll cell and genetic variations (both inter and intraspecific) have been identified. The enzyme sucrose-P synthase appears to be rate-limiting for sucrose formation, which indirectly controls the rate of starch formation. Consequently, starch and sucrose compete for fixed-carbon, and sucrose-P synthase is a key control point that regulates partitioning. Increased starch formation in leaves is associated with greater growth of shoots relative to roots. Control of partitioning leaves may be used to modify plant growth to favor increased productivity.

Determining the effect of IAA and ABA on potassium, proton exchange with tissue discs, protoplasts, and vacuoles - Logan, Utah. An active electrogenic proton pump was identified on the plasmalemma of protoplasts isolated from sugarbeet taproot tissue and cell suspension cultures. The pump is sensitive to inhibition by CCCP and DES and is stimulated potassium.

Technological Objective 2: Improve nitrogen fixation efficiency of bacteria-plant associations and develop nitrogen-fixing capabilities in crops lacking this capability in order to reduce energy requirements for crop production.

Research Locations:

Albany, California
Gainesville, Florida
Peoria, Illinois
Beltsville, Maryland
St. Paul, Minnesota
Ithaca, New York
Raleigh, North Carolina
Logan, Utah

Examples of Recent Progress:

Relationship of plant hormone to root modulation and nitrogen fixation - Albany, California. Elucidating the parameters of the triple symbiosis between legumes, "Rhizobium" bacteria, and a vesicular arbuscular mycorrhizal (VAM) fungus elucidated. With the continuing rise in cost of fertilizer due to increased difficulty maintaining yields, of crops, farmers are having increasing difficulty maintaining yields of crops. Rotation of legume with nonlegume crops has long been a way of increasing soil nitrogen without adding nitrogen fertilizer. The VAM fungus now provides potential for more efficient use of phosphorus in soils where this element is limiting.

Diazotrophic bacteria evaluated - Gainesville, Florida. Azospirillum strains were evaluated to determine those with the best capability of utilizing metabolites available in the rhizosphere. Strains varied in ability to interact with grass species. All strains tested promoted growth of some grass species but none showed high levels of competitive activity in the rhizosphere environment. Rates of nitrogen mineralization from the rhizosphere biomass were low in all conditions studied, and limited growth of host plants regardless of bacterial numbers in the rhizosphere.

^{15}N incorporation experiments conducted - Gainesville, Florida. A new gas lysimeter system was used for ^{15}N incorporation studies. Results showed low but consistent activity in selected grass-bacteria combinations.

Strains of the tropical legumes Aeschynomene and leuceana - Gainesville, Florida. All Aeschynomene genotypes nodulated well with local Rhizobium strains. This species tolerated soil moisture extremes better than other forage legumes tested.

Blue-green algae might contribute fixed N to Wet-land agriculture - Peoria, Illinois. Research on the contribution of blue-green algae to nitrogen fertility of soils has led to isolation from a paddy soil of a blue-green alga capable of enchanced nitrogen fixation during formation of akinetes (sporelike forms). This finding has certain agronomic implications. Polypeptide granules in the akinetes provide a means for massively accumulating fixed nitrogen in paddys in a form that could be released subsequently for plant growth. That is, the granules could constitute a substantial fraction of nitrogen in algal-rich paddy soils. Akinete formation in the algal strain is triggered by phosphate depletion.

Associative nitrogen fixation in grasses has limitations - Beltsville, Maryland. Progress is being made toward understanding the limitations of using associative nitrogen fixation in grasses in agriculture. We have demonstrated that an inverse relationship exists between root-associated nitrogenase activity and the concentration of nitrogen in root extracts of grasses. This relationship indicates that the development of nitrogen fixation in grasses occurs when the plants are nitrogen deficient. Therefore, we have to: 1) encourage associative N_2 fixation in the presence of combined nitrogen, and 2) transcend impediments to nitrogen transfer from the bacteria to the plant.

A modified enzyme assay procedure developed to screen alfalfa genotypes for their nitrogen fixation potential - St. Paul, Minnesota. The development and implementation of the first field scale methodology have measured nitrogen fixation of germplasm in the plant breeding program and of forage legume field

communities. This methodology, which used stability isotopes of nitrogen fixation as tracers of metabolism, has proved essential in testing the field performances of plant selection for improved nitrogen fixation capability made in controlled environments. The material has direct application in formulation of the breeding program for nitrogen fixation and selected parts are being implemented by many research groups.

Discovery of new N_2-fixing system - Raleigh, North Carolina. The nitrogenase enzyme in Azotobacter vinelandii bacterium is unique because of no requirement for molybdenum, an element necessary for N_2-fixation in common nitrogenase systems. Proteins associated with the enzyme have been characterized and genetic engineering technology has been utilized to clone and transform DNA segments specific for the new system. It is possible that this alternate system may be introduced into crops which do not presently fix N_2.

The effect of tissue aging on transport of organic molecules at the plasmalemma of sink tissue cells determined - Logan, Utah. The plasmalemma of sugarbeet tissue discs mediates a predominately passive exchange of sucrose. To determine whether this transport was an artifact of the tissue preparation, tissue was aged 20 hours to induce rapid transport. Active transport of glucose, sucrose, and leucine were more than doubled by the aging treatment. Passive transport was unaffected by aging. The stimulated active transport was actually a result of sucrose hydrolysis and was transported as glucose. Aging induced the formation of an acid invertase activity in the cell wall. Thus sucrose was hydrolyzed prior to uptake.

Technological Objective 3: Develop new and improved cell and tissue culture technology for plant improvement through increased genetic diversity and rapid vegetative propagation.

Research Locations:

Albany, California
Peoria, Illinois
Beltsville, Maryland
Madison, Wisconsin

Examples of Recent Progress:

Limits of viability of frozen plants and initiated studies were to determine biological mechanisms for plant protection from freezing at the cellular level - Albany, California. Several new varieties and cultivars of plants were cultured and protected with the DMSO-glucose-polyethylene glycol cryoprotective system. There were successful freezings with subsequent viability of alfalfa (3 varieties at -196°C), apple (3 varieties at -196°C), asparagus (1 variety at -196°C), asparagus (1 variety at -196°C, -30°C), elm (-30°C) date palm (several varieties at -196°C), sugarcane (several varieties) rice (8 mutants), and wheat (1 variety at -196°C). The alfalfa, asparagus (-30°C only), date palm and sugar cane differentiated to produce normal plantlets while the other showed viability. Most were not able to form plantlets whether frozen or not. Increased viability of cultures was obtained if a warm water wash was used to thaw and remove cryoprotectants from the cultures.

Studies of the effects of both cryoprotectant treatments alone and cryoprotectants with freezing were accomplished. Cryoadditive and freezing damage were parallel but frozen tissues required a longer recovery period. Various techniques were used to prepare treated and frozen tissue for electron microscopy. Each one of the cryoprotectants has a different effect, but polyethylene glycol appears to stabilize cell membranes that have been altered by dimethylsulfoxide. This is important because reestablishment of membrane systems is necessary for a frozen or treated tissue to be viable, reestablishment of membrane systems is necessary, especially the tonoplast and plasma membranes.

Morphogenesis from crown-gall tumor tissue - Beltsville, Maryland. Abnormal shoot regeneration has been obtained from an octopine-type crown gall tumor. Analysis of single-cell clones suggests that T-DNA of this tumor line may aid in developing a Ti plasmid-vector that permits regeneration of transformed cells to plants.

Liposome-mediated delivery of DNA to plant protoplasts demonstrated - Beltsville, Maryland. Conditions were optimized for delivery of plasmid DNA to carrot protoplasts by liposome encapsulation and fusion. It was demonstrated that, on the average, 200 to 1000 intact copies of the plasmid could be recovered from the plant nuclear fraction after liposome-mediated delivery. These results clearly demonstrate the potential for liposome-mediated delivery of nucleic acid to plant protoplasts as a method for gene transfer in higher plants.

Peach mesophyll bioassay system has potential to screen peach plants for resistance to Xanthomonas pruni - Beltsville, Maryland. A peach mesophyll bioassay system utilizing the fluorochrome merocyanine 540 determined that membranes of peach cells from varieties resistant to Xanthomonas pruni were insensitive to toxin produced by X. pruni whereas membranes of cells from susceptible varieties exhibited hyperpolarization. Such a bioassay system could be used to screen peach plants or tissues for resistance to X. pruni.

High protein mutants of rice - Beltsville, Maryland. Mutant rice plants selected for in vitro resistance to S-AEC have maintained increased protein content through five selfed generations. This the first time biochemical selection in vitro at the cell level has been applied to cereal improvements. If the improvement is expressed in the field the finding will be highly significant.

Technological Objective 4: Develop technology for improving the absorption, translocation, and utilization of nutrients and water to increase crop production efficiency.

Research Locations

Beltsville, Maryland
Corvallis, Oregon
Lubbock, Texas

Examples of Recent Progress:

VAM propagules ingested by worms and retrieved from excreted casting evaluated - Corvallis, Oregon. Spores obtained by wet sieving of fresh castings, collected Spring '81 at three different field sites, often showed signs of damage such as discoloration, mottling, coagulated contents, misshapen/partially collapsed

walls, hollow interiors, coated/parasitized surfaces, and relict shells. However, 10 to 20% appeared to be "intact" with good surface luster/color and full contents such as glistening, oil-droplet-packed interior. Also examined for comparison were large, firm castings from the surface of a Texas blackland vertisol that had been stored dry under refrigeration for 10 years. Of the spores retrieved from these castings, the majority were "floaters" or seemed otherwise damaged, but a few appeared viable. Bioassay with Kalo as host plant showed that germinable spores or other viable propagules survived passage through digestive tracts of soil annelids. These results from natural field-collected castings confirm previous findings of laboratory experiments that at least some viable vesicular-arbuscular mycorrhizae inocula can be transported/spread by earthworms.

Viable VAM inoculum discovered in broad range of soils that had been air dried and stored from 2 to > 28 years - Corvallis, Oregon. Geographic spread of the stored samples ranged from Pacific NW coastal flood plains to Florida sand. Such remarkable durability of some VAM propagules contrasts with apparent fragility of other VAM spores allowed to air dry for <1 hr. The incongruous finds have yet to be reconciled but will be of interest in efforts to devise commercially stable VAM inoculum for possible use in revegetating spoils and badly scarred/ stressed soil sites.

Soil-Plant-Water relationships in plants evaluated - Lubbock, Texas. Root tubes (minirhizotrons) and a borescope-TV system was utilized to evaluate root growth of three commerical varieties and two exotic cotton genotypes under field conditions. Root growth progressed as a linear function of plant height until reproductive growth commenced in the commercial varieties presumably due to competition of the fruits for carbohydrates. A significant decrease in root growth was not apparent in the toxic genotype because no fruit was produced by these plants. Preliminary data indicate that there was a significant increase in total root growth in the nonwilting genotype T-25 over the wilting genotype T-169.

Technological Objective 5: Improve technology for better crop production under environmental stress.

Research Locations:

Albany, California
Beltsville, Maryland
Lubbock, Texas

Examples of Recent Progress:

Protoplasts remain intact after dehydration and evacuation have been prepared - Albany, California. A technique was developed to modify nucleopore filters so that degree of surface coverage by cells and microorganisms could be quantitatively measured by x-ray photoelectron spectroscopy. Successfully isolating protoplasts from tender and hardy rye seedlings is an important step forward in our study of plant plasma membranes because it not only provides a source of *in vivo* plasma membranes for studies by ESA, Raman, ESCA but also supplies starting material for the isolation and purification of plasma membranes for physical, chemical, and biochemical analyses. Since plasma membranes from

seedlings differing only in their stress hardiness can be compared, the role of this membrane in the plant's ability to manage environmental stress can be determined. Such knowledge should point the way to genetic engineering of improved stress-resistant plants.

Established role of water stress in the aluminum stress syndrome - Beltsville, Maryland. Al-sensitive cultivars of barley and sunflower were more tolerant to ordinary drought than Al-tolerant cultivars of these species, whereas Al-tolerant cultivars of these species were more tolerant to water stress induced by Al. Findings indicate that the reductions in growth previously ascribed to Al toxicity may in fact have been caused by water stress in large part. When plants are to be grown in soils that are strongly acid in the surface and/or subsoil layers, both types of drought tolerance (ordinary and Al-induced) are needed. Because many plants are grown on soils characterized by both drought and Al toxicity, both stress factors must be evaluated in characterizing and breeding cultivars for stress tolerance. Separating drought tolerance into Al-related and nonrelated parts should be helpful in designing better plants for problem soils.

The degree of genetic variability and heritability of water stress tolerance mechanisms determined - Lubbock, Texas. Preliminary indications are that genetic differences exist in source types for grain filling. Senescing types tend to utilize a larger proportion of preanthesis assimilate for grain filling than do nonsenescing types. Under stress conditions the relative contribution of preanthesis assimilate to grain filling greatly increases in both types. The greater leaf area retention in the nonsenescing types does not appear to be the major cause of the increased carbon assimilation rates of the nonsenescing types over the senescing types. Rather, increased photosynthetic rates of the upper five leaves appear to be largely responsible for the difference.

Technological Objective 6: Develop new technology for control and regulation of biochemical, physical, and morphological processes of plants.

Research Locations:

Pasadena, California
Athens, Georgia
Beltsville, Maryland
Mississippi State, Mississippi
Ithaca, New York
Corvallis, Oregon

Examples of Recent Progress:

Cryostorage of crop germplasm through microcollections - Pasadena, California. Crop germplasm collections are difficult to assemble and maintain and expensive to operate. An alternative is development of microgermplasm collections coupling low temperature liquid nitrogen (-196°C) with tissue culture, seed and pollen samples. Plant tissue cultures may be retained at -196°C through controlled programmed freezing. Pollen and seeds may be quick-frozen by direct immersion into liquid nitrogen. Thus far, somatic, zygotic, and microgametophyte germplasm of the date palm can be retained outside the field. Development of cryostorage methodology such as this for other crops could provide backup insurance germplasm

reservoirs which may save millions of dollars that are currently being spent maintaining field collections.

Cloning date palms through rooting and division of shoot tips - Pasadena, California. Clonal production of plants from callus via tissue culture techniques is not always possible. The occurrence of aberrant plants from this technique has been noted in other cultured plants. Commercial laboratories producing plants clonally invariably obtain them through production of axillary buds and their subsequent rooting. Recent experiments in culturing date palm meristems and shoot tips reveal that this technique is a likely possibility with palms also. Further refinement of this tissue culture procedure will allow the large scale commercial production of clonal palms on demand and result in the wide-spread planting of clones with guaranteed fruit and vegetable qualities.

Extraction of biologically active natural products from assorted fungi for regulating physiological and biochemical processes in plants - Athens, Georgia. Prehelminthosporol, $C_{15}H_{24}O_2$, was isolated and characterized from Dreschlera sorokiniana (Helminthosporium sativum), an organism that decimates corn (Zea mays). The compound is active in the wheat coleoptile assay to 10^{-5}M, and selectively inhibits and controls the growth of corn at 10^{-2} and 10^{-3}M. Bean plants are not adversely affected by prehelminthosporol and tobacco plants are unaffected. Thus, because of the simplicity of the molecule, the compound is an excellent starting material for synthesis of a selective herbicide. It was toxic to chicks at doses up to 450 mg/kg. The nontoxic properties are also a cogent feature in synthesis of potential pesticides.

Rapid analysis of the plant hormones - Beltsville, Maryland. Rapid analysis of IAA and ABA with partially purified rabbit antibodies have been carried out with some success. The methods employed are potentially useful in the rapid analysis of these plant hormones. Also, definitive methods of identifying IAA and ABA by HPLC, and isotope dilution techniques have been developed. Plant hormones influenced photosynthate partitioning in sugarbeet roots. Here the plant hormones normally associated with slow growth, i.e. ABA and ethylene, stimulate sugar accumulation, whereas hormones associated with rapid growth, i.e., IAA, cytokinins, and GA either had no effect or inhibited sugar accumulation.

Allelopathy between weeds and crops - Mississippi State, Mississippi. In the study to assess the contribution of alleopathic effects of weeds to total crop losses, 150 weed plants were squared for the effects on radish and lettuce seedlings, 18 were active. When the activated weeds were planted in the greenhouse in containers designed so that the leachate could be collected, johnsongrass, sweet clover, Desmanthus and prickly sida were toxic to soybean seedlings. Several flavanoids have been identified in the Desmanthus.

Stability determined of leaf tannins as a function of leaf age, plant maturity, and evironmental influences - Mississippi State, Mississippi. The structural properties of cotton tannin were elucidated by ^{13}C NMR. The primary size in molecular weight ranged from 1,500 to 6,000 with an average of 4,500. The tannin content in terminals, leaves, squares, flowers, and bolls of 18 varieties increased weekly during the season from to 5 to 24 thousand. The tannins toxic to tobacco budworm did not vary significantly in their molecular weight or by cottton variety.

A new purification procedure developed utilizing chromatography on column of 8-hydroxyquinoline bonded to glass beads - Ithaca, New York. This procedure removes 99.9+ percent of the Ni from 2 M stock solutions of plant nutrient salts. Soybeans grown in purified nutrient solution exhibited tip necrosis of the leaves. This necrosis could be prevented by adding 1 ppb of Ni to the solutions.

Additional evidence found for the role of boron in plant membrane function - Beltsville, Maryland. A role for boron in some membrane properties has been further strengthened by new data. Boron has been found to be necessary for a leaflet movement of Albizia julibrissin influenced by far-red light.

Evidence found of a new plant pigment involved in responses to light - Beltsville, Maryland. Evidence has been obtained of an unidentified far-red light-absorbing pigment in plant tissues that could play an prominent part in far-red light mediated processes. The pigment appears to have far-red, green-reversible properties. It requires some action induced by phytochrome to become effective, and its effect is negated by green light.

Regulating daylength of assimilate partitioning involves nonphotosynthetic photoreceptor - Beltsvillle, Maryland. The daylength regulation of assimilate partitioning in pangola grass (Digitaria decumbens) was shown to be photoperiodic and to involve a nonphotosynthetic photoreceptor.

Technological Objective 7: Develop technology for reducing damage to crop plants from air pollutants.

Research Locations:

Beltsville, Maryland

Examples of Recent Progress:

Ozone in ambient air reduces yields of soybeans and other sensitive crop species an average of 11 percent - Beltsville, Maryland. In 1981 the soybean cultivars Essex and Williams showed 16 and 6%, respectively, reduction in bean yields due to ozone and other pollutants in ambient air. The information was obtained by comparing productivity in open top chambers with carbon-filtered air where pollutants are reduced about 65%. The 11% reduction in yield may be compared with 12% average yield reduction from '72-80 for five sensitive crop species: potatoes, soybeans, sweet corn, snap beans, and tomatoes. The loss values are somewhat different for each species cultivar as shown for Essex (16%) and Williams (6%) this year. The effects of mixtures of ozone and sulfur dioxide on the soybeans were additive. Similar loss values due to ambient pollutants have been obtained by USDA research scientists at Raleigh, NC, on other crops such as peanuts.

Cultural practices sensitize or desensitize crop plants to chronic oxidant-type stress and chlorosis - Beltsville, Maryland. Oxidant-sensitive plants can be transformed into highly tolerant ones by certain plant growth regulator treatments. The treatments enhance leaf carbohydrate and protein levels and induce the formation of protective enzymes. Light and nutrition regimes can aggravate the effects of chronic oxidant stress or impart resistance depending upon the physiological status of the tissues. Chloroplast carbohydrates, the

forms of nitrogen present, and iron availability and utilization are particularly important factors in stress-induced chlorosis. Chloroplasts lacking starch and sugar reserves are susceptible to being damaged by their own active-oxygen light-reaction products when grown under artificial light that is deficient in ultraviolet and blue wavelengths. Nitrate addition to susceptible plants appears to intensify the condition--possibly due to cytoplasmic nitrate-to-nitrite reduction and nitrite toxicity resulting from nitrite buildup in stressed chloroplasts. Treatment with ammonium or urea can correct the disorder, particularly if it is supplemented with exogenous sugar and ferrous iron. Cuvette gas-exchange studies showed net photosynthesis rates decreased in proportion to leaf chlorosis development.

Location	Principal Contact
Phoenix, Arizona	Cotton Physiology Research G. Guinn Supervisory Plant Physiologist USDA, S&E, ARS Western Cotton Research Laboratory 4135 E. Broadway Phoenix, AZ 85040 FTS: 261-3524
Albany, California	Cereal Products Research Unit R. M. Saunders Supervisory Research Chemist USDA, S&E, ARS Western Regional Research Center 800 Buchanan Street Albany, CA 94710 FTS: 449-3296
	Chemical & Structural Analysis Research Unit R. E. Lundin Supervisory Research Chemist USDA, S&E, ARS Western Regional Research Center 800 Buchanan Street Albany, CA 94710 FTS: 449-3343
	Plant Physiology & Chemistry Research Unit G. Fuller Supervisory Research Chemist USDA, S&E, ARS Western Regional Research Center 800 Buchanan Street Albany, CA 94710 FTS: 449-3379
Pasadena, California	Fruit and Vegetable Chemistry Research Vincent P. Maier Supervisory Research Chemist USDA, S&E, ARS Fruit and Vegetable Chemistry Laboratory 263 S Chester Avenue Pasadena, CA 91106 FTS: 681-7294

Gainesville, Florida

Plant Science Research Unit

Murray H. Gaskins
Supervisory Plant Physiologist
USDA, S&E, ARS
Agronomy Department, Physiology Laboratory
Bldg. 164, University of Florida
Gainesville, FL 32611
FTS: 946-7250

Athens, Georgia

Plant Physiology Research Unit

Horace G. Cutler
Supervisory Plant Physiologist
USDA, S&E, ARS
Richard B. Russell Agricultural
Research Center
P.O. Box 5677
Athens, GA 30613
FTS: 250-3378

Peoria, Illinois

Horticultural and Special Crops Laboratory

L. H. Princen
Supervisory Research Chemist
USDA, S&E, ARS
Northern Regional Research Center
1815 North University Street
Peoria, IL 61604
FTS: 360-4251

Biomaterials Conversion Laboratory

W. M. Doane
Supervisory Research Chemist
USDA, S&E, ARS
Northern Regional Research Center
1815 North University Street
Peoria, IL 61604
FTS: 360-4312

Fermentation Laboratory

C. W. Hesseltine
Supervisory Microbiologist
USDA, S&E, ARS
Northern Regional Research Center
1815 North University Street
Peoria, IL 61604
FTS: 360-4262

Urbana, Illinois

Photosynthesis Research Unit

William L. Orgren
Supervisory Plant Physiologist
USDA, S&E, aRS
S-215 Turner Hall
University of Illinois
Urbana, IL 61801
FTS: 958-5540

Beltsville, Maryland

Cell Culture & Nitrogen Fixation Laboratory

Gideon W. Schaeffer
Supervisory Plant Physiologist
USDA, S&E, ARS
Plant Physiology Institute
Rm. 116, Bldg. 011-A, BARC West
Beltsville, MD 20705
FTS: 344-2103

Light and Plant Growth Laboratory

William J. VanDerwoude
Supervisory Plant Physiologist
USDA, S&E, ARS
Plant Physiology Institute
Bldg. 046-A, BARC West
Beltsville, MD 20705
FTS: 344-2312

Plant Hormone Laboratory

James D. Anderson
Supervisory Plant Physiologist
USDA, S&E, ARS
Plant Physiology Institute
Rm. 205, Bldg. 002, BARC West
Beltsville, MD 20705
FTS: 344-3013

Plant Stress Laboratory

William P. Wergin
Supervisory Plant Physiologist
USDA, S&E, ARS
Plant Physiology Institute
Bldg. 001, BARC West
Beltsville, MD 20705
FTS: 344-3143

St. Paul, Minnesota

Plant Science Research Unit

Gordon C. Marten
Supervisory Research Agronomist
USDA, S&E, ARS
Department of Agronomy and Genetics
University of Minnesota
St. Paul, MN 55108
COM: 612/373-1679

Mississippi State, Mississippi

Chemistry Research Unit

Paul A. Hedin
Supervisory Research Chemist
USDA, S&E, ARS
Boll Weevil Research Laboratory
P.O. Box 5367
Mississippi, State, MS 39762
FTS: 490-4676

Ithaca, New York

U.S. Plant, Soi, and Nutrition Laboratory

Darrell R. Van Campen
Laboratory Directory
USDA, S&E, ARS
Microclimate Project
Tower Road
Ithaca, NY 14853
COM: 607-256-4502

Raleigh, North Carolina

Plant Physiology and Photosynthesis Research

Donald E. Moreland
Supervisory Plant Physiologist
USDA, S&E, ARS
Crop Science Department
North Carolina State University
Raleigh, NC 27650
FTS: 672-4408

Soybean and Nitrogen Fixation Research

Richard F. Wilson
Supervisory Plant Physiologist
USDA, S&E, ARS
4124 Williams Hall
North Carolina State University
Raleigh, NC 27650
FTS: 672-4248

Corvallis, Oregon

Field Crops and Breeding Production Research Unit

Sam T. Likens
Research Unit Leader, Chemist
USDA, S&E, ARS, Western Region
437 Weniger Hall
Oregon State University
Corvallis, OR 97331
FTS: 420-4738

Ornamental Plants Research Unit

Robert G. Linderman
Supervisory Research Plant Pathologist
USDA, S&E, ARS, Western Region
Ornamentals Plants Research Laboratory
3420 S. W. Orchard Street
Corvallis, OR 97330
FTS: 420-4544

Lubbock, Texas

Plant Stress and Water Conservation Research Unit

J. E. Quisenberry
Research Geneticist
USDA, S&E, ARS
Southern Plains Research Laboratory
Route 3
Lubboxk, TX 79401
FTS: 738-7413

Logan, UT

Sugarbeet Breeding and Production Unit

J. Clair Theurer
Research Geneticist
USDA, S&E, ARS
Crops Research Laboratory
UMC 63, Utah STate university
Logan, UT 84322
COM: 801-750-3057

Madison, Wisconsin

Plant Disease Resistant Research Unit

Richard D. Durbin
Research Plant Pathologist
USDA, S&E, ARS
Department of Plant Pathology
University of Wisconsin-Madison
Madison, WI 53706
FTS: 364-5276

PUBLICATIONS

Albany, California

Bethlenfalvay, G. J., R. S. Pacovsky, M. S. Brown. 1981. Measurement of mycorrhizal infection in soybeans. Soil Sci. Soc. Amer. J. 45:871-875.

Hua, S.-S. T. 1981. Response to salinity in mesquite-Rhizobium symbioses. In Perspectives in nitrogen fixation. A. H. Gibson and W. E. Newton, Eds. p. 467.

Hua, S. -S. T. 1981. Molybdate dependence of nitrate reductase activity in a class of chlorate resistant mutants of Rhizobium japonicum 110 J. Gen. Microbiol. 123:355.

Snyder, R. G., J. R. Scherer, and A. Peterlin. 1981 Low frequency raman study of drawn polyethylene. Macromolecules 14:77-82.

Tisserat, B., J. M. Ulrich, and B. J. Finkle. 1981. Cryogenic preservation and regeneration of date palm tissue. Hortscience. 16:47-48.

Windle, J. J. 1981. Hyperfine coupling constants for nitroxide spin probes in water and carbon tetrachloride. J. Magenetic Resonance 45:432-439.

Pasadena, California

De Mason, D. A., and B. Tisserat. 1980. Bisexual male flowers in date palms. Botany J. Linnean Soc. 81:283-292.

Tisserat, B. 1981. Date palm tissue culture. USDA/ARS/WR. Advances in Agricultural Technology. AAT-W-17. 1-50.

Tisserat, B. 1981. Production of free-living date palms through tissue culture. Date Palm J. 1:43-54.

Gainesville, Florida

Albrecht, S. L., J. M. Bennett, and K. H. Quesenberry. 1981. Growth and nitrogen fixation of Aeschynomene under water stressed conditions. Plant and Soil. 60:309-315.

Albrecht, S. L., M. E. Mitchell, and M. H. Gaskins. 1981. Influence of soil moisture and organic substrates on N_2 (C_2H_2)-fixation by sorghum and millet. Plant Physiol. 67:77.

Albrecht, S. L., Y. Okon, J. Lonnquist, and R. H. Burris. 1981. Nitrogen fixation by corn-Azospirillum associations in a temperate climate. Crop Sci. 21:301-306.

Hanus, F. J., S. L. Albrecht, R. M. Zablotowicz, D. W. Emerich, S. A. Russell, and H. J. Evans. 1981. Yield and N content of soybean seed as influenced by Rhizobium japonicum inoculants possessing the hydrogenase characteristics. Agron. J. 73:368-373.

Athens, Georgia

Cole, R. J., J. W. Dorner, R. H. Cox, B. Cunfer, H. G. Cutler, and B. Stuart. 1981. The isolation and identification of several trichothecene-mycotoxins from Fusarium heterosporium Nees ex Fr. J. Natural Prod. (Lloydia) 44:245-376.

Cole, R. J., J. W. Dorner, R. H. Cox, R. A. Hill, H. G. Cutler, and J. M. Wells. 1981. Isolation of citreoviridin from Penicillium charlesii cultures and molded pecan fragments. Applied and Environ. Microbiol. 42:677-681.

Cole, R. J., J. M. Wells, R. H. Cox, and H. G. Cutler. 1981. The isolation and biological properties of deacetylcytochalasin H from Phomopsis sp. J. Agric. Food Chem. 29:205-206.

Cutler, H. G. 1981. Tobacco basic research. In: 1980 Georgia Tobacco Research - Extension Report, p. 15-17. University of Georgia.

Cutler, H. G., F. G. Crumley, J. P. Springer, and R. H. Cox. Dihydropergillin: A fungal metabolite with moderate plant growth inhibiting properties from Aspergillus ustus. J. Agric. Food Chem. 29:981-983.

Cutler, H. G., J. P. Springer, and R. H. Cox. 1981. Biologically active natural production: New plant growth regulators. Proc. 8th Ann. Conf. Plant Growth Regulator Society of America.

Ku, S. B., Y. J. Shieh, B. J. Reger, and C. C. Black. 1981. Photosynthetic characteristics of Portulaca grandiflora, a succulent Cy dicot. Plant Physiol. 68:1072-1080.

Pressey, R. 1981. Cysteine-augmented inhibition of Avena invertase by mercuric ion. Phytochemistry 10:621-624.

Shieh, Y. J., M. S. B. Ku, and C. C. Black. 1981. Phytosynthetic metabolism of aspartate in mesophyll and bundle sheath cells isolated from Digitaria sanguinalis (L.) N Scop., A $NADP^{+}$malic enzyme Cu plant. Plant Physiol.

Springer, J. P., H. G. Cutler, F. G. Crumley, R. H. Cox, E. E. Davis, and J. E. Thean. 1981. Plant growth regulatory effects and stereochemistry of cladosporin. J. Agric. Food Chem. 29:853-855.

Wells, J. M., R. J. Cole, H. G. Cutler, and D. H. Spalding. 1981. Curvularia lunata, a new source of cytochalasin B. Appl. and Environ. Microbiol. 41:967-971.

Peoria, Illinois

Banks, D., and K. Eskins. 1981. Analysis of normal and mutant peanut chloroplast pigments by liquid chromatography. Peanut Sci. 8:40-42.

Edwards, K. G., H. J. Blumenthal, M. Kahn, and M. E. Slodki. 1981. Intracellular mannitol, a product of glucose metabolism in staphylococci. J. Bacteriol. 146:1020-1029.

Eissler, R. L., and H. J. Duton. 1981. Energy transfer from chlorophyll b to chlorophyll a in a hydrophobic model system. Photochem. Photobiol. 33:385-389.

Eskins, K. 1981. Chloroplast pigment accumulation during greening of etiolated red kidney beans. Presented at Annual Meeting American Society of Plant Physiologists, Quebec, Canada, June 14-18, 1981. Plant Physiol. Suppl. 67:158.

Eskins, K., and L. Harris. 1981. High-performance chromatography of etioplast pigments in red kidney bean leaves. Photochem. Photobiol. 33:131-133.

Eskins, K., L. Harris, and R. L. Bernard. 1981. Genetic control of chloroplast pigment development in soybeans as a function of leaf and plant maturity. Plant Physiol. 67:759-762.

Gardner, H. W., and P. A. Jursinic. 1981. Degradation of linoleic acid hydroperoxides by cysteine·$FeCl_3$ catalyst as a model for similar biochemical reactions. I. Study of oxygen requirement, catalyst, and effect of pH. Biochim. Biophys. Acta 665:100-112.

Gugliemelli, L. A., H. J. Dutton, P. A. Jurnsinic, and H. W. Siegelman. 1981. Energy transfer in a light-harvesting carotenoid-chlorophyll c-chlorophyll a-protein of Phaeodactylum tricornutum. Photochem. Photobiol. 33:903-907.

Jursinic, P. Investigation of double turnovers in photosystem II charge separation and oxygen evolution with excitation flashes of different duration. Biochim. Biophys. Acta 635:38-52.

Kaneshiro, T., F. L. Baker, and M. E. Slodki. 1981. Pleiomorphism of free-living rhizobia grown on glutamate-containing agar medium. Plant Physiol. (Suppl.) 67:81.

Khanna, R., and P. A. Jursinic. 1981. Absence of divalent cation effects on photosystem II reactions as monitored by oxygen evolution. FEBS Letters. 126:318-322.

Slodik, M. E. 1981. Extracellular microbial polysaccharides. In Encyclopedia of Chemical Technology, Third Edition, Edited by M. Grayson and D. Eckroth, Wiley Interscience, New York, NY Vol. 15, 439-458.

Urbana, Illinois

Duzgunes, N., S. Nir, J. Wilshut, J. Bentz, C. Newton, A. Portis, and D. Papahadjopoulos. 1981. Calcium- and magnesium-induced fusion of mixed phosphatidylserine/phosphatidylcholine vesicles: Effect of ion binding. J. Memb. Biol. 59:115-126.

Graan, T., S. Flores, and D. R. Ort. 1981. The nature of ATP formation associated with single turnovers of the electron transport carriers in chloroplasts. In: Energy Coupling in Phyotosynthesis. B. Selman and S. S. Selman-Reimer, eds. Elsevier-North Holland pp. 25-34.

Graan, T. and D. R. Ort. 1981. Factors affecting the development of the capacity for ATP formation isolated chloroplasts. Biochim. Biophys. Acta 637:447-456.

Hesketh, J. D., W. L. Orgren, M. E. Hageman, and D. B. Peters. 1981. Correlations between leaf CO_2-exchange rates, areas, and enzyme activities among soybean cultivars. Photosynthesis Res. 2:21-30.

Jordan, D. B., and W. L. Ogren. 1981. A sensitive assay procedure for simultaneous determination of ribulose-1,5-biphosphate carboxylase and oxygenase activities. Plant Physiol. 67:237-245.

Jordan, D. B., and W. L. Ogren. 1981. Species variation in the specificity of ribulose biphosphate carboxylase/oxygenase. Nature 291:513-515.

Martin, B., D. R. Ort, and J. S. Boyer. 1981. Impairment of photosynthesis by chilling temperatures in tomato. Plant Physiol. 68:329-334.

McCracken, D. A., D. R. Ort, and M. Nadakavukaren. 1981. The effects of 2,4-dichlorophenoxyacetic acid altered chloroplast development on photosynthesis. Physiologia Plantarum 52:285-291.

Portis, A. R. 1981. Evidence of a low stromal Mg^{2+} concentration in intact chloroplasts in the dark. I. Studies with the ionophore A23187. Plant Physiol. 67:985-989.

Somerville, C. R., and W. L. Ogren. 1981. Photorespiration-deficient mutants of Arabidopsis thaliana lacking mitochondrial serine transhydroxymethylase activity. Plant Physiol. 67:666-671.

Somerville, C. R., and W. L. Ogren. 1982. Mutants of the cruciferous plant Arabidopsis thaliana lacking glycine decarboxylase activity. Biochem. J. 202:373-380.

Somerville, C. R., S. C. Somerville, and W. L. Ogren. 1981. Isolation of photosynthetically active protoplasts and chloroplasts from Arabidopsis thaliana. Plant Sci. Lett. 21:89-96.

Whitmarsh, J., J. R. Bowyer, A. R. Crofts, and B. Bouges-Bocquet. 1981. Rieske FeS center: effect of UHDBT on the light-induced redox reactions of cytochrome f. 11th Steenbock Symposium, p. 47.

Whitmarsh, J., and T. Graan. 1982. Photosynthetic Q-loops and phosphorylation. Biophysical J. 37:224a.

Beltsville, Maryland

Ashworth, E. N., M. N. Christiansen, J. B. St. John, and G. W. Patterson. 1981. Effect of temperature and BASF 13338 on the lipid composition and respiration of wheat plants. Plant Physiol. 67:711-715.

Ashworth, E. N., J. B. St. John, M. N. Christiansen, and G. W. Patterson. 1981. Characterizaton of the phospholipid composition of wheat roots using high-performance liquid chromotography. Ag. and Food Chem. 29:879.

Bennett, J. H. 1982. Photosynthesis and gas diffusion in leaves of selected crop plants exposed to ultraviolet-B radiation. J. Environ. Qual. 10:271-275.

Bennett, J. H., E. H. Lee, H. E. Heggestad, R. A. Olsen, and J. C. Brown. 1981. Ozone injury and aging in leaves: Protection by EDU. In M.A.J. Rodgers and E. L. Powers (eds.) Oxygen and oxy-radicals in chemistry and biology. pp. 604-605, Academic Press, New York.

Berry, W. L., D. T. Krizek, D. P. Ormrod, J. C. McFarlane, R. W. Langhans, and T. W. Tibbitts. 1981. Variation in elemental content of lettuce grown under baseline conditions in five controlled-environment facilities. J. Amer. Soc. Hort. Sci. 106(5):661-666.

Britz, S. J., and N. J. Chatterton. 1981. Photoregulation of carbohydrate partitioning. Plant Physiology 67:S-35.

Bunce, J. A. 1981. Comparative responses of leaf conductance to humidity in single attached leaves. J. of Exper. Botany 32:629-634.

Bunce, J. A. 1981. Relationships between maximum photosynthetic rates and photosynthetic tolerance of low leaf water potential. Canadian J. of Botany. 59:769-774.

Christiansen, M. N., and J. B. St. John. 1981. The nature of chilling injury and resistance in plants. In Analysis and improvement of plant cold hardiness, (ed.) C. R. Olein, CRC Press.

Hadidi, A., D. E. Cress, and T. O. Diener. 1981. Nuclear DNA from uninfected or potato spindle tuber viroid-infected tomato plants contains no detectable sequences complimentary to cloned double-stranded viroid cDNA. Proc. Natl. Acad. Sci. USA 78:6932-6935.

Hammerschlag, F. A. 1981. Peach micropropagation, present and future. Proc. Nat. Peach Council 40:139-143.

Heggestad, H. E. 1981. Biomonitoring air pollutants with plants, by W. T. Manning and W. A. Feder. (Book Review) Phytopathology News, Nov. p. 117.

Heggestad, H. E., and J. H. Bennett. 1981. Photochemical oxidants potentiate yield losses in snap beans attributable to sulfur dioxide. Science 213:1008-1010.

Heggestad, H. E., J. H. Bennett, and E. H. Lee. 1980. Effects of mixtures of sulfur dioxide and ozone on tomato; open-top chambers (SERCLAP). p. 56-61., Sect. 5. In W. W. Heck, et al., (eds.) National Crop loss Assessment Network (NCLAN) 1980. Annual Report. EPA 600/3-82-001. National Technical Information Service, Springfield, VA.

Krizek, D. T. 1981. Plant physiology: ultraviolet radiation. In McGraw-Hill Yearbook of Science and Technology 1981. (S. P. Parker, ed.). McGraw-Hill Book Co., New York. pp. 306-309.

Krizek, D. T. 1981. Introducton to the workshop. Proceedings of the workshop, Adaptation to water stres in plants. Hort. Sci. 16(2):24.

Krizek, D. T., and W. L. Berry. 1981. Variation in elemental content of 'Grand Rapids' lettuce grown under four levels of far-red and infrared radiation in controlled environments. J. Plant Nutr. 3(5):827-841.

Kung, S. D., P. R. Rhodes, G. W. Schaeffer, and T. C. Tso. 1981. Hormonal effects on the biosynthesis of tobacco RuBPCase in vitro. Beitrage zur Tabakforschung International 11(1):44-49. March.

Kung, S. D., P. R. Rhodes, T. C. Tso, and G. W. Schaeffer. 1981. The effects of nuclear mutation on chloroplast development. Part I: Chloroplast DNA, proteins, ribosomes, hormones and tissue culture. Theor. Appl. Genet. 60:173-178.

Lee, E. H., and J. H. Bennett. 1981. Chemical modification of oxidant-sensitive plant cultivars: Relationship between senescence regulation and O_3 tolerance. Plant Physiol. Suppl. 67:68.

Lee, E. H., J. H. Bennett, and H. E. Heggestad. 1981. Retardation of senescence in red clover leaf discs by a new anti-ozonant EDU, N-[2-(2-oxo-1-imidazolidinyl) ethyl]-N'-phenylurea. Plant Physiol. 67:347-350.

Lee, E. H., H. E. Heggestad, and J. H. Bennett. 1981. The effects of SO_2 fumigation in the open-top field chambers on soil acidification and exchangeable aluminum. Plant Physiol. Suppl. 67:94.

Lee, E. H., C. Y. Wang, and J. H. Bennett. 1981. Soluble carbohydrates in bean leaves trasformed into oxidant-tolerant tissue by EDU treatment. Chemosphere 10:889-896.

Lewis, C. F., and M. N. Christiansen. 1981. Breeding plants for stress environments. Plant Breeding Symposium II. Ed. K. J. Frey, Iowa State University Press.

Lumdsen, R. D., and W. P. Wergin. 1981. Scanning-electron microscopy of infection of bean by species of Sclerotinia. Mycologia 72(6):1200-1209.

Matthews, B. F., and D. E. Cress. 1981. Parameters affecting the liposome-mediated delivery of DNA to carrot protoplasts. Planta 153:90-94.

Matthews, B. F., and G. W. Schaeffer. 1981. Agricultural applications of in vitro plant cultivation. In: Advances in Cell Culture, edited by Karl Maramorsch, Academic Press, Book Chapter.

Nickle, W. R., A. M. Golden, Y. Mamiya, and W. P. Wergin. 1981. On the taxonomy and morphology of the pine wood nematode, Bursaphelenchus xylophilus (Steiner & Buhrer 1934) Nickle 1970. J. Nematol. 13:385-392.

Obloj, H., and A. Kacperska-Palacz. 1981. Desiccation tolerance changes in winter rape leaf grown under different environmental conditions. Biol. Plant. 23:209-213.

Olsen, R. A., J. H. Bennett, D. Blume, and J. C. Brown. 1981. Chemical aspects of the Fe stress response mechanism in tomatoes. J. Plant Nutr. 3:905-921.

Olsen, R. A., R. B. Clark, and J. H. Bennett. 1981. The enhancement of soil fertility by plant roots. Amer. Sci. 69:378-384.

Owens, L. D. 1981. Characterization of kanamycin-resistant cell lines of Nicotiana tabacum. Plant Physiology 67:1166-68.

Owens, L. D. 1981. Towards the genetic transformation of plant cells. In: Genetic Engineering in the Plant Sciences. Praeger Publishers, Chapter 1, pp. 1-10.

Paape, M. J., W. P. Wergin, A. J. Guidry, and W. D. Schultz. Phagocytic defense of the ruminant mammary gland. In: The Ruminant Immune System, J. E. Butler, ed., Plenum Publishing Corp. pp. 555-578.

Purohit, A., J. B. Shanks, and W. J. Meudt. 1981. Effects of 2,3-dihydro-5,6-diphenyl-1,4-oxathiin (UBI-P293) on auxin and gibberellin induced growth of bean stem sections. Plant Growth Regulator 9:6-7.

Roberts, T. M., H. E. Heggestad, K. Orgis, and M. Jurkovicova. 1981. Evidence for direct effects of SO_2 on agriculture and forestry. Chapter 3, pp. 1-93. In: Vol. 2, Effects of SO_2 and Its Derivatives on Health and Ecology. International Electric Research Exchange. E.P.R.I., Palo Alto, CA.

Robinson, J. M., and M. Gibbs. 1981. Influence of the Mehler reaction upon the stoichiometric relationship between NADP reduction and O_2 evolution in isolated spinach chloroplast lamellae. Plant Physiol. 67:S-177.

Robinson, J. M., D. F. Kremer, and K. Englund. 1981. Influence of photosynthetic period upon mmetabolic conditions affecting starch in spinach synthesis in spinach leaves and plastids. Plant Physiol. 67:S-198.

Schaeffer, G. W. 1981. Mutations and cell selections: Increased protein from regenerated rice plants. Chapter in book entitled: Propagation of Higher Plants Through Tissue Culture: Merging Technologies and Strategies. J. Environ. & Exper. Botany 21:333-345.

Schaeffer, G. W., M. D. Lazar, and P. S. Baenziger. 1981. Tissue Culture of Wheat. (Book chapter, in manuscript, Dec. 1981.) McMillan Publishers.

Schaeffer, G. W., and F. T. Sharpe, Jr. 1981. Lysine in seed protein from S-aminoethyl-L-cysteine-resistant anther-derived tissue culture of rice. In Vitro 17(4):345-352.

Semeniuk, P., and H. E. Heggestad. 1981. Differences among Coleus cultivars in tolerance to ozone and sulfur dioxide. J. Heredity 72:459-460.

Sicher, R. C., W. G. Harris, N. J. Chatterton. 1981. Effect of shortened daylength upon leaf starch accumulation and translocation by pangola grass. Plant Physiology 67:S-54.

Sikorska, E., and A. Kacperska. 1981. Phospholipid biosynthesis in winter rape plants during the winter season. Bulletin de L'Academie Polonaise des Sciences 28:191-194.

Sobczyk, E. A., A. Scherbakova, A. Kacperska-Palacz. 1981. Effect of cold acclimation on the stability of some enzymes in winter plants. Z. Pflanzenphysiol. 100:113-119.

Thompson, M. J., N. B. Mandava, W. J. Meudt, W. R. Lusby, and D. W. Spaulding. 1981. Synthesis and biological activity of brassinolide and its 22,23-isomer. Novel Plant Growth Promoting Steroids. Steroids 38:567-580.

van Berkum, and P., C. Sloger. 1981. Physiology of root-associated nitrogenase activity in Oryza sativa L. In: Current Perspectives in Nitrogen Fixation. (eds.) A. H. Gibson, and W. E. Newton. pp. 490. Australian Academy of Science.

van Berkum, P., and C. Sloger. 1981. Ontogenetic variation in nitrogenase, nitrate reductase, glutamine synthetase activities in Oryza sativa. Plant Physiol. 68:722-726.

Wergin, W. P. 1981. Scanning electron microscopic techniques and applications for use in nematology. In: Plant Parasitic Nematodes, Vol. III, Chapter 7, pp. 175-204. (B. M. Zuckerman and R. A. Rohde, eds.) Academic Press, New York.

Wergin, W. P., and D. Orion. 1981. Scanning electron microscope study of the root-knot nematode (Meloidogyne incognita) on tomato root. J. Nematol. 13:358-367.

Wergin, W. P., and A. R. Stone. 1981. Techniques for preparation and examination of plant parasitic nematodes in the scanning electron microscope. Scanning Electron Microscopy 3:169-176.

St. Paul, Minnesota

Barnes, D. K., G. H. Heichel, C. P. Vance, D. R. Viands, and G. Hardarson. 1981. Successes and problems encountered while breeding for enhanced N_2 fixation in alfalfa. p. 233-248 In J. M. Lyons, R. C. Valentine, D. A. Phillips, D. W. Rains, and R. C. Huffaker (eds.) "Genetic Engineering of Symbiotic Nitrogen Fixation and Conservation of Fixed Nitrogen. Plenum Publ. Corp., New York, NY.

Cralle, H. T., and G. H. Heichel. 1981. Nitrogen fixation and vegetative regrowth of alfalfa and birdsfoot trefoil after successive harvests or floral debudding. Plant Physiol. 67:898-905.

Groat, R. G., and C. P. Vance. 1981. Root nodule enzymes of ammonia assimilation in alfalfa (Medicago sativa L.): Developmental patterns and response to applied N. Plant Physiol. 67:1198-1203.

Hardarson, G., G. H. Heichel, C. P. Vance, and D. K. Barnes. 1981. Evaluation of alfalfa (Medicago sativa L.) and Rhizobium meliloti for compatability in nodulation and nodule effectiveness. Crop Sci. 21:562-567.

Heichel, G. H., D. K. Barnes, and C. P. Vance. 1981. Nitrogen fixation of alfalfa in the seedling year. Crop Sci. 21:330-335.

Heichel, G. H., D. K. Barnes, and C. P. Vance. 1981. Nitrogen fixation by forage legumes, and benefits to the cropping systems. p. 1-12. In Proc. Minnesota Forage and Grasslands Council Symposium on Growing and Conserving Energy. St. Paul, MN.

Heichel, G. H., C. P. Vance, and D. K. Barnes. 1981. Evaluating elite alfalfa lines for N_2-fixation under field conditions. p. 217-232. In J. M. Lyons, R. C. Valentine, D. A. Phillips, D. W. Rains, and R. C. Huffaker (eds.) Genetic Engineering of Symbiotic Nitrogen Fixation and Conservation of Fixed Nitrogen. Plenum Publ Corp., New York, NY.

Nielsen, R. L., D. D. Stutman, and D. K. Barnes. 1981. Interference between oats and alfalfa in mixed seedings. Agron. J. 73:635-638.

Peterson, M. A., and D. K. Barnes. 1981. Inheritance of ineffective nodulation and non-nodulation traits in alfalfa. Crop Sci. 21:611-616.

Vance, C. P., and J. W. Bryan. 1981. Purification and properties of caffeic acid O-methyltransferase from alfalfa root nodules. Phytochemistry 20:41-43.

Vance, C. P., and G. H. Heichel. 1981. Nitrate assimilation during vegetative regrowth of alfalfa. Plant Physiology. 68:1052-1057.

Mississippi State, Mississippi

Lane, H. C., and M. F. Schuster. 1981. Condensed tannins of cotton leaves. Phytochemistry 20:425-427.

Nicollier, G., A. C. Thompson. 1981. Essential oils and terpenoids of Mikania micrantha. Phytochemistry 20:2587-2588.

Nicollier, G., A. C. Thompson, and M. L. Salin. 1981. Flavones of Scutellaria ovata. J. Agri. Food Chem. 29:1179-1181.

Ithaca, New York

Beachy, R. N., N. P. Jarvis, and K. A. Barton. 1981. Biosynthesis of subunits of the soybean 7S storage protein. J. Mol. Appl. Genet. 1:19-27.

Madison, J. T., J. F. Thompson, and A. E. Muenster. 1981. Turnover of storage protein in seeds of soya bean and pea. Ann. Bot. 47:65-73.

Thompson, J. F., J. T. Madison, M. A. Waterman, and A. E. Muenster. 1981. Effect of methionine on growth and protein composition of cultured soybean cotyledons. Phytochemistry 20(5):941-945.

Raleigh, North Carolina

Barber, L. 1981. Growth inhibition of rhizobia by Rhizobium meliloti strains. Proc. 8th N. Amer. Rhizobium Conf., p. 107.

Bishop, P. E. 1981. An alternative nitrogen fixation system in Azotobacter vinelandii. In Current Perspective in Nitrogen Fixation. (Proceedings of the Fourth International Symposium on Nitrogen Fixation held in Canberra, Australia.)

A. H. Gibson and W. E. Newton. Australian Academy of Science, Canberra, Australia, p. 171.

Edwards, G. E., and S. C. Huber. 1981. The C_4 Pathway. In: The Biochemistry of Plants. A Comprehensive Treatise, Vol. 8, Photosynthesis. M. D. Hatch and N. K. Boardman, eds. Academic Press, NY, pp. 238-282.

Huber, S. C., and D. M. Pharr. 1981. Occurrence and regulatory properties of uridine-5'-diphosphatase in fully expanded leaves of soybean (Glycine max Merr.) and other species. Plant Physiol. 68:1294-1298.

Israel, D. W. 1981. Cultivar and Rhizobium strain effects on nitrogen fixation and remobilization by soybeans. Agron. J. 73:509-516.

Israel, D. W. 1981. Effect of the hydrogen uptake system on N_2 fixation by the Rhizobium japonicum - soybean symbiosis. Plant Physiol. 67 (Suppl.) p. 43.

Jarrett, H. W., H. Charbonneau, J. M. Anderson, R. O. McCann, and M. J. Cormier. 1980. Plant calmodulin and the regulation of NAD kinase. Ann. New York Acad. Sci. Vol 356 pp. 119-129.

Maury, W. J., S. C. Huber, and D. E. Moreland. 1981. Effects of magnesium on intact chloroplasts. II. Cation specificity and involvement of the envelope ATPase in (sodium) potassium/proton fluxes across the envelope. Plant Physiol. 68:1257-1263.

Pharr, D. M., H. N. Sox, R. D. Locy, and S. C. Huber. 1981. Partial characterization of the galactinal forming enzyme from leaves of Cucumis sativus L. Plant Sci. Lett. 23:25-33.

Yamamoto, T., J. J. Burke, G. Autz, and A. T. Jagendorf. 1981. Bound ribosomes of pea chloroplast thylakoid membranes: Location, and release in vitro by high salt, puromycin, and RNase. Plant Physiol. 67:940-949.

Corvallis, Oregon

Young, J. L. 1980. Surface eroded non-point source pollutants entering selected upper Willamette River tributaries from agricultural lands. Completion Report. WRRI-1969. OSU Water Resources Research Institute, 101pp. + 6 Appendicies.

Lubbock, Texas

Elmore, C. D., and B. L. McMichael. 1980. Proline accumulation by water and nitrogen stressed cotton. Crop Sci. 21:244-249.

Jordan, W. R., J. E. Quisenberry, and B. Roark. 1981. Contribution of heat tolerance and root growth potential to drought resistance. Proc. Beltwide Cotton Prod. Res. Conf. p. 40.

Peterschmidt, N. A., and J. E. Quisenberry. 1981. Plant water status among cotton genotypes. Beltwide Cotton Prod. Res. Conf. p.43-44.

Quisenberry, J. E., W. R. Jordan, B. A. Roark, and D. W. Fryrear. 1981. Exotic cottons as genetic sources for drought resistance. Crop Sci. 21:889-895.

Logan, Utah

Daie, J., and R. E. Wyse. 1981. Mode of ^{14}C-ABA uptake by leaf and root tissue of sugarbeet. Plant Physiol. (Suppl.) 67:129.

Doney, D. L., R. E. Wyse, and J. C. Theurer. 1981. The relationship between cell size, yield, and sucrose concentration of the sugarbeet root. Canadian J. of Plant Sci. 61:447-453.

Saftner, R. A., and R. E. Wyse. 1981. Hormonal affects on photosynthate transport in the root sink of sugarbeet. Plant Physiol. (Suppl.) 67:156.

Wyse, R. E., and J. Daie. 1981. Characteristics of sugar transport at the plasmalemma in fresh and aged tissue discs of Beta vulgaris. Plant Physiol. (Suppl.) 67:54.

Madison, Wisconsin

Ursic, D., J. D. Kemp, and J. P. Helgeson. 1981. A new antibiotic with known resistance factors, G418, inhibits plant cells. Bioch. Biophys. Res. Comm. 101(3):1031-1037.

National Research Program 20180
CROP POLLINATION AND HONEY PRODUCTION

National Research Program 20180 involves research designed to develop new knowledge that may improve current technology in: managing honey bee colonies, apiaries, and wild bees; protecting honey bees and wild bees from pesticides, diseases, and pests; increasing the effectiveness of honey bees and wild bees as pollinators; and breeding honey bees. Two major problems face the beekeeping industry. The first is the hazardous relationship between bees and pesticides. The second is the potential entry into the United States of the Africanized bee and of two exotic pests, the Acarine mite and Varroa mite.

NPS Contact: P. H. Schwartz

Technological Objective 1: Improve management of honey bees to provide most effective crop pollination and honey production.

Research Locations:

Tucson, Arizona
Beltsville, Maryland
Stillwater, Oklahoma
Madison, Wisconsin

Examples of Recent Progress:

Gram-positive Cocci, Arthrobacter spp., and indole-positive Bacillus spp. isolated from apiarian sources - Tucson, Arizona. Gram-positive cocci are commonly associated with wax moths, Galleria mellonella, but are rarely found in honey bees or pollen. Additional species were identified in wax moths. Unusual indole-positive Bacillus spp. were isolated from larval scales of honey bees and wax moth frass. Unusual organisms also were isolated from provisions of wild bees but some were identified as B. alvei, B. thiaminolyticus, and B. laterosporus. Apparently the organisms are uniquely associated with apiarian sources, variability exists within known species, and is greater than previously reported, and other species remain to be described.

Photoperiod and age effect upon hoarding behavior and life span of worker honey bees confined in small cages - Tucson, Arizona. Newly emerged worker bees were confined in small cages and continuously supplied with a pollen diet, sucrose solution (50% w/w) and water. The bees were observed for effects of photoperiod and age upon hoarding behavior and life span. Results suggest that the life span of honey bees might be modified by varying the photoperiod. This is the first time that such a possibility has been shown for a social insect.

Honey bees show preferences among pollens with different properties - Tucson, Arizona. In feeding-choice tests, 22 pollen species were compared with a standard mixture of pollen. Preference apparently is positively correlated with gross protein content and inversely related to pollen texture. These results indicate that bees are choosy, prefer high-protein diets, and will not eat hard, rubbery or sticky diets. These preferences are important in designing and testing any artificial diet.

Honey bees prefer mixtures of pollens - Tucson, Arizona. Bees given a choice of 5 individual species of pollen versus a mixture of 20% of each preferred the mixture. That preference indicates that bees probably actively attempt to collect several species of pollen rather than just one. Thus, the presence of nearby "weeds" or second crops may be important to the well-being and efficiency of crop-pollinating colonies.

Environment influences the rhythmic patterns of honey bee drinking within the hive - Tucson, Arizona. Honey bees supplied with water within the hive do not need to forage for water and could conserve energy. An electronic monitor measured water consumption of bees within the hive, air temperature, relative humidity, and number of bees entering and leaving the hive. Those data help to explain the effects of environment on the consumption of water within the hive, to establish the conditions under which water in the hive is beneficial, and to predict the amount of benefit.

The Beltsville Bee Diet is available commercially - Beltsville, Maryland. The formula and method of packaging were established for the Beltsville Bee Diet which now is available commercially. Beekeepers and scientists in various geographical parts of the country continue to evaluate the Diet.

Pollen substitutes support brood production of honey bees - Madison, Wisconsin. Beekeepers have long assumed that quality or quantity of protein determined the merit of pollen substitutes. In this research, pollen substitutes with a wide range of protein contents had no observable effect on brood production. Proteins from common pollen substitutes were utilized with equal efficiency. Those data indicate that beekeepers could choose cost-effective pollen substitutes without impairing production.

Technological Objective 2: Improve methods of protecting bees from pesticides, diseases, pests, and pollution.

Research Locations:

Tucson, Arizona
Beltsville, Maryland
Logan, Utah
Madison, Wisconsin
Laramie, Wyoming

Examples of Recent Progress:

Dimethoate on citrus reduces honey bee foraging - Tucson, Arizona. Treatment of lemon orchards with dimethoate nearly eliminated honey bee foraging by direct toxicity rather than by repellancy, as previously thought. As a result, this showed that pollination was impaired and the honey crop and colony population were reduced. Honey bee colonies probably would not be destroyed if dimethoate were applied to citrus at night with treatments spaced several weeks apart, as they were at Yuma, Arizona, during 1981.

Methyl parathion treatment of sunflowers kills bees - Tucson, Arizona. Bee losses were serious for 4 days following treatment of sunflowers with methyl parathion emulsifiable concentrate (EC). The encapsulated methyl parathion treatment killed only 1/4 to 1/5 as many bees as the EC formulation. Further work is needed to provide a safe and effective means to control the sunflower head moth when bees are required in the production of hybrid seed.

Methyl parathion concentrates in pollen oils - Tucson, Arizona. Several studies of the severity of bee kills when crops being visited heavily by bees are sprayed by various formulations of methyl parathion gave confusing results. Possibly discovery that methyl parathion can diffuse and concentrate into the oils of pollen, which the spray never contacts, could help explain the results. The level of methyl parathion that concentrates in the oils of various individual pollens should be determined.

Samples are examined during the National Bee Mite Survey - Beltsville, Maryland. In 4 months, the joint ARS-APHIS National Bee Mite Survey received 2,567 apiary samples from 41 states. No specimens of either Acarapis woodi or Varroa jacobsoni were isolated from the 1,615 samples examined. Samples from about 5% of the apiaries in this country will be examined during 1982.

Certan® approved for wax moth control - Beltsville, Maryland. A formulation of Bacillus thuringiensis selected specifically for the greater wax moth has been registered by the Environmental Protection Agency. Certan® is now available from bee supply houses and is approved for use on stored honey combs.

Promising fungicide is tested for controlling chalkbrood disease of the leafcutting bee - Logan, Utah. A fungicide was tested for controlling a fungal disease (Ascosphaera, "chalkbrood") of larval leafcutter bees. Infection in treated nests averaged only 7% compared to 29% in untreated nests.

Research continues on the pathogenicity of Ascosphaera spp. - Logan, Utah. Cross infectivity studies indicate that Osmia lignaria was susceptible to Ascosphaera proliperda, A. apis, and A. spp. (isolates from other Apoidea). Megachile (Ex. Hylaeus, Apis) were not susceptible to A. aggregate (the organism causing "chalkbrood" in the alfalfa leafcutting bee). Nutrition, pH, humidity and temperature must be constantly adjusted to different values at different stages of the fungus to ensure development of the ascocysts. Four new species of Ascosphaera were discovered from non-Apis bees (Osmia californica, Osmia fulviventris, O. coloradensis and Megahile pugnate. Several promising fungicides were evaluated for control of the chalkbrood. Some fungicides have a potential for controlling this bee fungus.

Aseptic method developed for rearing leaf cutter bees from egg to adult - Logan, - Utah. An aseptic method of rearing Megachile rotundata was developed. Eggs were hatched and grown to the pupal stage in sterile, provisioned wells in a microtitration plate.

Methods improved for estimating time of sweet corn pollen dehiscence - Madison, Wisconsin. Data collected by highly sensitive methods showed that previous assumptions regarding the period(s) of sweet corn pollen dehiscence are, at least in Wisconsin, inaccurate. Hence, recommendations for the timing of insecticide applications to sweet corn (the leading source of bee losses in Wisconsin) that are based on those assumptions regarding pollen dehiscence are faulty. Aerial density of sweet corn pollen more accurately predicted honey bee foraging activity than did the existing predictive methods. Hence, the sensitive prediction of foraging should enhance the accuracy of studies for limiting bee loss from pesticides in sweet corn.

Bees pollinate sweet corn treated with the pesticide, permethrin - Madison, Wisconsin. In a 2-year study, the insecticide, permethrin, which repelled bees given a choice of sprayed and unsprayed plants, did not, in a no-choice situation, repel bees sufficiently to reduce sweet corn pollen collection, eliminate pesticide contamination of the hive, or prevent long-term bee losses. However, those data and the accurate prediction of sweet corn pollen dehiscence indicate that the spraying of sweet corn pre- and postbloom would protect bees and still ensure adequate control of pest insects.

Residues of the insecticide, methomyl, retained in honey bee colonies over winter - Madison, Wisconsin. Previous studies have indicated that methomyl (Lannate R) is relatively safe to honey bees foraging sweet corn if it is applied after 2 p.m. However, significant levels of methomyl were found in samples of comb containing pollen and honey 8 months after foraging bees from the contaminated hives had been exposed. The hives studied died over winter either from methomyl, methyl parathion (a second pesticide found in the hive) or a synergistic effect of the two. Nevertheless, data show that methomyl does, in some instances at least, persist in the honey bee colony for many months.

Technological Objective 3: Determine pollination requirements of economically important crops.

Research Locations:

Tucson, Arizona
Madison, Wisconsin

Honey bees pollinate hybrid cotton - Tucson, Arizona. During 1981, 456 acres of hybrid cotton were grown by private seed companies who rented 1,884 honey bee colonies for pollination. Bee colonies were maintained on cotton trailers and moved between fields, the study demonstrated the feasibility of this technique to improve visitation to small (less than 15 acres) of hybrid cotton seed fields. Large acreages with saturation pollination (more than 500 colonies) were well pollinated with four colonies per acre. Thus, for two consecutive years hybrid cotton seed was successfully produced with honey bee colonies as the principal pollinator.

Factors related to honey bee preferences among nine cotton cultivars were determined - Tucson, Arizona. Observations confirm that the hexaploid cotton cultivars are most preferred by honey bees. Glandless Acala was preferred again over the other non-hexaploid cultivars. Of the commercially grown cultivars tested, the Pima line had the lowest bee visitation but the highest nectar volume (but with the lowest sugar concentration). These data indicate that floral nectar/petal aroma factors should be studied in detail and then incorporated into hybrid lines to increase honey bee visitation and pollen transfer.

Factors related to honey bee preference among eight cucumber cultivars were determined - Tucson, Arizona. There is a difference in honey bee visitation between male and female flowers of a cultivar as well as among several cultivars. Some flower factor or factors make the male flowers more attractive up to 9 o'clock after which the bees visit the female flowers more. Visitation apparently is not influenced by the numbers of flowers.

Pollen dispersal could affect seed yield in hybrid cotton fields - Tucson, Arizona. A workable technique is needed to quantitate the movement and effectiveness of pollen from the male parent (B or R line) in hybrid cotton seed fields. Determine (1) Such data would help the bee populations required for adequate cross-pollination (which may vary among parental lines); and (2) The cause of near seed failures with Pima as B or R lines of the last 3 years. The suspected cause, poor pollen movement was not proven. When the cause of seed failure is known, measures can be taken and the potentially high yields of hybrid cotton could become reality.

Electrostatics and pollination - Tucson, Arizona, Madison, Wisconsin. Electrostatic interactions are thought to play important roles in pollen collection by bees, pollen shedding, stigmatic capture, and possibly as a marker delimiting flowers which are devoid of nectar and pollen.

Honey bees compete with native bees - Tucson, Arizona. Observations and experiments suggest that Apis preferentially exploits productive patches of flowers thereby reducing the standing crop of available nectar and the utilization of these sites by native bees.

Honey bee colonies placed around large almond fields to improve forager distribution - Tucson, Arizona. Success in experimentally improving the distribution of foragers implies that growers could improve nut yields and probably decrease colony numbers while improving nut yields. Improved colony placement should lower the cost of providing adequate pollination.

Gibberellic acid (GA3), commercially available as "Pro-Gibb", stimulates bolting in onion seed fields - Tucson, Arizona. When weather or other planting (seeding) problems result in a late-start and reduced bolting, a single application of 500 ppm GA3 can dramatically improve the situation by stimulating early and extensive bolting.

Environment influences soybean growth, flower morphology, and attractiveness to honey bees - Madison, Wisconsin. Growing conditions that affect the characteristics of plants and flowers can make soybeans more attractive to honey bees. Plants grown at high air temperatures, both day and night, high soil nitrogen, or low soil phosphorus were more attractive to bees than plants grown under the opposite conditions. In comparison with other plants, the plants that attracted bees grew larger, flowered earlier, and produced more flowers that were larger, more intensely colored, and produced more nectar. Except for a reversal of effects of nitrogen and phosphorus, flowers on attractive plants were also more fully open. The number of flowers per plant had the greatest effect on honey bee preferences; most other plant and flower characteristics had smaller positive correlations with attractiveness. Those findings help explain environmental influences on pollination of honey production from soybeans.

Soybean flower aroma sends messages to pollinators - Madison, Wisconsin. Soybean flowers produce two volatile chemicals that may act as signals indicating the availability of nectar and/or the readiness of flowers for cross pollination. Flowers grown at low day air temperature and not-yet open flowers grown at high day air temperature produced primarily one chemical (component #1). Open flowers, especially those grown at high day air temperature produced primarily a different volatile chemical (component #2). Flower openness, nectar secretion and attractiveness to honey bees were correlated positively with component 2 and negatively with component 1. Older flowers that ceased nectar secretion and were no longer highly attractive to bees released neither of the two aroma chemicals. Several hours after production of component 2 peaked, aroma disappeared. Those findings enhance the understanding of bee foraging and pollination in soybeans and other crops.

Floral nectar is collected, stored, and analyzed - Madison, Wisconsin. Techniques were developed for the collection and storage of microquantities of floral nectar and their analysis via high-performance liquid chromatography (HPLC). These techniques offer several advantages for efficient qualitative and quantitative analysis of floral nectar samples: (1) samples in the field can be collected, stored up to 23 months before analysis with no apparent

deterioration in carbohydrate content; (2) large numbers of samples can be analyzed in a relatively short time (ca 7 samples/hour); and (3) minimal sample volumes are required because as little as 0.13 µl of nectar can be analyzed. Sample preparation for analysis of nectar is minimal; two or three samples can be prepared during analysis of one sample. These techniques will expedite studies of honey bee (Apis mellifera L.) foraging behavior.

Technological Objective 4: Identify and study biology of wild bee pollinators and improve methods for use of wild bees for crop pollination.

Research Locations:

Logan, Utah

Native bees increase apple-pear production - Logan Utah. For the second year native bees, Osmia lignaria, were used in an apple-pear orchard; fruit production again increased (1.7x) even though the amount of bloom was lower than normal. The bee population increased 4.3 fold.

A candidate sunflower pollinator tested - Logan, Utah. A native sunflower bee, Megachile pugnata, was managed for sunflower pollination. The bees were trapped and released in test plots where they visited many sunflower cultivars and nested in artificial nesting sites. On a male sterile line, females pollinated an average of 72 florets/visit that set seed. The bee population increased 4-fold.

Technological Objective 5: Improve honey bee breeding and rearing knowledge of bee genetics and germplasm maintenance.

Research Locations:

Baton Rouge, Louisiana
Madison, Wisconsin

Empty comb regulates honey bee nectar hoarding efficiency - Baton Rouge, Louisiana. Increasing the amount of empty comb increased the hoarding efficiency of honey bees. Increased efficiency was displayed when bees showed enhanced preferences for highly concentrated food. The amount of empty comb flucuates seasonally in a base colony. By seasonally regulating hoarding efficiency, empty comb causes bees to actively select only the best nectar sources in spring and yet to work poorer nectar sources that are available later. Commercial exploitation of those findings should increase honey production and pollination activity.

Africanized bees are inferior honey producers - Baton Rouge, Louisiana. South American field experiments showed that Africanized bees were poor honey producers in areas favorable to the commercial exploitation of honey bees by North American standards. This information increases the need for continued research on Africanized bees.

Africanized-European bee hybrids maintain agressive characteristics - Baton Rouge, Louisiana. Africanized-European bee hybrids showed a variety of colony defense responses that generally were intermediate between both parental types. These intermediate responses were sufficient in strength to make the hybrids nearly as objectionable for commercial use as their Africanized parents. This information shows a continual need for behavioral-genetic studies of Africanized bee colony defense.

Theory of closed-population breeding program developed for honey bees - Madison, Wisconsin. The genetic theory of closed population honey bee breeding was developed and tested by computer simulation. Closed populations are genetically isolated by means of instrumental insemination or by geographical barriers. These studies showed that genetically isolated populations consisting of 25-35 colonies can expect to have high brood viability for at least 20 generations. That information will be used to establish a closed population of desirable European stock that may serve within the United States as a reservoir(s) of germ plasm from which genetic material may be selected for specific traits such as gentleness, resistance to disease, acarine or Varroa mite infestation, winter hardiness, etc. Should "Africanized" bees become established in the queen- and package-bee-producing areas of the Southern and Western United States, closed populations could be of paramount importance as African-gene-free reservoirs for future reselection programs.

Tucson, Arizona

Ahmad, R. 1981. A guide to honeybee management in Pakistan. Pak. Agric. Res. Council. Misc. Publ. 38 p.

Buchmann, S. L. and Buchmann, M. D. 1981. Anthology of Mouriri myrtilloides (Melastomataceae: Memecyleae), an oil flower in Panama. Biotropica. (Suppl. on Reproductive Botany) 13(2):7-24.

Felger, R. S., Leigh, L. Buchmann, S. L., Corenejo, D. O., Dimmitt, M. A., Gordon, D. J., Nagel, C., Ratener, L., and Stigers, C. A. 1981. Inventorying the world's arid lands for new crops: A model from the Sonoran Desert. Arid lands resource inventories: developing cost-efficient methods. USDA Forest Service, General Technical Report. WO-28, pp. 106-116.

Gilliam, M. 1981. Amino acids in the floral nectar of cotton (Gossypium spp.) Jour. AZ-NV Acad. Sci. 16(Proc. Supplemt.):17.

Gilliam, M. and Argauer, R. J. 1981. Oxytetracycline residues in surplus honey, brood nest honey, and larvae after medication of colonies of honey bees, Apis mellifera, with antibiotic extender patties, sugar dusts, and syrup sprays. Environ. Entomol. 10(4):479-482.

Gilliam, M. and Argauer, R. J. 1981. Terramycin residues in surplus and brood nest honey after medication of honeybee colonies by three different methods. Gleanings in Bee Culture 109(10):545-546, 550-551.

Gilliam, M, McCaughey, W., F, and Moffett, J. O. 1981. Amino acids in the floral nectar of cotton. Apidologie 12(2):125-132.

Loper, G. M. 1981. Cotton varieties change, so do pollination needs. CA-AZ Cotton, p. 18, 20.

Moffett, J. O., Standifer, L. N. and Shipman, C. W. 1981. Nectar flow in a Tucson apiary given minimum management: 1973-78. American Bee Journal 121(5):329-331, 335.

Moffett, J. O., A. Stoner, L. N. Standifer, and A. Wardecker. 1981. Effect of moving, confinement to ramadas and Wardecker Waterers on mortality of honey bees (Hymenoptera: Apidae) exposed to insecticides sprayed on cotton. J. Kansas Entomological Society 54(2):381-386.

Moffett, J. O., G. D. Waller, and D. R. Rummel. 1981. 1980 studies on insect pollinators and hybrid cotton production in the High Plains of Texas. Proc. Beltwide Cotton Res. Conf. p. 88.

Schmidt, J. O. and W. D. Seabrook. 1981. Tethered moths as a measure of mating-disruption on sex pheromone atmospheric permeation studies. J. Georgia Entomological Society 16:60-64.

Southwick, E. E., G, M. Loper, and E. E. Sadwick. 1981. Nectar production, composition, energetics and pollinator attractiveness in spring flowers of Western New York. Amer. J. Bot. 68:994-1002.

Spangler, H. G. and S. Taber, III. 1981. Adult queen honey bee storage and larval queen resistance to physical shock. American Bee Journal 121:21-22.

Waller, G. D. and W. W. Bachmann. 1981. Use of honey-sac load and dance characteristics of worker honeybees to determine their sugar preference. J. Apic. Res. 20(1):23-27.

Waller, G. D., and R. J. Barker. 1981. Dimethoate: A contact-systemic insecticide that is injurious to honey bees. Glean. Bee Cult. 109(3)114, 115, 137.

Waller, G. D., D. M. Caron, and G. M. Loper. 1981. Pollen patties maintain brood rearing when pollen is trapped from honey bee colonies. Amer. Bee J. 121(2)101-103, 105.

Waller, G. D., and J. O. Moffett. 1981. Pollination of hybrid cotton on the Texas High Plains: Nectar production and honey bee visits. Proc. Beltwide Cotton Res. Conf. p. 85-87.

Waller, G. D., F. D. Wilson, and J. H. Martin. 1981. Influence of phenotype, season, and time-of-day on nectar production in cotton. Crop Sci. 21(4):507-511.

Baton Rouge, Louisiana

Collins, A. M. 1981. Effects of temperature and humidity on honey bee response to alarm pheromones. Jour. Apic. Res. 20(1):13-18.

Harbo, J. R. 1981. Viability of honey bee eggs from progeny of frozen spermatozoa. Ann. Entomol. Soc. Am. 74:482-486.

Harbo, J. R. and A. B. Bolten. 1981. Development times of male and female eggs of the honey bee. Ann. Entomol. Soc. Am. 74:482-486.

Harbo, J. R., A. B. Bolten, T. E. Rinderer, and A. M. Collins. 1981. Development periods for eggs of Africanized and European honeybees. Jour. Apic. Res. 20(3):156-159.

Rinderer, T. E. 1981. Volatiles from empty comb increases hoarding by the honey bee. Anim. Behav. 29(4):1175-1276.

Rinderer, T. E. 1981. Honey bee characters that aid pollination. BioScience, November, 759-760.

Rinderer, T. E., A. M. Collins, A. B. Bolten, and J. R. Harbo. 1981. Size of nest cavities selected by swarms of Africanized honeybees in Venezuela. Jour. Apic. Res. 20(3):160-164.

Rinderer, T. E., B. G. Harville, J. J. Lackett, and J. R. Baxter. 1981. Variation in honey bee morphology, behavior, and seed set in white clover. Ann. Entomol. Soc. Am. 74:459-461.

Rinderer, T. E. and H. A. Sylvester. 1981. Identification of Africanized bees. Amer. Bee Jour. 121(7):512-516.

Beltsville, Maryland

De Jong, D., D. M. Caron, H. Shimanuki, and I. Barton Smith. 1981. Resolution of the Varroa jacobsoni problem in Maryland. Bull. Ent. Soc. Amer. 27(4):267-270.

Herbert, E. W., Jr. and H. Shimanuki. 1981. Cholesterol and salt requirements for brood rearing by honey bees fed a pollen substitute. Amer. Bee. J. 121(8):572-574.

Herbert, E. W., Jr., J. A. Svoboda, M. J. Thompson, and H. Shimanuki. 1981. Sterol requirements for brood rearing by honey bees fed a synthetic diet. Amer. Bee J. 121(7):523.

Lehnert, T. and H. Shimanuki. 1981. Oxytetracycline residue in honey following three different methods of administering the antibiotic. Apidologie 12(2):133-136.

Svoboda, J. A., E. W. Herbert, Jr., M. J. Thompson, and H. Shimanuki. 1981. The fate of radiolabelled C28 and C29 phytosterols in the honey bee. J. Insect Physiol. 27(3):183-188.

Logan, Utah

Buttery, R. G., F. D. Parker, R. Teranishi, T. R. Mon, and L. C. Ling. 1981. Volatile components of alfalfa leafcutter bee cells. Jour. Agric. & Food Chemistry 29:955-958.

McManua, W. R. In vivo development of Ascosphaera aggregata in the alfalfa leafcutter bee, Megachile rotundata (Fab). M.S. Thesis, U.S.U., Logan, UT.

Parker, F. D. 1981. Nests and nest associates of a desert bee, Osmia marginata. Southwest. Entomol. 6:184-189.

Parker, F. D. 1982. Efficiency of bees in pollinating onion flowers. J. Kans. Entomol. Soc. 55:171-176.

Parker, F. D. 1982. Sunflower pollination: abundance, diversity, and seasonality of bees on male-sterile and male-fertile cultivars. Environ. Entomol. 10:1012-1017.

Stephen, W. P. 1981. The design and function of field domiciles and incubation for leafcutting bee management. O.S.U. Agric. Exp. Sta. Bull. 654, 13 p.

Stephen, W. P., J. D. Vandenberg, and B. L. Fichter. 1981. Etiology and epizootiology of chalkbrood in the leafcutting bee, Megachile rotundata (Fab.), with notes on Ascosphaera species. O.S. U. Agric. Exp. Sta. Bull. 653, 9 p.

Stephen, W. P., J. D. Vandenberg, B. L. Fichter, and G. Lahm. 1982. Inhibition of chalkbrood spore germination in vitro. O.S.U. Agric. Exp. Sta. Bull. 656 16 p. +19 tables.

Tepedino, V. J. and N. L. Stanton. 1981. Diversity and competition in bee-plant communities on shortgrass prairie. Oikos 36:35-44.

Madison, Wisconsin

Detroy, B. F., L. O. Whitefoot, and F. E. Moeller. 1981. Food requirements of caged honey bees. Apidologie 12(2):113-123.

Erickson, E. H., W. H. Davis, J. O. Moffett, H. P. Williams, H. Leung, G. D. Waller and W. A. Griffiths. 1981. Pollination of entomophilous hybrid seed parents. Handbook of Experimental Pollination Biology. Van Nostrand Reinhold; Publ. 110 pages.

Erickson, E. H. and S. Buchmann. 1981. Section II: Chemical and physical aspects of pollination electrostatics and pollination. Jones and Little; Publ.

Erickson, E. H. 1981. Evidence for electrostatic enhancement of odor receptor function on worker honeybee antennae. J. of the Bioelectromagnetics Soc. 12 pages.

Page, R. E. and R. A. Metcalf. 1982. Multiple mating, sperm utilization, and social evolution. Am. Naturalist 119(2):263-281.

Severson, D. W. and E. H. Erickson. 1981. Reflections on winter 80'-81'. Am. Bee J. 121(8):556.

Laramie, Wyoming

Krause, G. L. and W. T. Wilson. 1981. Honey bee pollination and visitation patterns on hybrid oilseed sunflowers in central Wyoming (Hymenoptera:Apidae). J. of Kans. Entomol. Soc. 54(1): 75-82.

Menapace, D. M., and P. J. Hale. 1981. Citral and a combination of sodium propionate and potassium sorbate did not control chalkbrood. Am. Bee J. 121(12): 889-891.

Nunamaker, R. A. and W. T. Wilson. 1981. Comparison of MDH allozyme patterns in the African honey bee (Apis mellifera adansonii L.) and the Africanized populations of Brazil. J. Kans. Entomol. Soc. 54(4): 704-710.

Ross, J. and J. Harvey. 1981. A rapid, inexpensive, quantative procedure for the extraction of Penncap-M (Methyl parathion) from honey bees (Apis mellifera L.), beeswax and pollen. J. Ag. Food Chem. 29: 1095-1096.

Ross, B., and J. Harvey. 1981. Penncap-M(R) versus Penncap-M plus sticker applied to sunflowers (Helianthus annuus) at Pine Bluffs, Wyoming--effects on honey bees (Apis mellifera L.). Amer. Bee J. 121(7): 510, 511, and 516.

Stoner, A., W. T. Wilson, and J. O. Moffett. 1981. Research shows that bee protection program would aid cotton growers. CAL/ARI Cotton 16(5): 22 and 23.

Stoner, A., J. O. Moffett, W. T. Wilson, and L. N. Standifer. 1981. Apis mellifera: effect of management of one-and two-queen colonies on bee losses by spraying insecticides on cotton. J. Georgia Entomol. Soc. 16(3): 323-331.

PRINCIPAL CONTACTS NRP 20180

Tucson, Arizona	M. A. Gilliam Acting Center Director and Research Leader Honey Bee Nutrition Research Unit Carl Hayden Bee Research Center 2000 East Allen Road Tucson, AZ 85719 FTS: 762-6380
	G. M. Loper Research Leader Honey Bee Crop Pollination Research Unit Carl Hayden Bee Research Center 2000 East Allen Road Tucson, AZ 85719 FTS: 762-6709
Baton Rouge, Louisiana	T. E. Rinderer Laboratory Leader Bee Breeding and Stock Center Laboratory Rural Route 3, Box 82-B Baton Rouge, LA 70808 FTS: 687-0277
Beltsville, Maryland	H. Shimanuki Laboratory Leader Bioenvironmental Bee Laboratory Building 476, BARC-EAST Beltsville, MD 20705 FTS: 344-2205
Stillwater, Oklahoma	J. O. Moffett Department of Entomology Oklahoma State University Stillwater, OK 74074 FTS: 728-4126
Logan, Utah	F. D. Parker Laboratory Leader Wild Bee Biology & Systematics Laboratory UMC 53, Room 261 Utah State University Logan, UT 84322 (801) 750-2525
Madison, Wisconsin	E. H. Erickson Laboratory Leader Russell Laboratories, Room 436 University of Wisconsin Madison, WI 53706 FTS: 364-5430
Laramie, Wyoming	W. T. Wilson Laboratory Leader Honey Bee Pesticides/Diseases Laboratory University Station, Box 3168 Laramie, WY 82701 FTS: 328-4386