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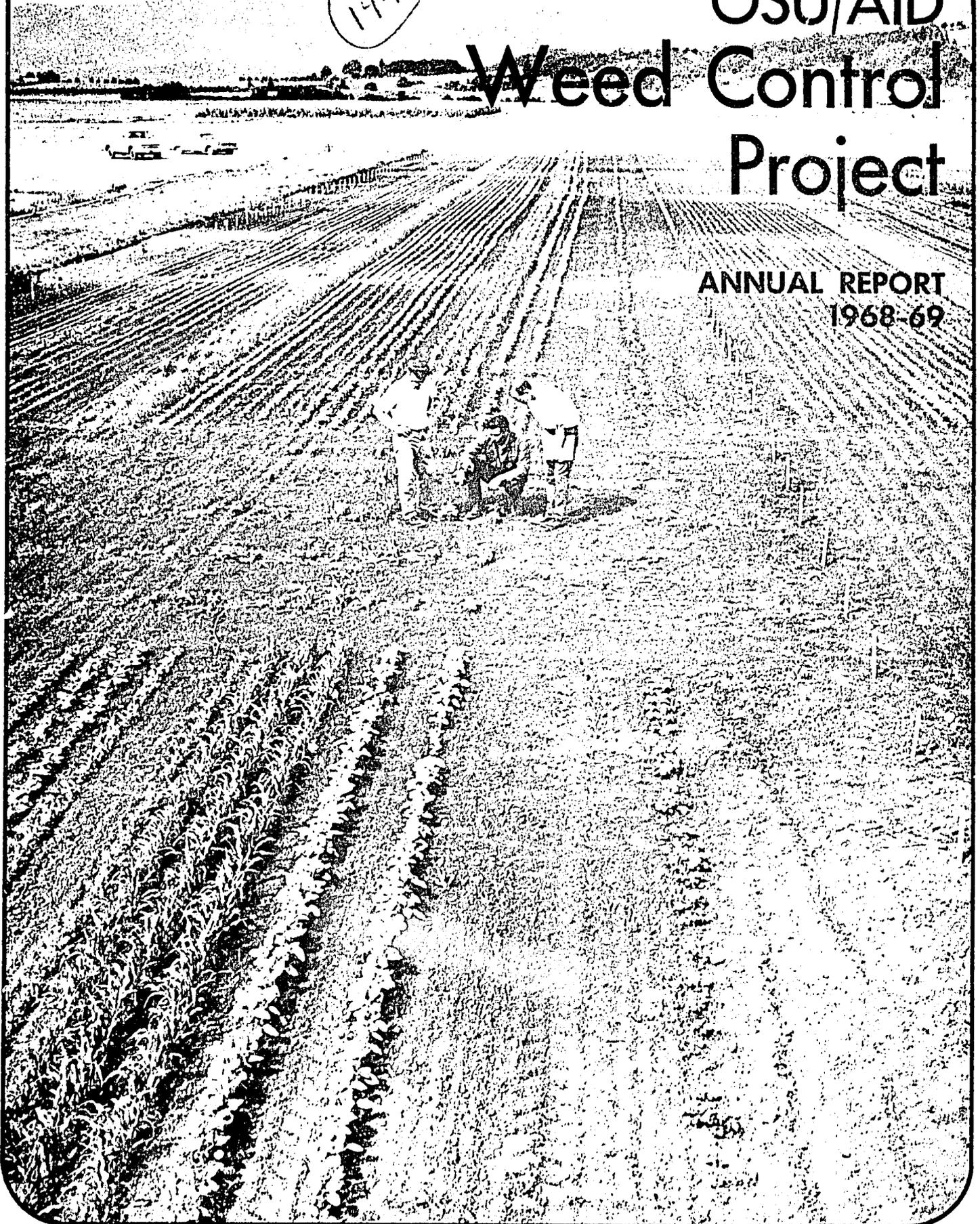
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OSU/AID Weed Control Project

ANNUAL REPORT
1968-69



Second Annual Progress Report

"WEED CONTROL IN LESS
DEVELOPED COUNTRIES"
1968-69

USAID/Oregon State University
Regional Contract AID/csd-1442

OSU/AID Publication 69-7
Department of Farm Crops
Oregon State University
Corvallis, Oregon 97331

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COVER Project staff members evaluate the results of a chemical screening test at the experimental site in Oregon.

FOREWORD

The development of experience, capability and the organizational structure to handle a broad range of international programs in weed control has been a major achievement of the project during the first three years. Although in-field staffing was limited to one man in the Colombia-Ecuador region of South America, the accomplishments have been substantial.

Additional manpower trained under this project and prevented from going into the field during the establishment of BALPA manpower quotas in AID have been utilized effectively in other contract programs. Dr. Homer Hepworth and Dr. Floyd Bolton have established a program in Turkey for development of weed control and tillage practices for improving wheat production. A review of this project in June indicated excellent progress is being made to establish an effective program. Mr. Rudy Vigil spent two five-month tours in Jordan establishing weed control research and extension activities with excellent success.

The development of research equipment and manuals of useful information for weed research programs have laid the foundation for new projects that are to be fielded in 1969-70. The manuals have been received with enthusiasm by government research workers and industry staff around the world. The equipment has been field tested and modified to build the base for effective research by experiment stations in many countries.

Development of an effective new product, practices and equipment project collaboratively with the College of Tropical Agriculture of the University of Hawaii has provided an important service to world research staffs in experiment stations and industries. This project has brought visitors from throughout the world to review the procedures and results. The project reports have been in brisk demand.

Development of the basic staff and experience to provide a diversity of back-up support and technical assistance to missions throughout the world offers promise of providing a wide array of new services in the future.

To lay the ground work for program expansion, a trip was made in June to review the potential for establishing a program in Southeast Asia with the missions in Thailand, The Philippines, South Viet Nam, and Malaysia. A program in this region is contemplated in 1969-70.

The Central America project, frozen in 1968, is expected to be established early in 1969-70 with headquarters in El Salvador.

During 1969 the various missions will be made aware of the services this project can now offer. The more detailed reports of the various accomplishments of the project during the year 1968-69 that follow give every confidence that the project is achieving, and has laid the base for, rapid expansion of activities and services in the future.



William R. Furtick
Director

"WEED CONTROL IN LESS DEVELOPED COUNTRIES"

1968-69 Annual Report

SUMMARY

The pace of activities, scope of coverage and output of results from the USAID/Oregon State University cooperative project in "Weed Control in Less Developed Countries" accelerated in 1968-69.

In the field the Colombia-Ecuador regional project under the directorship of Dr. Juan Cardenas consolidated work started during its first year of operation and advanced into new areas, principally, by establishing a program in Ecuador. Mr. Daniel Navia was assigned as counterpart from Ecuador for the project and spent six months with the project in Colombia during an intensive training period.

In June 1969 the first short course in weed control held in Ecuador was organized by the OSU/AID project with the cooperation of national institutions and others. Twenty-five participants from a number of different organizations attended lectures and field demonstrations on both weed control research and practical application.

OSU and ICA (Instituto Colombiano Agropecuario) were the prime movers in organizing and establishing the Colombian Weed Control and Plant Physiology Society, a vehicle for exchange of information and cooperative pooling of research. The first meeting drew 111 people from a broad array of official, semi-official, and private organizations.

Expansion of project activity in Colombia also included further assessment of weed control problems (with particular attention to pasture weed control and urgently needed control of aquatic weeds), cataloging and identification of weeds in several key agricultural production areas, a full program of class work and thesis

supervision plus preparation and submission of several manuscripts for publication.

As a result of the two years of project activity, ICA, through efforts of the Colombian counterparts working with the project, has solidified its lead in weed control research, and is devoting increased attention to extension work in weed control.

The economics of weed control are slated for increased emphasis based on integration into the Colombia-Ecuador project. Feasibility, evaluation and data collection will all be considered. Extensive information on all elements of weed control will assist government and industry of many countries in setting priorities for research and extension plans.

Continuation and expansion of the New Products and Practices Evaluation project carried out through field trials in Oregon and Hawaii were implemented with testing and screening of 146 compounds from 33 chemical companies during the year. Cooperative testing operations with the University of Hawaii are scheduled to be broadened for 1969-70.

Several special projects have advanced with the publication and distribution of the HERBICIDE INDEX, a comprehensive, cross-referenced listing of all known herbicides from major suppliers. Companion publications are the CROPS-HERBICIDE INDEX and WEED SUSCEPTIBILITY INDEX; the former has been prepared and is being circulated for comments prior to publishing in 1969-70.

To fill the need for a single publication containing detailed information and visual material on worldwide equipment and materials

designed for experimental work and small-scale farming, the project is assembling an AGRICULTURAL EQUIPMENT MANUAL.

Phase One of a computerized information storage and retrieval system moved forward. Projected goals include establishment of an extensive repository of weed control information coupled with a method that provides instant access to any stored data. Experimental data from project herbicide trials are being used as a pilot program to set up the system and determine how future expansion may be achieved.

In addition to the basic AID/OSU entities involved in the overall project cooperation was received from a number of other institutions. The University of Hawaii and University of Nebraska, official agencies in both Colombia and Ecuador, the Rockefeller Foundation and over 40 chemical companies are actively involved.

At OSU the program has become cross-disciplinary with the participation of numerous departments besides Farm Crops in a variety of modes ranging from direct participation to supportive training and orientation.

Programs of orientation and training have been given to staff out-bound for field assignments. The project is continuing to supply technical back-up support for these field personnel.

Indications are that an increasing demand for pre-field exposure to a gamut of technical and cultural material—tailored to the specific country involved, its individual needs and predominant culture— will be expanded.

During 1968-69 the project broadened its scope of interest and operations from pure weed control to plant protection in general with the goal of aiding developing nations to improve economic potential through more efficient control of weeds, insects, plant diseases, rodents and other pests which hamper crop production, cause food spoilage and damage stored commodities.

To this end the International Plant Protection Center was chartered at Oregon State University on January 15, 1969. OSU, with its diversity of crops, strengths and breadth of departments, has the necessary inputs for all aspects of plant protection in the broadest sense. IPPC is envisioned as the nucleus for drawing together and coordinating what is now a fragmented approach to plant protection problems in the developing nations.

The Center's Advisory Committee, a select group of OSU staff members from departments associated with plant protection development, has been appointed by the President of the University. The group advises on matters of institutional policy, direction and coordination of University programs.

REGIONAL REPORT FOR COLOMBIA

Increased Program Needs

During the year July 1, 1968 to July 1, 1969 changes in the internal structure of Columbia's agricultural institute (ICA) occurred which made it necessary to re-orient the project research program to meet new and expanded needs. As of January 1, 1969, the Crop Physiology and Weed Control sections of the Entomology program were set up as an independent program.

The creation of a new program was reflected in adjusted plans for a reduction in number of laborers and equipment available. The new head of the program is Dr. Guillermo Riveros, a recent Ph. D. from the University of California at Davis. Under his leadership the program is being reorganized administratively and the assignment of at least one M. S. level leader at each research station is planned. Greater emphasis will be placed on research in the northern states of Colombia.

In addition to the program changes, ICA was given added responsibilities for total research in cotton, tobacco, sesame, peanuts, soybeans, African oil palm, and other oil crops. For the period 1967-68 research was conducted in seven research stations: "Tibaitata" (Bogota); "Palmira" (Cauca Valley); "Nataima" (Tolima); "Obonuco" (Narino); "Tulio Ospina" and "La Selva" (Antioquia); and "Turipana" (Atlantic coast). Work was expanded in 1968-69 to include twelve stations plus a large number of regional trials.

The added research stations were: "Surbata" (Boyaca); "Marconia" (northern Atlantic coast); "Santa Lucia" (Atlantic coast); "El Nus" (Antioquia); and "Uraba" (Antioquia-Caldas). Starting July 1, 1969, work will be initiated at "La Libertad" (Los Llanos); Valledupar (Atlantic coast); and Armero (Tolima).

To meet these new responsibilities the number of Colombian counterparts has been increased.

At present there are seven counterparts working on a full-time basis in weed control in Colombia. Five other part-time counterparts are working in rice, sugar-cane, horticultural crops, and bananas.

Activities are being coordinated with the Colombian Agrarian Reform Institute (INCORA) and work in aquatic weed control will be expanded in order to solve vast problems being created by new irrigation systems now in operation. INCORA will soon assign two more counterparts for training in weed control in irrigation systems.

In August 1969 another ICA counterpart will be added to the program following his return from the United States and completion of requirements for a M. S. degree in weed control. The added responsibilities have made it necessary to increase the flexibility of the program since needs are greater than manpower and physical facilities available.

Training of Counterparts

The most successful part of the program has been the training of counterparts. Increased program responsibilities have been met through the active and growing involvement and leadership of Colombian counterparts. Though their training is far from complete, noticeable progress has been made. Their efforts have helped establish ICA as the leader in weed control research in Colombia.

Inquiries from other Latin American countries concerning the latest research and developments are increasing. One of the most outstanding counterparts, Octavio Franco, was invited by Ecuador to participate in the weed control short course organized by Oregon State University.

On the basis of counterpart competence and initiative a modest, but nevertheless forward,

effort has been made in the area of extension. The weed control program was one of the first ICA programs to work cooperatively with the embryonic ICA extension service and this work is to be expanded.

There is a critical need to send counterparts abroad for advanced training to avoid in-breeding and to expose them to different ideas and ways of thinking as well as to new concepts. Two counterparts are currently completing work on their Master of Science degrees, but there is no candidate working on a Ph. D. degree. At present there are three counterparts ready to become candidates for scholarships for study abroad (Octavio Franco, Ph. D.; Carlos Romero, M. S.; and Hernando Franco, M. S.). The limited number of scholarships will allow only one of them to go abroad in the near future.

Colombian Weed Society

Through a joint move between Dr. Juan Cardenas (Oregon State University/AID) and Ing. Agr. Octavio Franco (ICA) a meeting was called in August 1968 to bring together all interested persons for the formation of the Colombian Weed Control and Plant Physiology Society. Representatives of official, semi-official and private entities as well as students of agronomy (over 40 attended) met at the National University of Bogota, formed the Society, and elected Dr. Cardenas its first president.

The initial meeting of the Society occurred January 23 and 24, 1969, had over 110 members in attendance and fifty papers presented. Attendance was not confined to members within Colombia as representatives from Ecuador, the United States and Europe were present and actively participated in the meetings.

Two publications were printed for the meeting: a program containing the abstracts of the papers presented (50) and the Society's Constitution and By-laws; the other publication was a terminology manual.

The manual was well received as the initial Colombian effort at publishing standards in weed control. It also contained definitions, units and equivalents, abbreviations, crop physiology terminology, common and scientific names of weeds of Colombia and standardized herbicide nomenclature.

The importance of establishing the Society lies in that, for the first time in Colombia, a technical body was formed in which all efforts in weed control research are being pooled, information exchanged, and projects organized. The group is also one of the few societies that sponsors student members and actively supports weed control courses and programs of the agronomy schools of Colombian universities.

While industry is actively involved the Society has been able to generate supplemental financing to industry contributions through membership dues and sale of publications.

The Society will emphasize educational programs in weed control as one of its major objectives. Annual meetings will be sponsored where exchange of information can take place



Material to control wild oats in wheat is applied to a regional cooperative test plot in Colombia by Carlos Romero of ICA.

and publication of research results will be encouraged. The next meeting will be held in Bogota, January 29-31, 1970.

At the conclusion of the first formal meeting of the Society new officers were elected. Dr. Rafael Gonzalez Mendoza (Head, Velsicol International for Northern South America) was elected president of the Society and Octavio Franco (ICA) was elected president-elect for 1970-1971.

Teaching and Guest Lectures

Due to the temporary vacancy of the University of Nebraska/AID Mission position in weed control in Colombia, the weed control course at the National University of Bogota was taught in the fall semester of 1968 by Dr. Cardenas in conjunction with another University of Nebraska staff member, Dr. Frank S. Davis. During the spring semester (1969) teaching was limited to guest lectures at the National University of Bogota and a seminar was presented at the University of Tunja.

The favorable reception of the special topic lectures made it desirable to expand them to other universities in Colombia. These lectures will be coordinated through the Society in order to draw upon its membership. Contacts have already been made with the Deans of the Faculties of Palmira and Ibague. Slide sets for these lectures have been prepared including principles of weed competition; principles of herbicide selectivity; classification of herbicides; safety in the use of herbicides; and mode of action of herbicides.

Aquatic Weeds

A lecture was given on aquatic weeds and weeds in irrigation systems to technical personnel of INCORA's Cordoba Irrigation District on the Atlantic coast. In recent months, as more irrigation districts have come into operation, aquatic weed problems have increased to alarming proportions. Not only has the efficiency of the irrigation district been impaired, but maintenance costs have soared.

One report indicated that aquatic weeds had totally covered a 30,000 hectare water reservoir. In another report a multi-million peso cement factory was shut down because of aquatic weeds. Heavy machinery and a large labor crew were constantly dredging the weeds from the water reservoir. Aquatic weeds also contribute to other problems by harboring mosquitoes and very poisonous snakes and restricting fishing. Research is critically needed to evaluate in detail the losses due to aquatic weeds, the feasibility of methods currently being used to control the weeds and possible alternative economic methods of control.

Thesis Problems

An asset to the program has been the number of students doing thesis work in weed control. To compensate for the lack of project manpower within the ICA program, student theses have been aimed at strengthening areas of research in which time-consuming observations must be made.

Nineteen projects are presently underway:

1. Control of wild oats (*Avena fatua*) in wheat and barley.
2. Effect of weed competition on the establishment of alfalfa.
3. Post-emergence application of DNBP in wheat, barley, and oats.
4. Critical periods of application of picloram in wheat and barley.
5. Paraquat movement in beans.
6. Life cycle of ten weeds of economic importance in the highlands.
7. Chemical control of *Malva silvestris* in wheat and barley.
8. Highland seedling identification manual.

9. Chemical control of *Phalaris minor* in wheat.
10. Critical periods of weed competition in cotton.
11. Weed identification manual for the Tolima Valley.
12. Incorporation of herbicides—Factors affecting their selectivity and performance.
13. Critical periods of weed competition in sorghum.
14. Overall vs. band application of herbicides for weed control in corn.
15. Overall vs. band application of herbicides for weed control in cotton.
16. Nutsedge and its control.
17. Weed control in bananas.
18. Weed control in hotland wheat.
19. Aquatic weeds and their control—A study of four species.
20. Production of growth inhibitors by nutsedge.

Several of these are outstanding, particularly the thesis on identification of weeds of economic importance of the Tolima Valley. This work of a single student has resulted in the compilation of a color slide set and a manual of the economically important weeds and is serving as a lead in establishing the weeds of economic importance of all the areas in Colombia.

Another benefit to students is that, by performing thesis work, they are being prepared to fill positions in industry and research, incidentally preventing loss of research personnel from ICA. Three students who are about to complete their theses have already been hired as choice recruits by one chemical company. Since at least one of the universities

requires some of their students to undergo a six-month in-field semester of practical work, efforts are being made to initiate an industry-sponsored training program.

Integration Between Official, Semi-Official, and Private Institutions

A close working relationship has been established between the different institutions involved in weeds and their control. The creation of the Colombian Weed Society has aided considerably in coordination of effort. Among the accomplishments are exchange of research and extension information, involvement of industry personnel in education aspects and integrated assessments of needs and priorities in research. Cooperation between official and semi-official entities has increased and periodic meetings are held to review work, objectives and future developments.

Extension Efforts

Work was intensified in order to expand regional trials required for final weed control recommendations in corn, potatoes, beans, wheat, barley, cotton, soybeans, citrus, sugar-cane, sorghum and rice. Lack of adequate transportation limited the effort, but sufficient trials were established to provide the required information.

ICA assigned one counterpart for training in extension methods in weed control. Upon completion of the training period, ICA reversed its policy and eliminated extension subject specialists. The expected benefits thus did not develop.

Extension efforts will be expanded in the coming year. The Peace Corps contacted the Oregon and Nebraska programs advising them that this fall a Peace Corps volunteer with a Ph. D. degree in weed control would be assigned to Colombia if he could be integrated in a joint effort. A proposal was made to the Peace Corps suggesting that the PCV could coordinate extension efforts, and this plan was accepted.

Extension publications have been submitted to ICA for approval and other works are being prepared. Upon publication of extension bulletins the program will be oriented toward establishing the recommendations at the farmers' level.

Plant Sanitation

The plant sanitation program is a recent creation within ICA. One of its functions is to set standards for weed prevention, control and eradication. The first cooperative effort is classification of highland weeds according to their aggressiveness and difficulty of control. The classification will be made on the basis of noxious, semi-noxious, and common weeds. The program is also preparing a picture manual of weed seeds.

Talks are underway to integrate the efforts of plant sanitation, weed control and seed certification to develop regulations which will prevent the introduction of new weeds and the spread of established weeds.

Publications

The following articles have been submitted for publication:

1. Kikuyo Grass and Its Control.
2. Weed Control in Potatoes.
3. Weed Control in Beans.
4. Weed Control in Corn.
5. Principles of Herbicide Selectivity.
6. Mode of Action of Herbicides.
7. Seed Identification Manual for the Highlands,
8. Seed Identification Manual for the Tolima Valley.

9. Calibration and Maintenance of Sprayers.

10. Movement of Paraquat in Plants.

In addition, a number of technical and extension-type manuscripts are in rough draft form. In the coming months these will be submitted for publication.

Assessment of Weed Problems and Weed Identification

Specific weed problems have been determined by region and by crop in areas where research is underway. Color slide sets of the economically important weeds by region are being collected. During the previous year the important weeds of the Tolima Valley and of the highlands were collected and described. For the coming year the weeds of the Cauca Valley and Antioquia will be identified and photographed. In collaboration with the Nebraska Mission weed control



Dr. Juan Cardenas (left) and ICA technician study weed identification in Colombia.

specialist, identification of aquatic weeds and pasture and rangeland weeds will be initiated.

Research Efforts

Development of weed control recommendations for certain crops has made possible expanded research efforts into specific areas such as nutsedge (*Cyperus rotundus*) and its control, herbicide residue studies, compatibility of herbicides with other pesticides, combination of herbicides and economic studies to determine quantitatively the effect of weeds on the economics of crop production.

Other research includes: new techniques in weed control; integrated methods of weed control; screening trials on a cooperative basis with Oregon; weed identification; critical periods of application of such herbicides as 2,4-D, DNBP and atrazine; variety susceptibility studies;

selective grass control; evaluation of commercial spraying equipment; pasture and aquatic weed control; control of specific weeds such as "maciega" (*Paspalum virgatum*), "caminadora" (*Manisuris exaltata*), kikuyo grass (*Pennisetum clandestinum*), "alpiste" (*Phalaris minor*), wild oats (*Avena fatua*) and "malva morada" (*Malva silvestre*).

Initiation of research in weed control in pastures and the control of aquatic weeds is of critical importance. Pasture weed control has been assigned top priority. Research will be initiated at "Turipana," "La Libertad," and "El Nus." The cooperative screening program with Oregon has already provided advance information on a number of compounds which would have otherwise been delayed in arriving in Colombia. Specific examples are Elanco's EL-119, a rice herbicide; Monsanto's CP-53619 for rice and CP-52223 for wheat; Rohm and Haas' RH-315; Shell's WL-3419; Geigy's GS-14260 for wheat; Velsicol's VCS-438 and a host of others.

INFIELD ECONOMIC EVALUATION

The Need for Information

Recent studies in Colombia have questioned the economic feasibility of non-traditional agricultural inputs such as fertilizers and pesticides. Research has indicated that herbicides used alone often yield a relatively minimal advantage in increased crop yields, but that substantial economic gains result from coordinated application of fertilizer and herbicide.

Colombia is the largest consumer of herbicides in Latin America (\$5.1 million of imports in 1968) including Mexico. It can be concluded that herbicides, in combination with other practices, are proving to be a valuable asset to Colombian agriculture. Solid research data are needed to support or refute this conclusion.

Studies Underway

The AID/OSU technical assistance program in weed control has begun assembling data to pinpoint and evaluate the economics of herbicide application and to define the needs for additional information. Initial economic evaluation studies were carried out during a three-month stay in Colombia by Mr. Lane Coulston of the project staff.

Among the objectives: 1) to assess herbicide potential in Colombia both by areas cultivated and by products available; 2) to measure the economic feasibility—at the farmer level—of procedures recommended by ICA as technically practical; and 3) to cooperate with Colombian technical personnel in establishing research that will lead to determination of the most economical practices and rates of application for commercial use.

To date the data available is not of sufficient reliability to make economic comparisons of alternative herbicides. However, studies show that chemical weed control has an economic advantage over manual weeding and estimates on crop losses due to weeds indicate that manual weeding resulted in a crop yield gain over unweeded check plots.

The initial economic evaluation study has been a major factor in stimulating and providing direction for further research activities. Alternative treatments of major interest have been established in each of the crops currently under study. It is anticipated that these efforts will provide impetus to continue the study on other crops.

REGIONAL REPORT FOR ECUADOR

Initiation of the Program

The Ecuadorian weed control program was initiated July 1, 1968 with assignment of a counterpart (Daniel Navia) for training in Colombia. His six-month training included basic concepts of practical weed control, as well as theory of weeds and their control. He attended a short course on weed control in Venezuela for one month.

Training in Colombia consisted of extensive travel in order to review research underway at all Colombian research stations. In addition Mr. Navia initiated thesis work at one of the research stations.

Since the return of Mr. Navia to Ecuador INIAP (Instituto Nacional de Investigaciones Agropecuarias) has had an active weed control program, which although modest, has been effective and productive. Research in Ecuador has been conducted in the highlands on potatoes, wheat and oats and in the tropics on corn, cotton, pastures and cacao.

Work already underway in Colombia has made possible rapid progress in these areas. In some instances results were almost directly applicable to Ecuadorian conditions. Work in the tropics has developed faster particularly at the "Pichilingue" experiment station near Quevedo where the Ecuadorian counterpart is stationed. Work has also been underway at the Sto. Domingo research station.

Due to encouraging progress made by the Ecuadorian counterpart, INIAP is ready to assign a second counterpart for training in Colombia under the Oregon program. In addition the first Ecuadorian counterpart is scheduled for advanced training (M. S. level) for next year (1970). Indications are that he will be sent to Oregon State University.

Weed Control Short Course

An important aspect of the project is that total cooperation has been established between the Oregon program, AID/Ecuador, Rockefeller Foundation and INIAP. One of the most outstanding achievements in Ecuador was a short course in weed control organized by Oregon with the full cooperation of INIAP, AID/Ecuador, Rockefeller Foundation-Ecuador, ICA and the University of Nebraska/AID Mission in Colombia.

Attending the meeting were extension personnel, Peace Corps volunteers from rural areas, Ministry of Agriculture personnel, INIAP researchers, a student from the University of Guayaquil and a representative from industry.



Director of the cacao program for INIAP, INIAP weed control specialist Daniel Navia and Dr. Cardenas (left to right) discuss evaluation techniques in Ecuador.

The course lasted five days during which the principles of weed control were both discussed and demonstrated. The course was well received and a second course was petitioned for early next year.

The course lectures were mimeographed and distributed. Field demonstrations were held and practical labs were included for student participation. Dr. A. D. Flowerday, extension specialist of the Nebraska Mission in Colombia, was included in the meeting as an observer and evaluator. Changes in the course will be made based on his recommendations. Dr. F. S. Davis, also of the Nebraska Mission, participated in lecturing during the short course. Other lecturers included Octavio Franco (Colombian counterpart) and Daniel Navia (Ecuadorian counterpart).

The list of topics presented included: principles of weed competition; principles of prevention, control and weed eradication; methods of weed control; classification of herbicides; calibration and maintenance of sprayers; principles of herbicide selectivity; safety in the use of herbicides; physical and chemical properties of herbicides; physiology of herbicide action; weed control in cultivated crops; factors which influence the effectiveness of herbicides; economic principles in weed control; development of an herbicide; how to plan and conduct a demonstration on weed control; and herbicide nomenclature.

Other Activities

In addition to research projects, thesis problems have been initiated in Ecuador in potatoes, small

grains, rice, corn and hotland wheat. Students involved are from the University of Quito and the University of Guayaquil. Three representatives from Ecuador attended the first meeting of the Colombian Weed Society and each presented a paper.

To date industry has not collaborated on weed control research programs, but they now show increased interest due to the outstanding efforts of Mr. Navia.



During the weed control short course in Ecuador Dr. Juan Cardenas (center) explains calibration of field spray equipment.

NEW PRODUCTS AND PRACTICES EVALUATION PROJECT

Need for the Project

The need for a procedure to identify herbicides capable of solving weed problems in the multitude of world crops precipitated the new product evaluation project at Oregon State University. Of particular importance are the so-called minor crops of the world which are not grown in sufficient acreage to justify major attention on the part of chemical companies.

In providing a procedure for this type of evaluation the OSU/AID program also meets the need of chemical manufacturers to have experimental herbicides tested and compared by an independent and impartial organization. In the history of the project company management has found it beneficial to be able to compare their new materials with new products from other companies. These comparisons increase in validity when the evaluations are made under identical environmental conditions.

146 Compounds Tested in 1968-69

Most of the world chemical industry's new experimental herbicides are brought together each year for preliminary and follow-up testing. In addition the project makes a concerted effort to report test results accurately and promptly.

At the preliminary testing stage, or screening trials, all of the new herbicides are evaluated and compared on both the basis of their safety to a wide range of crops and their effectiveness in controlling a group of annual weeds.

One hundred forty-six (146) new herbicides from 33 chemical companies were tested in preliminary trials during the period July 1968 to July 1969. These chemical companies are located in England, France, Germany, Holland, Japan and Switzerland as well as the United States.

Cooperative Trials with the University of Hawaii

In January 1969 the fifth annual new materials evaluation trial was established on the Island of Kauai in cooperation with the University of Hawaii. Fifty-one new herbicides from 15 chemical companies were tested on 28 crop and weed species.

The Hawaii trials have proven to be very useful to both chemical companies and project research workers. The availability of field test results during the winter months from plots in Hawaii is a significant assist in planning the extent of herbicide testing for the coming summer months.

Chemical company personnel, local industry representatives and other interested persons are



Weed control technician Dave Sutherland applies material to field trials in Oregon in connection with new products evaluation program.

invited on a tour of the field plots in Hawaii each year. This tour has been well attended by mainland and Hawaiian company representatives. About 80 people attended the tour in March 1969.

Expansion of the testing in Hawaii is planned for 1969-70 by carrying out a second trial in a dry climate and on a low organic matter soil in contrast to the high rainfall and high organic matter of the present site. The proposed site for the second trial also has a high population of nutsedge which will aid testing on this very serious weed.

Field Trials at Oregon State University

Two trials similar to the one in Hawaii were carried out in Oregon during 1968-69. A spring trial in May includes many of the same materials tested in Hawaii. Crop species are changed and, of course, the weed population is much different. A tour of this trial is also held each year with over 100 people attending in 1969. Many chemical company personnel also visit the work in Oregon independently during the year.

A summer trial is established in July of each year which includes both the most promising materials from the spring trial plus any new chemicals made available by industry in the interim. Crop and weed species are again changed to fit environmental conditions and to provide as broad exposure as possible for materials under test.

Secondary Testing

New product evaluation also has the responsibility for a certain amount of follow-up testing of promising herbicides in Oregon as well as coordinating testing of promising materials in other areas.

A large secondary screening trial was conducted in 1968-69 on wheat and corn in Oregon. Many new materials were applied to these two crops, at various locations in Oregon, through the efforts of this project.

A major amount of follow-up testing of new herbicides is also being done under the regional program in Colombia. Fifteen promising new herbicides were sent directly to Colombia by the project and many others were supplied by chemical companies.

Seven of the most promising new herbicides from the Oregon/Hawaii tests were sent to Chile for secondary evaluation as part of a cooperative program which has been underway for ten years.

Soil Persistence

Another function of the new products project is, at an early stage of herbicide development, to determine soil life or persistence. An annual trial is designed specifically for this purpose. Thirty-two promising new herbicides were compared with 12 standard herbicides for persistence in the soil. Results have proven to be very useful to chemical companies as it is often difficult to obtain adequate information on chemical persistence in soil at an early stage in the development of a new compound.



During preparation and training of in-field staff Larry Burrill (left) reviews evaluation methods and product performance with Lupe L. Garcia, project leader for El Salvador.

SPECIAL PROJECTS

Need for Information Worldwide

General lack of information is a major roadblock for development of modern weed control in many parts of the world. Additionally the available information is often inaccurate, incomplete or in conflict. Recognizing this as a problem, a series of interrelated publications was initiated by the project during the past year. These are: an herbicide index; a crop-herbicide index; and a weed susceptibility index.

Herbicide Index

Herbicides are sold under various trade names throughout the world. The number of names may vary from one or two for certain proprietary herbicides up to an estimated several thousand for common products such as 2,4-D. Coupled with the problem of numerous trade names is the fact that many countries do not require the seller to list the common or generic name of a product. As a result there is slow interchange of weed control information because in many reports herbicides are identified only by the local trade name.

The herbicide index was conceived as a workable aid to correct identification of herbicides listed by trade names only. It lists all herbicides, first by common name with all known trade names, then by the chemical name and then by one or more of the major suppliers. A second element of the index contains all chemical trade names alphabetized and cross-referenced to common names.

The HERBICIDE INDEX has been distributed to the world's pesticide industries and to many other organizations through USAID/Washington.

Crops-Herbicide Index

On a worldwide basis voluminous chemical weed control information is available for specific

crops. This information is found in the official weed control recommendations and progress reports of many private and governmental research organizations. Additional information is also available from most of the pesticide industries in the form of technical data sheets, labels and other types of commercial literature. This information, however, has never before been condensed and assembled into a single publication.

As an aid to beginning workers in the field of weed control, members of the project are preparing a guide to the commercial and experimental herbicide treatments currently being used and tested on most of the principal food and fiber crops of the world. The CROPS-HERBICIDE INDEX is being circulated to world pesticide industries for comments before being published this coming year.

Weed Susceptibility Index

Another information void exists in regard to the susceptibility of the world's major weeds to the principal commercial herbicides. A few indexes exist that list susceptibility of major weeds of an area to one or two herbicides, but a definitive publication is needed. Much of the information, both from the literature and from the pesticide industries, necessary to prepare a detailed weed susceptibility index has been gathered by the project. This information is being organized in a form that will permit the reader to readily determine the necessary herbicide(s), approximate rate(s), and time(s) of application to control most of the world's major weed species.

Agricultural Equipment Manual

An international agricultural equipment manual is now being compiled to meet the need for a

comprehensive guide to equipment and materials from the U. S. and abroad designed for experimental work and small-scale farming. Equipment used in weed control will be the major emphasis.

The manual is being developed to meet the needs of agricultural workers throughout the world with special attention to workers in developing countries. Entries will include illustrated descriptions of tools and equipment;

buyers' guide; manufacturers' names and addresses; trade and brand names; and index to products in English with foreign language glossaries in French, Spanish and Arabic.

The equipment survey which is now in progress will be representative of those manufacturers (on a list developed from international sources) who reply to a questionnaire sent out by the project.

INFORMATION SECTION

Information Storage and Retrieval System

One of the most important objectives of the project is accurate and rapid dissemination of research information. This objective is being accomplished by establishing an Information Storage and Retrieval system. The ISR system will serve as a repository of pertinent data and provide instant access to any stored information. Presently the project is in Phase One which involves the following areas: initial definition of desired output; evaluation of methods of input; and investigation of prospective users.

In this phase experimental data from the Oregon State University herbicide evaluation trials are being used as input to the system. This data serves as a good pilot project to evaluate the system and to estimate what will be necessary to extend it to a much larger system on an international scale.

When Phase One becomes operative the data bank will be increased by extending input sources to include those professional societies and other organizations that can provide similar information. This material will be periodically summarized, published and distributed to interested organizations on a subscription basis. In addition, specialized, non-recurring data runs will be available on a service fee basis.

All indications point toward a definite need for such a system. However, it must be developed with the user in mind, and the input record must be maintained in as simple a form as possible.

The design of Phase One, which has been in operation on a part-time basis since December 1968, has been made a full-time effort as of July 1969 under the charge of a computer specialist.

Economic Evaluation

The recent economic assessment of the weed control research program in Colombia has initiated efforts by the program to develop basic data important in economic evaluations. This information is useful in setting priorities for research by government and industrial organizations to be utilized for determining development, marketing and extension plans.

It is anticipated these data will include location and frequency of infestations for the common pests by geographic location; crop acreage and production figures of the major crops in the various world production areas; distribution of cultural practices by geographic region; cost of production factors for various types of production methods by geographic area; import duties; licensing requirements; registration requirements; product costs; commodity prices; and similar basic data useful in evaluating all facets of marketing, pricing, and patent maintenance.

These compilations of economic information will be an integral part of the Information Section of the International Plant Protection Center.

AGENCIES AND ORGANIZATIONS SUPPORTING THE PROJECT

Cooperating Industries

The project receives substantial financial support, in addition to USAID contract funds, in support of new products evaluation. The major chemical manufacturers in the U. S., Europe and Japan fully support the OSU/AID materials testing program.

Oregon State University

Participation in the program has been both broad and cross-discipline as a number of different departments at OSU have become involved. Among them: Agricultural Chemistry, Agricultural Economics, Agricultural Engineering, Forestry, Geography, Horticulture, and Modern Languages.

Activities have ranged from direct project activity and data supply to presentation of special background material to out-bound field staff.

University of Hawaii

The University of Hawaii has been a major collaborator on the program with direct involvement in the new products and practices evaluation under tropical conditions. Drs. R. R. Romanowski and Donald Plucknett have been responsible for guidance and coordination in Hawaii.

University of Nebraska

The project in Colombia has continued to operate in close collaboration with the University of Nebraska, Colombia Mission. That Mission provides necessary administrative in-country back-up support. Dr. Cardenas, Director of the Colombia-Ecuador regional project, works closely with the University of Nebraska Mission staff in the areas of weed control education and plant physiology.

CURRENT PROJECT STAFF AND CAMPUS FACILITIES

The AID contract staff is currently housed in Gilmore Annex, Farm Crops Department, on the Oregon State University campus.

Staff members on campus include Dr. William R. Furtick, Director; Dr. A. P. Appleby, Assistant Director; Mr. Lane E. Coulston, Assistant to the Director; Mrs. Georgena S. Knapp, assistant in charge of fiscal affairs and Spanish translation; Mr. Larry C. Burrill, project leader for new products and methods evaluation; Mr. Richard Fine, sub-project leader for International Weed Control Manual and Weed-Herbicide Susceptibility Indexes; Dr. John A. Edwards, Agricultural Economics advisor; and John R. MacDonald and David R. Sutherland, project aides.

The project is administered under the Department of Farm Crops with Dr. J. Ritchie Cowan as department head. It is part of the School of Agriculture. Disbursement of contract funds is through the Business Office of Oregon State University, Corvallis.

Project responsibilities overseas have been limited to Colombia and Ecuador. Dr. Juan Cardenas, stationed in Bogota, has supervised weed control experiments at several sites in Colombia and this year has expanded his efforts to include several locations in Ecuador.

STAFF ORIENTATION AND TRAINING

During the past year technical personnel who had been brought into the program in anticipation of project expansion in Latin America, accepted assignments on other OSU contracts to participate in technical assistance programs in weed control.

Drs. Floyd Bolton and Homer Hepworth are currently with the Turkey wheat program operating out of Ankara. They are specifically involved in improving cultural practices in tillage and moisture conservation as well as developing weed control practices suitable to the wheat areas of the Anatolian Plateau. The OSU/AID weed control project is providing continuing in-field support for these men, necessary for the efficient development of their programs.

There was a similar relationship with Mr. Rudy Vigil, formerly of the project staff, while he was on a short-term technical assistance program to develop weed control practices in Jordan.

Programs of orientation, training and back-up support for technical personnel in weed control are affording the staff useful experience in developing facilities to handle all facets of training persons with expertise in weed control for duty with a variety of contracts and collaborating organizations. There appear to be substantial demands on a worldwide scale for these weed control activities and it is expected that, with a deepening background, the International Plant Protection Center will become more effective in this role.

PROJECT ADVISORY COMMITTEE AND ANNUAL WORK CONFERENCE

Annual Work Conference

The annual work conference was held on February 10, 1969, prior to the meetings of the Weed Science Society of America in Las Vegas, Nevada. Dr. Juan Cardenas, Director of the Colombia-Ecuador regional program, and the on-campus back-up staff attended the one-day work conference and participated in the Weed Science Society of America meetings. Mr. Ralph Gleason, AID/Washington, who had just visited the facilities of the program at Oregon State University, participated in the review and discussion of the work conference.

The agenda for the work conference:

1. Development and evaluation of new products and practices
2. Needs for equipment development
3. Communication and reporting
4. Review of on-campus projects
5. Discussion of proposed economic study to be conducted in Colombia
6. In-depth review of Colombia program
7. Presentation of International Plant Protection Center (IPPC)

8. Development of Information Section of IPPC

Advisory Committee

The project Advisory Committee was called upon to participate in the program review and to offer advice and guidance in the conduct of the in-field program. Members of the Advisory Committee are persons of broad experience in the weed control field who have volunteered their services to the program from the initial phase. They are:

1. Dr. Keith Barrons—Director of Biological Research, The Dow Chemical Company, Midland, Michigan
2. Dr. Will Carpenter—Manager, Herbicide and Fungicide Development, Monsanto Company, St. Louis, Missouri
3. Dr. W. B. Ennis—Chief, Plant Protection Branch, ARS, USDA, Beltsville, Maryland
4. Dr. A. H. Lange—Extension Weed Specialist, University of California, Riverside, California
5. Dr. J. R. Orsenigo—Weed Research Specialist, University of Florida, Belle Glade, Florida

LIST OF PUBLICATIONS**1967**

- 67-1 Helpful U. S. Metric Conversions. Dean R. Donaldson and Luis Figuerola
- 67-2 Weeds of Colombia. Juan Cardenas and Lane Coulston
- 67-3 Weeds of Mexico. Juan Cardenas and Lane Coulston
- 67-4 Weeds of Central America. Juan Cardenas and Lane Coulston
- 67-5 Weeds of Trinidad. Juan Cardenas and Lane Coulston
- 67-6 Weeds of Dominican Republic. Juan Cardenas and Lane Coulston
- 67-7 Weeds of Peru. Juan Cardenas and Lane Coulston
- 67-8 Weeds of Venezuela. Juan Cardenas and Lane Coulston
- 67-9 Weeds of Uruguay. Juan Cardenas and Lane Coulston
- 67-10 Weeds of Puerto Rico. Juan Cardenas and Lane Coulston
- 67-11 Weeds of Chile. Juan Cardenas and Lane Coulston
- 67-12 Weeds of Argentina. Juan Cardenas and Lane Coulston
- 67-13 Weeds of Brazil. Juan Cardenas and Lane Coulston
- 67-14 First Annual Progress Report: "Development of Weed Control in Less Developed Countries."
- 67-15 First Monthly Progress Report: "Development of Weed Control in Less Developed Countries."

1968

- 68-1 Weed Research Methods Manual for Establishing New Programs. William R. Furtick and Roman R. Romanowski (under revision).
- 68-2 OSU/AID Weed Control Project: Annual Report
- 68-3 Turkey—A Background Analysis

1969

- 69-1 Herbicide Index. Homer M. Hepworth (manuscript copy only)
- 69-2 Hawaii Screening Trial. Larry C. Burrill
- 69-3 Herbicide Status Report. Larry C. Burrill
- 69-4 New Herbicide Evaluation Trial. Larry C. Burrill .
- 69- Crops-Herbicide Index. Richard Fine (manuscript copy)