AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523

BIBLIOGRAPHIC INPUT SHEET

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Batch #22

1. SUBJECT CLASSIFICATION
A. PRIMARY: Serials — Y-AH60-0000-0000
B. SECONDARY: Agriculture--Weeds

2. TITLE AND SUBTITLE
Weed control systems for representative farms in developing countries; annual research report 1973/1974

3. AUTHOR(S)
(101) Or.State Univ. Int.Plant Protection Center

4. DOCUMENT DATE	5. NUMBER OF PAGES	6. ARC NUMBER
1974	35p.	ARC 632.58.066a

7. REFERENCE ORGANIZATION NAME AND ADDRESS
Or.State

8. SUPPLEMENTARY NOTES *(Sponsoring Organization, Publishers, Availability)*
(Research summary)

9. ABSTRACT

10. CONTROL NUMBER	11. PRICE OF DOCUMENT
PN-RAB-267	
12. DESCRIPTORS	**13. PROJECT NUMBER**
Research	**14. CONTRACT NUMBER** AID/CM/ta-C-73-23 Res.
	15. TYPE OF DOCUMENT

AID 590-1 (4-74)

AID

REPORT SUMMARY

A. 1. Project Title and Contract Number: Weed Control Systems for Representative Farms in Developing Countries. AID/CM/ta-C-73-23.

2. Principal Investigator, Contractor and Mailing Address: Dr. Stanley F. Miller, International Plant Protection Center, Oregon State University, Corvallis, OR 97331.

3. Contract period: March 1, 1973 to March 31, 1974.

4. Period covered by Report: March 1, 1973 to March 31, 1974.

5. Total AID funding of contract to date: $381,115. (Under a previous AID project, "Weed Control Research in Less Developed Countries," csd-1442, expenditures totaled $1,617,615. Equipment and materials and supplies on hand at termination of csd 1442 were transferred to AID/CM/ta-C-73-23.)

6. Total expenditures and obligations through previous contract year: $314,775.

7. Total expenditures and obligations for current year: $314,775.

8. Estimated expenditures for next contract year: $371,452.

B. Narrative Summary of Acccomplishments and Utilization

The objectives of the new USAID/OSU project are to develop and evaluate weed control systems for representative farms in developing countries with special emphasis on small and medium sized farms. The AID authorization is from March 1, 1973 to December 31, 1975. This report covers the first year of the new contract(March 1, 1973 - March 31, 1974).

During the year, two agronomists and one agricultural economist were established in Brazil. A program was developed and work is in full swing. Initial experiments have been, or are now being installed and both a farm survey and an agricultural labor survey questionnaire are being pre-tested.

The work program in Central America carried over from the previous project was modified to be consistent with the project effort. Similar work will be done in both Brazil and Central America for comparative purposes. The previous research agronomist in Central America resigned in August, 1974. A competent replacement has been secured and is scheduled to take up residence in May, 1974. Most data from the previous OSU/AID project has been brought to Oregon for analysis.

Corvallis-based project personnel continued to provide administrative, logistic and technical support, not only to OSU foreign-based staff, but to international weed control researchers in general. A complete worldwide communication system continues to function. Publications, participation in short courses and seminars, and maintaining linkages with other international and LDC institutions and organizations are major contributions of the OSU/AID project.

AID/CM/ta-C-73-23

Weed Control Systems for Representative Farms in Developing Countries

Annual Research Report - 1973-1974

A. General Background

The green revolution has brought progress to numerous groups within the agricultural sector of many LDCs. As crop production has been intensified with improved varieties, irrigation and fertilizer, competition from weeds has increased significantly. Crop production losses range from 30 to 100 percent if weeds are not controlled. Most LDCs recognize the problem and are now seeking expertise and assistance in developing adequate weed control systems.

Not all groups within agriculture have been benefited equally by the new technologies. Some people, because of economic or social constraints, have been left behind. These often include many small farmers and farm laborers in the agricultural force. Special programs and technologies must be developed and existing programs and technologies need to be evaluated if these groups are to improve their lot or at least remain no worse off with the changes that are occurring.

In recent months, matters have become more complex. Shortages of important agricultural inputs -- fertilizer, fuel, etc. -- have

raised concern about the ability of LDCs to provide sufficient food to increase the welfare of their people or, indeed, to feed them adequately to support life. The LDCs may have to put greater reliance on movement of produce from small farmers into commercial markets, if food shortages are to be avoided.

B. Statement of Project Objectives as Stated in the Contract

The major goal of project AID/CM/ta-C-73-23, "Weed Control Systems for Representative Farms in Developing Countries," is to reduce food crop losses due to weeds, to the extent that is economically and socially justified. The project is designed to develop new weed control technologies for representative tropical farms, but with special emphasis on small subsistence farms. The technologies will be evaluated in terms of their abilities to meet various societal goals, among them being economic efficiency, high employment, and more equitable income distribution.

Additional goals are: to train counterparts in proper methodology for weed control research; to promote practical and safe usage of herbicides and other pesticides through training programs; to encourage consideration of regulatory laws and ecological and environmental aspects of such programs; and to continue development and maintenance of a worldwide communication network for weed control researchers.

C. Continued Relevance of Objectives

The objectives of the project are equally relevant now as when the project was initiated one year ago. Weed competition continues to be a critical factor, and often a limiting one, to increased crop production. The lot of small farmers and the agricultural labor force has not improved. In fact, the increased cost of agricultural inputs has probably worsened the relative position of the small farmer. And certainly, higher food costs and higher cost of consumer goods in general have reduced the real income of many agricultural laborers in LDCs.

D. Accomplishments to Date

Brazil

Actual research findings are few since the project program is in its developmental phase. Two agronomists and one agricultural economist were located in Recife, Brazil during this period to initiate research for the fulfillment of project objectives. The first agronomist arrived June 14, 1973, and the second, August 11, 1973. The agricultural economist arrived January 1, 1974.

Through the efforts of the combined project staff, planning for the new program was completed and implemented as the staff arrived in Brazil. Needed equipment was secured and shipped. Contacts were made with AID/Brazil, the Brazilian Ministry of Agriculture, and other personnel of relevant organizations in order to explain the program and secure their cooperation where possible. An agreement was entered into jointly with AID/Brazil and EMBRAPA (a state

corporation which has the responsibility of conducting agricultural research in Brazil) to locate two agronomists and one economist in Recife and to work cooperatively with IPEANE and other state and federal institutions. After reviewing relevant data on soils, climate, cropping patterns, and weed problems, an experimental site in Caruaru, Pernambuco state, was selected. The area includes an abundance of small farmers and an active IPA (Instituto Pernambuco Agropecuaria) experiment station. It is also within one day's commuting distance of Recife. Through an initial survey, production characteristics of farms, as well as economic and social parameters, were obtained. The survey was not extensive nor necessarily representative. Rather, it was designed to ascertain those characteristics of production needed to design adequately the experiment.

Field trial plans were developed to study different weed control systems and ascertain how they relate to other agricultural inputs in the more generalized system and how they affect income distribution and unemployment. The trials were planted in March, 1974, with the first data to be available in September and October, 1974. (A description of the experiments is given in Appendix III.)

A complete population frame was obtained for the area, and the sample will be drawn from it. Stratification will be made by farm size. An initial questionnaire has been developed. Once the field work will allow, the questionnaire will be taken to the field, pretested, modified, and used in the farm survey.

Preliminary efforts have been started to conceptualize the model that will be employed in the development of economically efficient weed control systems for the several farm sizes and in the evaluation of the effects of the proposed systems on alternative social goals.

Project staff in Brazil has also participated in formal as well as informal training courses. These include participation as a lecturer in an intensive weed control short course at the Viçosa Federal University and as a lecturer on weed control principles at the Federal Rural University of Pernambuco. Informal training consisted of on-the-job instruction to counterpart (and other interested) personnel and to agronomy students at several of the rural universities in the area.

Additionally, OSU Brazilian staff have been of assistance to the Wisconsin team of the EMBRAPA/AID Loan program. Not only have they recommended weed control measures for the Wisconsin trials, but because of their language proficiency, they have been of assistance in establishing contacts and maintaining a liaison with the IPEANE administration.

Central America

Guadalupe García, Research Agronomist in El Salvador under project csd-1442, resigned August 31, 1973. An immediate effort was started to find a replacement who could be oriented toward the new objectives of the project. Mr. Richard L. Chase has been hired for this position with an effective starting date of May 1, 1974.

Prior to the departure of Mr. García, publications on control of weeds in beans, sorghum, rice and corn in El Salvador were written. The recommendations published are the result of several years of experimentation with these crops. The individual experimental results have been reported previously.

An important weed in all typical areas is *Cyperus rotundus*, purple nutsedge. Results from El Salvador indicate that it can be controlled effectively in beans by the use of EPTC or butylate at the rates of 5 to 6.5 kilograms per hectare.

Work conducted in Costa Rica indicates that paraquat in a mixture with simazine (0.36 + 4.0 kilograms per hectare) or diuron (0.36 + 4.0 kilograms per hectare) give good results for controlling grasses and broadleaves in citrus. Equally good weed control can be obtained through manual and chemical means. The differences in yields are insignificant; choice between the two methods depends on relative costs. Unfortunately, no cost comparison can be made from the available data. Good weed control in corn was obtained through the use of atrazine and butylate or EPTC. No effect was noted on the germination of potatoes when a selected group of herbicides was applied.

Additional work in Costa Rica, as well as in Honduras, El Salvador, Guatemala, is presently being analyzed. Hopefully, some of the information will yield economic implications.

Subsequent to the departure of Mr. Garcia and prior to the hiring of Mr. Chase, a program similar to that developed for Brazil was prepared for El Salvador. Many of the same experiments will be installed. The government of El Salvador has given its firm endorsement to the program and has promised necessary counterpart personnel and logistic support to insure the success of the effort.

Mr. Eduardo Locatelli of Oregon State University spent two months in El Salvador developing the detailed trial plans and budgets for the experiments and in gathering available data from previous experiments. He also traveled to Honduras, Guatemala, Costa Rica, and Nicaragua explaining the new approach. He was well received and the weed control specialists of those countries asked for plans and technical help so that they could install a portion, if not all, of the experiments.

The socio-economic effort in El Salvador will be carried on cooperatively with the University of Florida program in El Salvador and both OSU, Corvallis, and El Salvador personnel.

Corvallis

The primary responsibilities for the Corvallis based staff are to provide administrative, technical and logistic support for field staff, to develop and maintain liaison with AID/Washington, and other domestic and international organizations and institutions interested in working in the development of weed control systems, to maintain a communication system between weed control researchers, and to assure broad utilization of the research.

During the project period, the following man-weeks were spent by Corvallis-based staff in the countries and regions indicated to meet these objectives:

Country	man-weeks
Brazil	7
Colombia	3
Mexico	4
Central America	11
Southeast Asia	6
Africa	1
Domestic weed and agricultural conferences	5

Contact was maintained with numerous key institutions and individuals involved in international weed research. Information and data exchange arrangements were developed. During the year personal contact by IPPC* staff was made with the following international research centers:

1. CIAT (International Center for Tropical Agriculture)
2. CIMMYT (International Maize and Wheat Improvement Center)
3. WARDA (West African Rice Development Association)
4. IRRI (International Rice Research Institute)
5. FAO (Food and Agricultural Organization of the UN)
6. BIOTROP (Regional Center for Tropical Biology)

* International Plant Protection Center

In addition, personal contact was made with governmental, international and university personnel in many countries in Central and South America, Africa, and Southeast Asia. IPPC staff participated in professional association meetings in the U.S., Asia-Pacific, and Latin America.

Two field trials were conducted by Corvallis staff to provide preliminary evaluation of experimental herbicides. In addition, a summary of the current status of experimental herbicides available for testing was prepared. All of these reports are sent to many weed control researchers around the world as well as the in-field staff.

All experimental data in which IPPC participated in Central America have been collected and brought to Corvallis. The data are being re-analyzed in an attempt to prepare better recommendations and comparisons and, where possible, to evaluate the treatments economically. No findings are available yet.

E. Dissemination and Utilization of Research Results

The project, despite undergoing a year of transition and shift in operational emphasis, continued an active and vigorous program of information dissemination through exchange of technical information, responding to requests for information and distribution of publications. Highlights of this phase of the program follow:

1. A new publication, A PARTIAL BIBLIOGRAPHY OF WEED RESEARCH AND CONTROL PUBLICATIONS FOR SOUTH AND CENTRAL AMERICA, THE CARIBBEAN, AND MEXICO - 1942-72, was compiled, published and issued in

conjunction with the International Plant Protection Center. The material is believed to be the most extensive single collection of weed research and control bibliographic listings for the stated geographic areas. In addition to the introductions and acknowledgements appearing in Spanish, Portuguese, and English, the overall emphasis is on non-English terminology.

2. AID's Regional Technical Aids Center (RTAC) Mexico completed translation and publishing of MANUAL DE METODOS DE INVESTIGACION DE MALEZA (WEED RESEARCH METHODS MANUAL), an illustrated handbook with emphasis on establishing new programs. The project began to distribute copies in the fall of 1973 and as of March 1, 1974, had mailed a total of 238 copies, 93 of which were in response to direct requests mainly originating from Latin America. A notice concerning availability, in Spanish, appeared in the October 1973 issue of INFOLETTER.

3. During calendar 1973, the project/IPPC dispatched over 2,400 copies of ten different publications and reports (for which records are kept). A country-by-country and title-by-title analysis appears in Appendix IV (World Distribution of Publications).

4. Five issues of INFOLETTER were published during the report period. The informational mix and editorial thrust has evolved to reflect the revised goals of the project and the increased concern with economics, environment, and other social values. A sampling of news items that appeared in the five issues includes:

IRRI studies impact of weed control methods, costs for Asian rice farmers

Crop loss data sought for FAO publication

Brazilian university sets short course

Tool bar system offers improved weeding

Weed researcher challenges counterparts to help guide wise introduction of herbicides

55 papers highlight Colombian weed meeting

Weeding: bottleneck for ag development

Weed research program launched at CIAT

Weed research events scheduled in India

USAID/OSU weed research project received new contract

Brazil, USAID ink pact for co-op weed research

Weed scientist cites preventive practices

A useful control method: clean irrigation water with weed seed screens

Agricultural economist picked to lead project

African study cites weed control need

Proper operator attire

Rotary engine powers sprayer

Weed Research Organization serves England and world

Fiber glass mulch aids weed control

Tropical weed control course slated in UK

Each issue also carries lists of relevant publications (and the sources from which they may be requested) as well as announcements of forthcoming conferences, seminars and short courses. A thorough review of the extensive project/IPPC mailing list was carried out, increasing the number of recipients in LDCs and

reducing those in other areas. Approximately 3,400 copies are currently mailed to recipients in more than 120 countries and territories.

5. Various members of the project staff were responsible for presentations and articles during the reporting period (please see Appendix I, Bibliographic List). Reprints and copies were made available as applicable. In addition to those meetings where they presented papers, project personnel also attended the joint ALAM-COMALFI (Latin American Weed Association-Colombian Plant Physiology and Weed Society) meeting at Cali, Colombia, in February 1974 (where the Bibliography was announced).

6. Project staff at Corvallis continue to receive inquiries from sources in LDCs concerning various technical aspects of weed control. These range from fairly brief, specific questions, to broad entreaties for guidance in how to organize a total weed research effort. An effort is made to respond to each individual inquiry and to provide information -- either publications, technical literature, names of other contacts or institutions -- to the greatest degree possible consistent with time and resource constraints.

7. During this reporting period, a manuscript entitled "Prevalent Weeds of Central America" was prepared. It is an improved and corrected version of a previous manuscript, "Weeds of Central America." The manuscript contains detailed descriptions in Spanish

and English for 277 weed species prevalent in Central America and will include a full color plate for each specie. It is anticipated that the publication will be printed and distributed during late 1974.

8. A report, "Experimental Herbicides, 1973 Status Report by Crop," was prepared from domestically and internationally conducted experiments. The report was sent to 236 researchers in 33 different countries and is an attempt to keep researchers abreast of the new promising herbicides.

Project personnel are constantly seeking ways of strengthening ties with existing international and LDC institutions. A course in cooperation with CIAT was proposed and presented to AID/Washington for funding. It outlines a training course for weed researchers of intermediate expertise with special emphasis on socio-economic impacts. Many of the instructors will be from LDCs. Thus, a dual benefit will occur -- qualified LDC instructors will be helped to instruct their less well-prepared colleagues, and both groups will benefit. International AID cooperation is also advanced by the joint OSU/AID/CIAT effort. The proposed course is still under consideration.

F. Statement of Expenditures and Obligations and Contractor Resources

The following table lists the expenditures and obligations related to the four broad work areas of the project.

1973-74 Expenditures by Category and Location (13 months)

Classification	Corvallis Hdqs.	Corvallis Publications	Brazil	Central America	Totals
Salaries & Wages	97,333.20	-	22,441.05	11,870.19	131,644.44
Payroll Assessments	12,478.24	-	2,876.98	1,521.78	16,877.00
Indirect Costs	46,165.13	-	7,208.07	3,812.71	57,185.91
Consultant Fees	1,195.00	-	-	2,305.00	3,500.00
Travel, Transportation and Allowances	19,432.59	-	34,885.56	10,784.33	65,102.48
Other Direct Costs	5,156.55	-	975.17	801.24	6,932.96
Equip., Vehicles, Supplies & Materials	6,132.85	6,415.83	18,662.80	2,302.47	33,531.95
TOTALS	187,893.56	6,415.83	87,049.63	33,415.72	314,774.74

As noted in the budget, approximately 62% of the total expenditures were made by Corvallis-based personnel, while 38% was made by internationally-based personnel. This apparent misallocation arises from personnel and program changes that occurred during the year (see Appendix II). At the beginning of the budget year, only one OSU/AID staff member was based away from Corvallis. At the end of the year, this number had grown to three, with a fourth to be placed by May 1, 1974. As researchers are located abroad, a shifting of related expenditures will occur also.

A total of 12.75 positions were budgeted in the proposed budget for 1973-1974. In operation, this number was reduced to 11.3 full-time

equivalents by better internal organization and combining of positions, resulting in a budget savings of $64,900 for the year.

G. Work Plan and Budget Forecast

During the 1974-75 budget year, the plan of work consists of the following:

1. Establish field trials in Northeast Brazil and Central America to study:
   a. yield losses due to weed competitions;
   b. optimal time(s) and techniques of mechanical and manual weeding (critical period(s) of weed competition);
   c. herbicide selectivity;
   d. variety-fertility-spacing interactions;
   e. integrated weed control including combinations of manual, cultural, chemical and biological methods;
   f. cultural weed control practices such as continuous, multiple and inter-cropping; chemical and mechanical fallow, cover crops, tillage and mulching.

2. Evaluate costs of alternative weed control methods.

3. Obtain preliminary estimates of substitution rates between capital and labor employed in weed control.

4. Select, refine and repeat promising field trials.

5. Install trials on crops not included in prior studies.

6. Conduct farm and labor surveys.

7. Identify characteristics of the labor pool.

8. Estimate cross-sectional production functions by farm size.

9. Initiate construction of generalized quantitative model to be used for the development of economically-efficient weed control systems and evaluation of alternative social goals.

10. Maintain contact with major U.S. and world wide research agencies such as the USDA, the British Weed Research Organization, and the International Research Institute for the purpose of receiving the latest available scientific knowledge.

11. Publish and distribute an informational newsletter at least three times yearly to disseminate useful knowledge on weed control to an established list.

12. Answer inquiries on weed control from AID Missions, government officials of LDCs and others requesting information on the control of weeds.

The proposed budget for the period April 1, 1974 to March 31, 1975 is listed in the following table.

Classification	Corvallis Hdqs.	Corvallis Publications	Brazil	Central America	Totals
Salaries & Wages	87,737	-	48,563	21,007	157,307
Payroll Assessments	12,283	-	6,799	2,941	22,023
Indirect Costs	41,614	-	15,599	6,747	63,960
Consultant Fees	-	-	7,460	3,730	11,190
Travel, Transportation & Allowances	35,241	-	32,232	15,890	83,363
Other Direct Costs	4,925	-	750	400	6,075
Equipment, Vehicles, Materials & Supplies	3,550	7,550	5,634	10,800	27,534
TOTALS	185,350	7,550	117,037	61,515	371,452

In contrast to the previous budget, only 52% of the total expected expenditures are related to the Corvallis staff, while 48% will be made as a result of the international phase of the program. The budget is in harmony and consistent with the work plan.

H. Appendixes

Appendix I - Bibliographic List

Burrill, L.C. 1973. New techniques in weed control. Paper presented to the 4th Asian-Pacific Weed Science Society, Rotorua, New Zealand, March 12-16.

Four techniques which are being developed to improve or safen herbicides were discussed. The use of foam in place of straight water as a herbicide carrier is proving to be useful in reducing spray drift. Other benefits have been observed, such as better coverage, cleaner equipment, and fewer reloading trips.

The absorptive properties of charcoal are being used to protect emerging crops from herbicides. The charcoal is put into a slurry and sprayed over the seeds in a one-inch band. A broadcast herbicide is absorbed by the charcoal but is free to kill weeds between the rows.

Herbicide antidotes are being used to improve the safety of certain thiocarbamate herbicides when used to kill weeds in corn. One chemical is now being marketed under the name Protect and is used as a seed treatment. Another chemical is added to the herbicide during the manufacturing process.

Subsurface layering of herbicides has proven effective in controlling certain problem perennial weeds. A third layer of herbicide is placed 8 to 10 inches below the soil. As the weeds grow into the treated layer of herbicide, they are killed or stunted.

Burrill, L. C. 1973. The future of herbicides in the tropics. Paper presented to the Second Indonesian Weed Science Conference, Jogjakarta, Indonesia, April 2-5.

There seems to be little doubt that the use of herbicides will increase in tropical areas. The introduction will be much more rapid in plantation crops than on family farms. Displacement of labor by herbicides and other forms of technology is of concern to many people. This needs to be balanced with the need for increased food production. Solid research programs need to be established so that decisions can be based on facts. These programs need to be supported by good systems of communication and favorable government policy.

Burrill, L. C. 1973. Weed control methods in rice. Paper presented at the West African Rice Development Administration Plant Protection Seminar, Monrovia, Liberia, May 1973.

In much of Western Africa, rice production is at a primitive level. The slash and burn system is often used, commercial fertilizer is rare, and most of the rice is broadcast seeded.

Under these conditions, non-herbicidal methods of weed control should be encouraged. Using transplanted rice, good water control crop rotation, clean seed, row planting, and hand or mechanical weeding should provide a dramatic increase in yield. Herbicides should be introduced to help solve special problems.

Burrill, L. C. 1973. Pest Control and Multiple Cropping. AGRICULTURAL MECHANIZATION IN ASIA, 4(2): 29-30.

While various forms of multiple cropping have been used for centuries, it is now being looked to as a means of producing more and better food in areas where land use and population pressure is high. It is difficult enough under a monocrop system to provide good pest and weed control. The expectation that problems will be more severe under a more intensive system should not be looked upon as a deterrent. There appears to be enough information available now to indicate that chances of success are good.

Burrill, L. C. 1974. Influence of weed density on efficacy of diuron and cycloate. Paper presented at the annual meeting, Weed Science Society of America, Las Vegas, Nevada, USA, February 11-14.

Greenhouse and field tests were conducted to determine the relationship between weed density and efficacy of preemergence herbicides. Diuron and Italian ryegrass were used for most of the tests but cycloate on green foxtail was studied also. Atrazine on oats previously was used in greenhouse tests by other researchers.

In field tests diuron was applied preemergence at various rates to plots previously seeded with different densities of Italian ryegrass. In greenhouse tests seeds were planted into soil treated with the herbicides.

Under both greenhouse and field conditions, control of Italian ryegrass decreased as plant density was increased. In one greenhouse test, control dropped from 76% to 14% when Italian ryegrass density was raised from 10 plants to 100 plants per 7.6 cm square pots. This trend was observed both at high densities and at densities commonly observed in the field. Similar results were obtained from cycloate on green foxtail and atrazine on oats. Not all experiments showed this trend, however, and further research is needed to determine the reasons for this inconsistency. Diuron and atrazine are nonvolatile herbicides that enter the plant primarily through the roots and inhibit photosynthesis. Cycloate is a volatile herbicide that is taken up by the shoots and affects the meristematic region of the grasses. These differences suggest that the observed results may not be limited to the herbicides and plants studied.

The greatest effect of density on herbicide performance was at sublethal dosages. Since we usually do not get 100% control of weeds under field conditions, these results suggest that weed density may be another factor to consider in formulating herbicide recommendations.

No experiments were conducted to explain why herbicide effectiveness was reduced by increased weed population, but a logical answer seems to be a simple dilution effect.

Deutsch, A. E. 1973. India to Oregon--with Stopovers. WAR ON HUNGER, 7(2): 20-21.

Five experienced, degree-holding Indian plant protection officers participated in a nine month training program in the U.S. supported by AID in cooperation with USDA and land grant colleges and universities. The primary purpose was to provide a functional exposure to contemporary developments in extension training and application related to plant protection, with a long range goal of increased crop production from improved plant protection. The bulk of training occurred at Oregon State University where the five man team took part in field, classroom, and special activities, including a weed control short course carried out by the International Plant Protection Center at OSU.

Deutsch, A. E. 1973. Cyperus rotundus: the World's Worst Weed and What's Being Done About It. WORLD FARMING, 15(3): 12-13.

Due to its ability to regenerate rapidly from underground tubers, purple nutsedge, Cyperus rotundus, is an extremely difficult weed to control, competes vigorously with young crops, and has earned a reputation as the "world's worst weed." A variety of methods have been tested for effectiveness in controlling purple nutsedge. A recently developed chemical herbicide appears to be one of the most promising. However, no single control method, or combination of methods, can be applied universally with assured success. All local conditions have to be carefully evaluated to design a specific and effective control program.

Deutsch, A. E. 1973. New Twist in Weed Control. WORLD FARMING, 15(6): 12-13.

A new weed control technique developed in Oregon utilizes a narrow band of activiated carbon deposited over the seed row of a crop. Nonselective herbicide blanket sprayed on the ground surface is adsorbed by the carbon, providing a herbicide-free zone for germination of the crop while weeds between the rows are controlled. The finely ground activated carbon is mixed with water and applied as a slurry. The method was developed initially for grass seed producers, but is believed to have vast potential, particularly for high value crops.

Deutsch, A. E. 1974. Small Pesticide Application Equipment--Its Selection, Use and Maintenance. WORLD FARMING, 16(1): 21-23.
-also appeared as:
Deutsch, A. E. 1974. Equipos Pequenos Para Applicar Plaguicidas--Su Selecion, Uso y Mantenimiento. AGRICULTURA DE LAS AMERICAS, 23(2): 41-43.

The emergence of effective pesticidal chemicals in the last two decades has given rise to development of a new generation of efficient, lightweight small application equipment. An applicator should be selected on the basis of several factors such as the crop-soil complex, terrain, and labor situation, as well as specific design features. Equipment should be carefully calibrated before being used and operators require proper protective attire during application. Several procedures are important for correct maintenance of equipment and safe handling of pesticidal materials.

Deutsch, A. E. 1974. Some Equipment for Mechanical Control of Aquatic Weeds. International Plant Protection Center, Oregon State University. Illus. 18 pages.

Uncontrolled aquatic weeds can pose a threat in a number of ways to man and his environment. Whereas total erradication is often impractical, expensive and unnecessary, appropriate control systems are frequently desirable. Aquatic weeds can be controlled by mechanical, chemical, biological, or cultural means, alone and in combination. Mechanical control is generally considered to be cutting or dislodging of aquatic weeds (often with subsequent removal of the resulting cut organic matter from the water body) and can also include physical restraint of floating aquatic plant material. A number of firms worldwide manufacture specific equipment for mechanical control of aquatic weeds. The largest single category of equipment is floating, powered cutters/rakes. Other equipment includes dewatering units, barriers, hand operated cutters, and hydraulic dislodgers. (Fourteen items or systems are illustrated and briefly described, accompanied by a manufacturer's name and address list.)

Fisher, H. H., and E. Locatelli. 1974. A Partial Bibliography of Weed Research and Control Publications for South and Central America, the Caribbean, and Mexico - 1942-1972. (with Spanish and Portuguese sections). 179 pages.

Several thousand bibliographic listings have been collected and categorized in A Partial Bibliography of Weed Research and Control Publications for South and Central America, the Caribbean, and Mexico - 1942-1972, a new publication from the International Plant Protection Center at Oregon State University.

The bibliography was conceived and published as a tool for weed research and a source for researchers and students to utilize when conducting literature reviews. It is also envisioned as an aid to avoiding duplication in research, and hopefully as a vehicle for improving communications among the entire weed research community.

South America, Central America, the Caribbean, and Mexico constitute the four geographic sections of the bibliography, each printed on a different color paper to facilitate ease of use. Entries are listed by country of origin and are further segregated under four arbitrary categories: taxonomy, biology, weed control and physiology, and poisonous plants. The introduction and acknowledgements appear in Spanish, English, and Portuguese.

Material for the bibliography was obtained from a literature search, particularly the Bibliography of Agriculture (USA), Weed Abstracts, a number of Latin American periodicals, plus other journals. An inquiry mailed to researchers provided many additional references. The 1942-1972 time frame was selected as representative of the period in which most meaningful weed control research was performed, although there are a few entries from outside this era.

The publication is readily acknowledged to be a partial and incomplete compilation. However, it is believed to be the first and only published collection of specialized weed research references for Latin America and the Caribbean to date. The editors, H. H. Fisher and E. Locatelli, note in the introduction their interest in receiving additional information for possible future revised editions.

Miller, S. F., et al. 1973. Modeling of beef cattle production systems in Venezuela. Paper presented to the American Society of Agronomy, Las Vegas, Nevada, USA, November 11-16.

A systems simulation approach was used to develop a model of the Venezuelan beef cattle industry. Four policies for improving productivity of the national herd were tested. They were: Policy 1, Program to increase use of nitrogen on established pasture; Policy 2, Program to improve genetic quality of beef cattle; Policy 3, Program to improve natural pesticide productivity through spraying of undesirable woody plants; and Policy 4, Combination of Policy 1 and Policy 3.

Results indicated incompatibility between societal and governmental goals. Policy 1 maximizes net farm income, but Policy 3 minimizes the imports of meat and maximizes meat output. Decision makers need to be constantly aware of the possible inconsistencies in proposed policies.

Shenk, M., et al. 1974. Acción de various herbicidas en el control de malezas del algodonero en en Valle de Portoviejo. Paper presented to the second Asociación Latinoamericana de Malezas meeting, Cali, Colombia, January 28-30.

Various preemergent herbicides on cotton were tested at the Portoviejo Station of the Instituto Nacional de Investigaciones Agropecuarios (INIAP), Ecuador during the dry and wet seasons of 1972. The treatments studied were: fluometuron (25 kg a.i.), fluometuron + prometryne (2.0 + 0.5 kg a.i.), fluometuron + alaclor (2.0 + 1.5 kg a.i.), diuron + alaclor (0.8 + 1.5 kg a.i.), norea + alaclor (2.0 + 1.5 kg a.i.), alaclor + methazole (1.5 + 1.5 kg a.i.) prometryne + methazole (0.5 + 2.0 kg a.i.), oxadiazon (1.5 kg a.i.), fluometuron + diuron (2.0 + 1.0 kg a.i.), oxadiazon + alaclor (1.0 + 1.5 kg a.i.), manual control (4 weedings), and check (no control).

The plots treated with prometryne + methazole, oxadiazon + alaclor and oxadiazon (wet season) and prometryne + methazole and oxadiazon (dry season) yielded less than the manual control. The others were appreciably better. Methazole and oxadiazon were toxic to cotton. The best yields were obtained with fluometuron + alaclor, but the most economical treatment was diuron + alaclor. Weeds in the check plot reduced yields by 49 percent.

Shenk, M., et al. 1974. Estudio de la competencia de malezas en algodón bajo diferentes epocas de deshierbas en el Valle de Portoviejo. Paper presented to the second Asociación Latinoamericana de Malezas meeting, Cali, Colombia, January 28-30.

Cotton is a slow growing crop which, in conjunction with a small number of plants per hectar, indicates that considerable time passes before "complete closing" occurs. Prior to "complete closing" weeds compete vigorously with the cotton. Thus, it becomes necessary to establish the critical periods of competition for the several species of this crop.

This study was conducted at the Portoviejo Experiment Station of INIAP situated in a dry tropical zone with an average temperature of 25°C. and an average precipitation of 500 mm. which comes during the months of January - April.

Twenty treatments of varying weeding periods were tested in randomized block design. From the analysis it is concluded: weeds cause yield reductions of 3.9, 7.5, 38 and 50-59 percent when they compete with cotton for 20, 30, 45, 60 and 80 days from planting, respectively. When weeding was made at 30, 45 and 60 days, yield reduction was only 10 percent. Increasing the interval of weeding reduced yields further.

Shenk, M., et al. 1974. Estudio sobre el control del Solanum paniculatum con aplicaciones de herbicidas a los tocones. Paper presented to the second Asociación Latinoamericana de Malezas meeting, Cali, Colombia, January 28-30.

Solanum paniculatum is a woody plant that reaches three meters height and infests much of Northeast Brazil. An experiment was conducted to determine the efficiency of control of various combinations of picloram, 2,4,5-T, and 2,4-D. An evaluation of percent of dead plants with no regrowth showed as high as 90 percent kill with the best combination.

Appendix II - Project Personnel

Stanley F. Miller, Corvallis, Director and Agricultural Economist, July 1, 1973 to March 31, 1974.

Arnold P. Appleby, Corvallis, Acting Director, March 1, 1973 to July 1, 1973; thereafter, served as Support Agronomist, 20% FTE, July 1, 1973 to March 31, 1974.

Myron Shenk, Brazil, Research Agronomist, March 1, 1973 to August 11, 1973 in Corvallis; August 12, 1973 to March 31, 1974 in Brazil.

Herbert H. Fisher, Brazil, Research Agronomist, March 1, 1973 to June 14, 1973 in Corvallis; June 15, 1973 to March 31, 1974 in Brazil.

Larry C. Burrill, Corvallis, Support Agronomist, March 1, 1973 to March 31, 1974.

Allan Deutsch, Corvallis, Information Specialist, March 1, 1973 to March 31, 1974.

Georgena S. Knapp, Corvallis, Fiscal/Translation Specialist, March 1, 1973 to March 31, 1974.

Douglas Young, Brazil, Agricultural Economist, November 15, 1973 to December 31, 1973 in Corvallis; January 1, 1974 to March 31, 1974 in Brazil.

Guadalupe L. Garcia, El Salvador, Research Agronomist, March 1, 1973 to August 31, 1973.

Eduardo Locatelli, El Salvador, Research Agronomist, January 1, 1974 to March 25, 1974.

Frank Fraser, Corvallis, Technician, March 1, 1973 to March 31, 1974.

Ronald Burr, Corvallis, Support Agronomist, 10% FTE, July 1, 1973 to March 31, 1974.

Myrna Wade, Corvallis, Secretary, April 27, 1973 to March 31, 1974.

Dolores de Casanova, El Salvador, Secretary, March 1, 1973 to March 31, 1974.

Georgann Dobie, Corvallis, Secretary, March 1, 1973 to December 17, 1973.

Barbara Pleskac, Corvallis, Secretary, December 17, 1973 to March 31, 1974.

Christabel A. Stearns, Corvallis, Secretary, March 1, 1973 to April 25, 1973.

Student helpers, Corvallis, equivalent of three months during year.

Appendix III - Experiments

I. Substitution between labor and capital
   - A. Factors
     1. 3 levels of labor input
     2. 3 levels of herbicide
     3. 3 levels of technology
        - a. traditional - soil prepared with hoe, without fertilizer and low plant density.
        - b. modern - soil prepared with tractor, fertilizer, and high plant density.
   - B. Crops
     1. Corn
     2. Common beans
     3. Corn and beans in consortium
   - C. Measurement
     1. Yield
     2. Time
   - D. Uses
     1. Response surfaces
     2. Rates of substitution
     3. Optimal input rates
     4. Interaction
     5. Optimal yields

II. Herbicide Selectivity Trials
   - A. Treatments
     1. 35 different herbicides and combinations

B. Crops
   1. Corn
   2. Common beans
   3. Cow pea
   4. Mandioc (cassava)

C. Measurement
   1. Yield
   2. Weed Control
   3. Crop damage

D. Uses
   1. Identify promising herbicides
   2. Simple production function of certain herbicide (three levels)

III. Input Interactions

A. Factors
   1. 3 plant density levels
   2. 3 fertilizer levels
   3. 3 hoeing levels

B. Crops
   1. Corn
   2. Common beans

C. Measurement
   1. Yield
   2. Time

D. Uses
   1. Response surfaces
   2. Rates of substitution
   3. Optimal quantities of input
   4. Interaction
   5. Optimal yields

IV. Comparison of various weed control methods in relation to availability of labor

A. Treatments
   1. 11 different weed control methods containing manual, cultural and chemical components. (Emphasis on weed control aids to supplement labor availability.)

B. Crops
   1. Corn
   2. Common Beans

C. Measurement
   1. Yield
   2. Time
   3. Cost

D. Uses
   1. Compare different weed control methods as supplements to labor.
   2. Identify promising weed control systems
   3. Identify timing effects of weeding.

V. Comparison of manual,mechanical, chemical, and diverse integrated weed control systems.

A. Treatments
   1. 12 treatments comparing different manual, mechanical, chemical and combined weed control systems

B. Crops
   1. Corn
   2. Common beans
   3. Corn and beans

C. Measurement
   1. Yield
   2. Time
   3. Cost

D. Uses
   1. Compare different weed control methods
   2. Obtain technical coefficients for mathematical models
   3. Obtain cost data for mathematical models

USAID/OSU Weed Control Project
in cooperation with the
International Plant Protection Center and the
Agronomic Crop Science Department of
Oregon State University

WORLD DISTRIBUTION OF PUBLICATIONS[1/]

Country	Info-Letter 2/	Status Report 3/	HUNI 4/	Aquatic Weeds 5/	Manual de Metodos 6/	Equip-ment Manual 7/	Tropical Weeds 8/	Weed Seeds Sheets 9/	Cool Climate 10/	Weed Lists 11/	Weed Problems of Turkey 12/
Aden	1	--	--	--	--	--	--	--	--	--	--
Afghanistan	2	--	--	--	--	--	--	--	--	--	--
Algeria	2	--	--	--	--	--	--	--	--	--	--
Angola	1	--	--	--	--	--	--	--	--	--	--
Arab Republic of Egypt	7	--	--	--	--	--	--	--	--	--	--
Argentina	159	3	1	8	--	9	13	--	1	1	--

1/ *As of December 31, 1973*
2/ *A periodic newsletter issued free by IPPC*
3/ *EXPERIMENTAL HERBICIDES, STATUS REPORT BY CROP, 1973*
4/ *HERBICIDE USE AND NOMENCLATURE INDEX*
5/ *MALEZAS ACUATICAS/AQUATIC WEEDS*
6/ *MANUAL DE METODOS DE INVESTIGACION DE MALEZA*
7/ *MANUAL OF PESTICIDE APPLICATION EQUIPMENT*
8/ *TROPICAL WEEDS/MALEZAS TROPICALES*
9/ *TROPICAL WEED SEEDS SHEETS*
10/ *MALEZAS DE CLIMA FRIO/WEEDS OF THE COOL CLIMATE*
11/ *WEED LISTS (of various LDC's)*
12/ *WEED PROBLEMS OF TURKEY*

USAID/OSU Weed Control Project

WORLD DISTRIBUTION OF PUBLICATIONS 2

Country	Info-Letter	Status Report	HUNI	Aquatic Weeds	Manual de Metodos	Equip-ment Manual	Tropical Weeds	Weed Seeds Sheets	Cool Climate	Weed Lists	Weed Problems of Turkey
Australia	47	8	4	11	--	13	17	10	--	--	--
Austria	4	--	--	--	--	--	--	--	--	--	--
Bahamas	1	--	--	--	--	--	--	--	--	--	--
Bangladesh	1	--	--	--	--	--	--	--	--	--	--
Barbados	2	--	--	--	--	--	--	--	--	--	--
Belgium	11	--	--	--	--	--	--	--	--	--	--
Belize	5	--	--	--	1	1	3	--	--	--	--
Bermuda	1	--	--	--	--	--	--	--	--	--	--
Bolivia	14	--	--	2	--	10	7	--	--	--	--
Borneo	1	--	--	--	--	--	--	--	--	--	--
Botswana	1	--	--	--	--	--	--	--	--	--	--
Brazil	137	2	18	13	14	12	3	--	6	10	1
Brunei	1	--	--	--	--	1	--	--	--	--	--
Bulgaria	1	--	--	--	--	--	--	--	--	--	--
Burma	3	--	--	--	--	--	--	--	--	--	--
Burundi	1	--	--	--	--	--	--	--	--	--	--
Cambodia	1	--	--	--	--	--	--	--	--	--	--
Cameroon	5	--	--	--	--	1	--	--	--	--	--
Canada	118	4	--	11	--	25	6	--	--	--	--
Canal Zone	3	--	--	--	--	--	--	--	--	--	--
Central African Rep.	1	--	--	--	--	--	--	--	--	--	--

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WORLD DISTRIBUTION OF PUBLICATIONS

Country	Info-Letter	Status Report	HUNI	Aquatic Weeds	Manual de Metodos	Equip-ment Manual	Tropical Weeds	Weed Seeds Sheets	Cool Climate	Weed Lists	Weed Problems of Turkey
Chad	2	--	--	--	--	6	--	--	--	--	--
Chile	35	--	1	2	5	5	--	--	3		
Colombia	169	11	2	3	13	23	2	--	--	--	--
Costa Rica	37	--	--	3	4	1	8	--	1	--	--
Cyprus	2	--	--	--	--	1	--	--	--	--	--
Czechoslovakia	7	--	--	--	--	--	--	--	--	--	--
DDR (East Germany)	2	--	--	--	--	1	--	--	--	--	--
Denmark	10	1	--	1	--	2	1	--	--	--	--
Dominican Republic	7	--	1	--	--	3	--	--	--	--	--
Ecuador	35	--	--	1	--	2	--	--	--	--	--
El Salvador	27	--	--	1	20	2	7	--	1	--	--
England	104	10	--	14	--	24	14	--	2	--	1
Ethiopia	11	--	1	--	--	1	--	--	--	--	--
Fiji	4	--	--	--	--	--	--	--	--	--	--
Finland	6	--	--	--	--	--	--	--	--	--	--
France	26	4	2	1	--	5	3	--	--	--	--
Gabon	1	--	--	--	--	--	--	--	--	--	--
Gambia	1	--	--	--	--	--	--	--	--	--	--
Ghana	8	--	--	--	--	--	--	--	--	--	--
Greece	16	3	--	5	--	5	2	--	--	--	--
Guam	2	--	--	--	--	--	--	--	--	--	--

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WORLD DISTRIBUTION OF PUBLICATIONS

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Country	Info-Letter	Status Report	HUNI	Aquatic Weeds	Manual de Metodos	Equip-ment Manual	Tropical Weeds	Weed Seeds Sheets	Cool Climate	Weed Lists	Weed Problems of Turkey
Guatemala	29	--	--	--	19	1	--	--	--	--	--
Guyana	2	--	--	--	--	--	--	--	--	--	--
Haiti	2	--	--	--	--	--	--	--	--	--	--
Honduras	21	--	--	1	16	--	5	--	--	--	--
Hong Kong	5	--	--	2	--	1	9	--	--	--	--
Hungary	4	--	--	--	--	--	--	--	--	--	--
India	89	4	1	7	--	11	11	9	1	--	--
Indonesia	57	3	1	50	--	13	53	--	3	--	1
Iran	8	--	--	2	--	--	1	--	--	--	--
Ireland	10	2	--	--	--	--	--	--	--	--	--
Israel	17	1	--	2	--	1	4	--	--	--	--
Italy	21	--	--	3	2	3	1	--	--	--	--
Ivory Coast	2	--	--	1	--	--	--	--	--	--	--
Jamaica	9	1	--	4	--	3	6	--	--	--	--
Japan	45	5	--	6	--	4	6				
Jordan	3	--	--	2	--	--	--	--	--	--	--
Kenya	20	2	--	2	--	4	3	--	--	--	--
Korea	12	--	--	1	--	2	--	1	--	--	--
Lebanon	3	--	--	1	--	--	1	--	--	--	--
Leeward Islands	1	--	--	--	--	--	--	--	--	--	--
Lesotho	1	--	--	--	--	--	--	--	--	--	--

WORLD DISTRIBUTION OF PUBLICATIONS

Country	Info-Letter	Status Report	HUNI	Aquatic Weeds	Manual de Metodos	Equip-ment Manual	Tropical Weeds	Weed Seeds Sheets	Cool Climate	Weed Lists	Weed Problems of Turkey
Liberia	6	--	--	2	--	1	1	--	--	--	--
Libya	1	--	--	--	--	--	--	--	--	--	--
Malagasy Republic	1	--	--	--	--	--	--	--	--	--	--
Malawi	5	--	1	1	--	1	1	--	--	--	--
Malaysia	34	1	--	9	--	8	12	--	--	--	--
Malta	3	--	--	--	--	--	--	--	--	--	--
Mauritius	2	--	--	--	--	--	--	--	--	--	--
Mexico	104	1	--	9	8	12	15	--	--	2	--
Morocco	4	--	--	--	--	--	--	--	--	--	--
Mozambique	2	--	--	2	--	--	--	--	--	--	--
Netherlands	23	1	--	8	--	8	8	5	--	--	--
New Caledonia	3	--	--	--	--	--	--	--	--	--	--
New Guinea	5	--	--	2	--	2	3	--	--	--	--
New Hebrides	1	--	--	--	--	--	--	--	--	--	--
New Zealand	17	2	--	1	--	2	2	--	--	--	--
Nicaragua	25	1	--	6	--	1	20	1	--	--	--
Nigeria	15	1	--	--	--	2	--	5	--	--	--
Norway	10	--	--	--	--	--	--	--	--	--	--
Pacific Islands	3	--	--	--	--	2	--	--	--	--	--
Pakistan	13	--	--	2	--	16	2	--	--	--	--
Panama	26	2	1	3	1	5	5	--	--	--	--

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b

Country	Info-Letter	Status Report	HUNI	Aquatic Weeds	Manual de Metodos	Equip-ment Manual	Tropical Weeds	Weed Seeds Sheets	Cool Climate	Weed Lists	Weed Problems of Turkey
Paraguay	6	--	--	--	--	2	1	--	--	--	--
Peru	41	1	1	10	4	4	6	--	6	6	--
Philippines	34	4	--	5	--	5	8	10	--	--	--
Poland	5	--	--	--	--	--	--	--	--	--	--
Portugal	4	--	--	--	--	--	--	--	--	--	--
Romania	2	--	--	--	--	--	--	--	--	--	--
St. Lucia	1	--	--	--	--	--	1	--	--	--	--
Saudi Arabia	5	--	--	--	--	--	--	--	--	--	1
Scotland	4	--	--	--	--	1	--	--	--	--	--
Senegal	1	--	--	--	--	4	4	--	--	--	--
Seychelle Islands	1	--	--	--	--	--	--	--	--	--	--
Sierra Leone	3	--	--	--	--	--	--	--	--	--	--
Singapore	5	--	--	--	--	1	--	--	--	--	--
Solomon Islands	3	--	--	1	--	--	1	--	--	--	--
South Vietnam	10	1	--	--	--	--	--	--	--	--	--
Spain	9	--	--	2	--	1	1	--	--	--	--
Sri Lanka	9	--	--	1	--	--	--	--	--	--	--
Sudan	8	--	--	--	--	--	--	--	--	--	--
Surinam	2	--	--	--	--	1	--	--	--	--	--
Swaziland	1	--	1	--	1	1	--	--	--	--	--
Sweden	11	--	--	2	--	1	2	--	--	--	--

WORLD DISTRIBUTION OF PUBLICATIONS

Country	Info-Letter	Status Report	HUNI	Aquatic Weeds	Manual de Metodos	Equip-ment Manual	Tropical Weeds	Weed Seeds Sheets	Cool Climate	Weed Lists	Weed Problems of Turkey
Switzerland	23	3	1	9	--	6	5	--	3	21	2
Syria	1	--	--	--	--	--	--	--	--	--	--
Tahiti	2	--	1	--	--	--	1	--	--	--	--
Taiwan	14	1	--	2	--	1	2	--	--	--	--
Tanzania	8	--	--	--	--	1	--	5	--	--	--
Thailand	30	2	--	14	--	9	9	--	--	--	--
Trinidad	10	--	--	1	--	--	1	--	--	--	--
Tunisia	4	1	1	--	--	1	--	--	--	--	--
Turkey	11	--	--	--	--	8	7	--	--	96	--
Uganda	4	--	--	--	--	--	--	--	--	--	--
Upper Volta	--	--	--	--	--	1	--	--	--	--	--
Uruguay	14	--	--	1	--	1	1	--	--	--	--
U.S.S.R.	4	--	--	--	--	2	--	--	--	--	--
United States	1173	147	8	228	73	220	339	22	11	27	2
Venezuela	35	--	--	7	4	9	2	--	--	--	--
Western Samoa	6	2	--	2	--	2	4	--	--	--	--
West Germany	41	2	--	13	8	16	--	--	1	--	1
West Indies	--	--	--	--	--	--	1	--	--	--	--
Yugoslavia	4	--	--	--	--	--	--	--	--	--	--
Zaire	2	--	--	--	--	--	--	--	--	--	--
Zambia	4	--	1	--	--	3	2	--	--	--	--
Totals for 1973	3229	236	48	503	193	557	653	68	39	157	9