

INTERNATIONAL COUNCIL FOR DEVELOPMENT  
OF UNDERUTILIZED PLANTS

Semi-Annual Report on Winged Bean Program in Asia  
December 1980 - May 1981

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### Appendix

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Under the terms of the grant from the U. S. Agency for International Development (Program Description, Attachment I to Letter of September 29, 1981, Paragraph C), the International Council for Development of Underutilized Plants is required to make reports to ASIA/TR throughout the life of the project.

This report must address

- a) the work of the germ plasm centers in the Philippines and Papua New Guinea;
- b) the goals of each project calling for study, experimentation, and extension under priority areas of work;
- c) evaluation of the International Winged Bean Varietal Trials in Asia;
- d) evaluation of the Winged Bean Information and Documentation Service Center in the Philippines, and
- e) the international Seminar on the Potential of the Winged Bean.

Although the grant was approved and signed on September 29, 1980, notification that the Federal Reserve Letter of Credit, No. 72-00-1229 dated November 5, 1980 was received on November 12, 1980, effective November 29, 1980 and funds were not received for expenditure until December 2, 1980. During the period September until December 2, 1980, however, the Council made conclusive arrangements for the holding in Sri Lanka, from January 19-24 of the "2nd International Seminar on Winged Bean," including cooperation with the Government of Sri Lanka and the Sri Lanka Winged Bean Committee on the details of the Seminar program, selection of papers and participants, physical arrangements for the meetings and the exhibits, printing of necessary materials, local and international publicity, and undertook to raise additional funds for the Seminar. It also made arrangements for continued publication of The Winged Bean Flyer, the Council's semi-annual newsletter to coincide with the opening of the Seminar, the operation of the Winged Bean Information and Documentation Service Center, submission of reports on the first International Winged Bean Varietal Trials, review of criteria for selecting priority studies and experimentation to be supported, additional underutilized plants to be considered for support by ICDUP, and other matters.

The effective period covered by this report, however, is the six-month period from December 1980 through May 1981. The sections, below, as appropriate include summary reports on the preparatory and other work relative to each section which took place during the period September 29 - December 2, 1980.

A. Establishment and Continuation of Germ Plasm Centers in Asia

At the time of the signature of the grant agreement with AID the Council anticipated that a grant of \$25,000 from the Rockefeller Foundation would enable it to establish the Principal Germ Plasm Center at the Institute of Plant Breeding, University of the Philippines, Los Banos (\$18,000) and a Germ Plasm Subcenter at the Faculty of Agriculture, University of Papua New Guinea (\$7,000). During the period, September to December, it learned finally that the Rockefeller Foundation would not be in a position to make such a grant having terminated its central budget for germ plasm work, and that funds for the establishment of the Germ Plasm Centers would have to be secured from alternative sources.

It was decided to raise the question of germ plasm centers at the meeting of the Council's Winged Bean Steering Committee, scheduled to be held in Sri Lanka immediately preceding the 2nd International Seminar on Winged Bean. At this meeting, it was agreed that, absent sufficient funds to establish a principal center and until such funds were obtained, that the task of assembling winged bean germ plasm be assigned to a number of existing institutions where major work on winged bean was under way. The following regional centers were therefore proposed, with representatives of most of the institutions present at the Steering Committee meeting:

<u>Center</u>	<u>Responsible Officer</u>	<u>Region of responsibility</u>
University of Papua New Guinea, Port Moresby.	Dr. V. Kesavan	PNG, Pacific Island Countries.
University Kebangsaan Malaysia, Bangi, Malaysia.	Dr. B. S. Jalani	Malaysia, Indonesia, Philippines,
Thailand Institute of Scientific and Technological Research Bangkok.	Dr. N. Chomchalow	South China, Thailand, Indochina and Burma
University of Peradeniya, Kandy, Sri Lanka.	Dr. H.M.W. Herath	Sri Lanka, South India.
Bangladesh Institute of Agricultural Research, Bangladesh.	Director of the Inst. or his nominee.	Bangladesh, Eastern India, Western Burma.
Dept. of Crop Science, University of Ghana, Accra, Ghana	Dr. S. Karikari	Ghana and the adjoining countries.

However, the decision taken by the Government of Sri Lanka to establish an International Winged Bean Institute in that country may now make it possible to omit this interim step and plan instead for the early establishment of a principal and world-wide germ plasm center in Sri Lanka. This possibility is referred to below, in the discussion of the new Institute. Meanwhile negotiations were underway between the Council and the University of Papua New Guinea exploring the possibility of establishing a sub-center for winged bean collection in that country.

B. Study, Experimentation and Extension

The Council's Winged Bean Steering Committee at its meeting also reviewed the criteria to be followed by the Council in making grants in support of Priority Studies and Experiments. The subcommittee appointed to prepare such criteria included participants from the Tropical Products Institute, London (TPI). TPI has been engaged in a number of studies on winged bean and its representatives were invited by the Council to meet with the Steering Committee. The criteria, prepared in its final draft by Dr. A.A. Duncan of the University of Florida and two specialists from TPI, Dr. N. R. Jones, Deputy Director, and Dr. John C. Caygill, is circulating among other members of the Steering Committee. The draft appears in the Appendix as item 1.

Bearing these criteria in mind, the Steering Committee is reviewing the following proposals for study, experimentation and extension:

Dr. B. S. Jalani, Department of Genetics  
Universiti Kebangsaan Malaysia (The National University of Malaysia)

"Genetics of Protein and Oil Content and Yield Components of Winged Bean (Psophocarpus tetragonolobus)," a 2½ year project totaling \$15,000.

The purpose of the grant is to secure a better understanding of the genetics of winged bean so as to assist Malaysia in overcoming its food supply problems. The objectives of the study will be to determine types of gene action, heritability, paternal and maternal effects, number of effective factors, and genotypic and phenotypic correlations of protein and oil content, seed size, pod length, seeds per pod, pods per plant and other relevant characters of the crop, with emphasis on breeding for seed yield. The work is to be done in cooperation with the Winged Bean Growth Center at the Agricultural University of Malaysia. (The growth Center is sponsored jointly by the University and ICDUP.)

Dr. H. P. M. Gunasena, Dr. Y. D. A. Senayake, and Dr. Walter Herath Faculty of Agriculture, University of Peradeniya, Sri Lanka

"Germplasm evaluation and agronomic studies on winged bean, Psophocarpus tetragonolobus (L.) DC," a 2 year project totaling \$8,400.

Under the grant, local and introduced varieties of winged bean would be collected and evaluated for green pod, grain and tuber yield; desired characteristics, including potential for year-round production, would be incorporated in a crop improvement program; adaptability to the dry, wet and intermediate zones of Sri Lanka would be tested; and suitable agronomic practices would be determined. The grant is designed to provide the basis for continued and expanded work to be assumed ultimately by the new International Winged Bean Institute.

Dr. Dely P. Gapasin, Dr. Nelson M. Esguerra, Department of Crop Protection, Visayas State College of Agriculture, Baybay, Leyte, Philippines

"Collection, Identification and Seasonal Abundance of Insect Pests and Diseases of Winged Beans," 1 year study totaling \$8,500.

The objectives of the study are to collect and identify the insect pests and diseases affecting winged beans in the Philippines; to correlate severity of damage with population levels in the field; to correlate seasonal abundance of insect

pests and diseases with weather conditions existing in the various areas where the crop is grown; to collect and identify the natural enemies of these pests and to study their seasonal abundance.

Agreement has been reached in principle to support a project for which the Council approached the Coca-Cola Company for assistance and toward which that firm has made a grant. The project, as described below, involves the use of winged bean for Kampuchean refugees and concurrently a program to encourage winged bean cultivation among small farmers in Thailand.

Mr. Mechai Viravaida, Director, Community-Based Appropriate Technology and Development Services (CBATDS), Bangkok, and Dr. Narong Chomchalow, Deputy Governor, Thailand Institute of Scientific and Technological Research (TISTR) "Using Winged Bean to Provide Nutritious Food for Kampuchean Refugees and Improved Nutrition and Income for Thai Farmers," a 2 year project totaling \$23,600.

The purposes of the project are twofold: to promote the cultivation and use of winged bean as a source of nutritious food for Kampuchean refugees and for the Thai farmers who would market it, and to achieve the large scale, regular supply required by using an existing farmer network to promote cultivation of winged beans on small holdings, thus helping introduce winged bean into the Thai farming system. Distribution of seeds, extension information, and collection and marketing of farmer harvests to be done by CBATDS through its farm network. Seeds and technical information including assistance in second year in processing ripe seed into winged bean infant weaning food and edible oil, with residue for animal feed, to be provided by TISTR. Project is designed to affect nutrition and income while laying the basis for introducing larger and more regular cultivation and sale by small Thai farmer.

This project was discussed at the Winged Bean Seminar in Sri Lanka:

### C. Evaluation of the International Winged Bean Varietal Trials

A preliminary report on the 1st International Winged Bean Varietal Trials has been prepared by the Research Coordinator of the Council's Winged Bean Steering Committee. Breeding and selection of high yielding and adapted varieties are given high priority by the Council in the development of the winged bean. To initiate selection and stimulate varietal evaluation work particularly in areas where winged bean has recently been introduced for the first time, a series of uniform trials were recommended by the Steering Committee at its first meeting in 1976. The aims of the trial were to study the yield and yield related characteristics of a range of varieties in as many environments as possible, and to point out any production problems encountered. It was also hoped that the trials would help in selecting the most appropriate varieties in new areas as a first step towards introduction. Although the statistical analysis is still underway at this writing, certain tentative interpretations can be made.

The basic plan included 14 standard genotypes and one local control. In places where a local variety was not available, variety Chimbu (UPS 122) was recommended as filler. A randomised block design with four replications was applied. Each plot consisted of two 5 m long rows situated 0.5 m apart. Plot to plot distance was kept at 1 m and a border of any available variety was recommended on either side of the trial.

A guide or manual to ensure adequate plant nutrients, and disease and pest control was provided.

More than 60 trial kits were distributed. Data is now available from about 20 trials. However, only 15 trials have so far been examined - - 12 of which were undertaken in tropical and subtropical climates and three in more temperate climates (latitudes 31° to 35°).

A number of variations from the original design were necessary. For example, because there were insufficient quantities of Nigerian variety Tpt-1, this type was omitted from a number of trials. Thirteen varieties were, however, common to all trials. (In some locations, as, for example, Western Samoa, where driving monsoons collapsed the stakes and uprooted the plants, only one to 2 replications survived to provide the data. In other trials there were occasional missing plots.)

The coefficients of variation for three characters varied as follows:

	<u>C.V. %</u>
Days to flower	2- 34
Seed yield	11- 43
Tuber yield	39-122

Whereas coefficients of variations of this magnitude in yield are not uncommon in tropical environments, the variation in tuber yield is of some concern.

The preliminary results reveal significant variation in days to flowering. The Papua New Guinean varieties proved to be generally early flowering; the Southeast Asian varieties, late flowering. Of these, the Thai variety flowered ahead of the two Indonesian varieties.

It was apparent that photoperiod conditions as dictated by the date of sowing and latitude may affect date of flowering. However, such differences failed to explain moderately late flowering in Singapore, and relatively earlier flowering in Nepal when compared with Taiwan.

One variety, UPS 99 from Papua New Guinea, turned out to be the earliest flowering genotype with a range of 39 to 83 days. The early flowering habit of this variety has also been supported in trials conducted at latitudes 31° to 35°.

Papua New Guinean varieties also appeared as an early maturing group, maturing in less than six months. Indonesian varieties matured on the average between 183 to 223 days, whereas the Thailand variety took up to 340 days. At individual locations some P.N.G. varieties matured in less than 80 days and Indonesian varieties in up to 288 days. In Singapore and Nepal, Indonesian varieties were too late in flowering to yield.

Mean pod number per plot ranged from 183 to 383, but in Taiwan, UPS 102 produced an average 964 pods per plot. The Thai variety gave the highest pod yield.

Highest mean yield of seed was obtained in Taiwan trial. However, it was in Guatemala where UPS 62 produced an estimated 4,325 kg/ha, the highest yield in all the trials reported. Varieties LBNCI and Thailand yielded over 3,000 kg/ha in at least one trial. But the highest yielding standard variety yielded marginally lower than the local control in Ghana and at two locations in India; and moderately lower than the

local control in Sri Lanka. In the Philippines and Singapore, however, yields of the local control variety were greatly exceeded by the best standard varieties.

Both genotype and environment appear to affect seed size. All the South East Asian genotypes are large seeded ranging in 100 seed weight from 33.85 to 36.53 g. Variation between locations range from 24.70 g. in Nepal to 39.75 in Sri Lanka.

Sizeable tuber yields were available from only four locations, with Taiwan ranking as the best location. Indonesian variety LBNC3 appears in these tests to be the best yielder.

These uniform trials discussed have been useful in identifying varieties with overall potential, as well as specific potential in certain environments. The South East Asian varieties, showed on an average high yield, and lower stability which may be attributed to greater sensitivity to photoperiod conditions. Based on present data, six varieties can be recommended (see table attached). The length of growing season may present an important consideration, and if winged bean had to fit within a crop rotation, Papua New Guinean varieties would be the obvious choice. On the other hand estimated per hectare yield in Taiwan of 2,699 kg seed plus 12,523 kg tuber from LBNC3 would suggest the long growing season to be economically acceptable. Whereas both Indonesian varieties outyield UPS 122 consistently in tuber yield, the quality factor needs to be studied carefully: UPS 122 which under suitable management produces tubers of acceptable quality, yields over 12,000 kg of tubers per ha.

The trial results received so far have highlighted a number of problems that should be corrected in future yield trials. Trellis structure has been known to influence growth and yield and despite a standard trellis structure suggested in these trials, local variations have occurred. Emergence and establishment has varied due to difference in seed viability and local conditions. Although varietal differences are within a limited range of 28 to 33 plants per plot, locations varied between 7 to 42. It is planned to study the per plant yield in further analysis of the data but its value is questionable in view of insufficient understanding of the relationships between genotype and plant population. More important, a lack of sufficient genetic diversity and preponderance of Papua New Guinea germ plasm, which seem to be specifically adapted to tropical highland conditions, has limited the usefulness of these trials. Only three non-PNG varieties were uniformly represented and within PNG genotypes, genetic variation for yield has been shown to be very limited. The trials omitted observations on soils types and on nodulation, which besides explaining some of the differences in growth and yield may have also been useful from the N<sub>2</sub> fixation point of view, a very important consideration in evaluation of winged bean as a crop.

Further, more than half the cooperators had little experience in handling such trials and their data collection has been inadequate. Finally, a significant proportion of trial sets were not planted.

#### D. Second International Cooperative Winged Bean Varietal Evaluation

At the second International Seminar it was agreed to proceed with the arrangements for a Second Cooperative Winged Bean Varietal Evaluation. Planning for such a second set of variety trials, including preliminary arrangements for selecting varieties and assembling seeds, had been begun by the Council in anticipation of the decision likely to be reached in Sri Lanka. A total of 24 varieties of Psophocarpus tetragonolobus and one variety of Psophocarpus scandens were nominated. Those selected

are from Papua New Guinea, Malaysia, Thailand, Nigeria, India and Bangladesh. The P. scandens variety (Illinois 66) has been recommended for its usefulness as a forage and cover crop.

In all there will be five types from Papua New Guinea, brown to black in seed color and high yielding, one additional from PNG, one of the earliest flowering types known, also from Papua New Guinea, but not high yielding; two of the best known from Nigeria; one from Malaysia (with the possibility of a second being selected as well); a Sri Lankan variety with cream colored seed, (a seed color in particular demand for processing purposes); five seed and tuber types, including those best known for tuber yield from Thailand; five very high yielding types from Bangladesh, and one seed producing type from India. In addition two Indonesian varieties from Gadja Mada University appear promising for inclusion having done very well in trials in Malaysia and Perth, Australia. There are expected to be a few more nominations from Philippines, and hopefully Burma, Vietnam, and possibly China. Variety Chimbu (UPS 122 from Papua New Guinea) will be included as international control.

Approximately 24 institutions and persons have, thus far, asked to participate in the Trials. Local costs for the trials are expected to be met by the individual cooperators.

It was agreed that the trials should be simple and make as few demands as possible on cooperators' resources; that the genotypes selected represent a wide genetic base; and that those institutions conducting successful trials in the first series of variety tests be given priority in distribution of trial sets.

Cooperation has been secured from Prof. J. Q. Lynd of Oklahoma State University, Stillwater for the inclusion of soil analytical data, from Dr. Jake Halliday and Dr. Bill Kerrey of the NifTAL Project of the university of Hawaii for provision of rhizobium and instructions for including data on nodulation, from Dr. Terry Price of La Trobe University, Australia for assessment of pest and disease infestation, from Dr. Yap of the Agricultural University of Malaysia on modification of the suggested data sheets, and from Dr. R. B. Singh, Regional Genetic Resources Officer, Southeast Asia, International Board for Plant Genetic Resources (IBPGR), Bangkok, on the trials design and the trial manual.

The manual providing instructions for the management of the 2nd Cooperative Winged Bean Variety Trials has been completed and is being circulated to participants. This provides a Fieldbook for recording of data and environmental management records, describes the experiment, identifies the varieties and their importance for seed, green pod, and tuber, gives planting instructions, information on site selection, land preparation, irrigation, fertilization, field layout, plant support, cultivation, information on pest and disease management, harvesting, and itemizes the data required. These latter include number and weight of pods, grain yield, tuber yield, date of flowering, date of first and last harvest of ripe pods, hundred seed weight, quality of seed, disease and insect scores, soil analyses, number and weight of nodules, other observations and data analysis. (A copy or copies once printed, of the Manual can be supplied, if desired, to AID for use in Washington and/or the field offices.)

At the conclusion of the Trials, the Trial Coordinator will prepare a report for distribution. Results will be entered into the computer maintained at the Councils' Information and Documentation Service Center at AIBA/SEARCA in the Philippines, and published in an appropriate scientific journal.

The Coordinator of the 2nd International Variety Trials is Mr. Wong Kai Choo, Department of Agronomy and Horticulture, University Pertanian Malaysia (the Agricultural University of Malaysia) and Director of the Winged Bean Growth Center being sponsored jointly by the Council and the University.

During the reporting period the council made a one year grant of \$3,000 to the Growth Center to cover the cost of airmailing of seeds, and rhizobium, printing and distribution of the working manual, provision of import permits and phytosanitary certificates for exported seeds, correspondence, stationery and miscellaneous.

#### E. Documentation and Information Services

Soon after the Council was established, in January 1978, the Agricultural Information Bank for Asia (AIBA) headquartered in the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA), Los Banos, Philippines was invited by the council to be responsible for the international documentation center for the winged bean program. There are two aspects to this program: 1) The operation of the computer bank at AIBA for storing and ready retrieval of all current and past information on winged bean, copies of studies, experiments, reports of winged bean projects, etc., and, 2) publication and distribution of the Council's semiannual newsletter, The Winged Bean Flyer.

Because of funds secured through the assistance of the Council, no funds were required for maintenance of the winged bean Information and Documentation Service Center during the period under review. A request for funds to continue these services has been forwarded to the Council by AIBA/SEARCA. During the review period, the Center continued to collect and store material and to make them available to winged bean workers. A revised draft data collection form is now being designed and will shortly be sent to members of the Council's Winged Bean Steering Committee for comments and suggestions. The Information and Documentation Service Center has been meeting requests for copies of documents although no requests have yet been received for research data. There are now close to 600 entries in the bibliographic data base and it is expected this number will be more than doubled to 1500 entries or over within twelve months. The Center's first winged bean annotated bibliography has been published with other funds secured with the Council's assistance and the second volume is expected to be published before the end of 1981.

Also, with other funds secured for SEARCA through the Council's efforts, it was possible to arrange for publication of Vol. 3, No. 1 of The Winged Bean Flyer, the semiannual newsletter, which was distributed at the time of the Second International Seminar on Winged Bean in January 1981, and Vol. 3, No. 2, the copy for which has now been sent to AIBA for publication. A copy of Vol. 3, No. 1 is enclosed as Item II in the Appendix. Vol. 3, No. 2 of the Flyer is expected to be published in August 1981.

The Council continues to receive requests for back issues of the Flyer from institutions and individuals. Back issues are now provided at cost. Until the present time, the Flyer has been distributed without charge. In the forthcoming Vol. 3, No. 2, recipients of the Flyer will be advised that in an effort to make the publication self-supporting, we will be charging for subscriptions and mailing costs beginning with Vol. 4, No. 1. The subscription and mailing costs will be as follows: U.S. \$6.00 for two issues a year, plus \$2.50 for sending by surface mail and \$10.00 by airmail.

Subscription forms will be included in the publication.

Vol. 3, No. 2 will include summaries of presentations made at the Second International Seminar for Winged Bean. A copy will be sent to the AID Washington office and to offices the Missions in Asia as soon as it has been published.

F. 2nd International Seminar on Winged Bean

The 2nd International Seminar on Winged Bean, sponsored jointly by the Ministry of Agricultural Development and Research of the Government of Sri Lanka and the Council was held in Colombo, Sri Lanka from January 19 through 24, 1981. Approximately 200 persons from approximately 34 countries, most from the developing world, attended the seminar. A total of 81 technical papers were submitted for presentation. Since there was insufficient time to arrange for presentation of all, 48 were selected for oral presentation; the remainder were reproduced for distribution to the participants while a few were presented in such fashion that they could be visually displayed among the numerous Seminar exhibits. The meetings were accompanied by meetings of the Winged Bean Steering Committee, separate meetings of the African and of the Latin American participants, and a two-day field trip to agricultural research stations and winged bean research plots in Kandy, Mahalluppallama and Anuradhapura. On the fifth day a Planning Session was held to consider the direction of future work.

The Seminar was opened with addresses by the Prime Minister of Sri Lanka, the hon. R. Premadasa; the minister of Agricultural Development and Research, Mr. E. L. Senanayake; Professor Cyril Ponnampereuma, Director, Laboratory of Chemical Evolution, University of Maryland (and unofficial Science Advisor to the President of Sri Lanka) who delivered the principal address; and Dr. J. D. Drilon, Jr., President of ICDUP. A copy of Dr. Ponnampereuma's address appears as Item III in the Appendix.

As an indication of his support for their deliberations, the President of Sri Lanka, the Hon. J. R. Jayawardene and Mrs. Jayawardene hosted a reception and tea party for the delegates in the gardens of his historic official residence, President's House.

The Seminar covered five principal areas:

- Germplasm, Genetics and Crop Improvement
- Physiology
- Agronomy
- Entomology and Pathology
- Utilization, Food, Nutrition and Processing

It was evident from the data presented and the lively discussions that knowledge of winged bean is expanding, that it is in good hands, and that there have been significant findings with respect to winged bean in the three years since the holding of the first winged bean meeting in 1978. It was evident that the network of cooperating scientists worldwide, which ICDUP had set about to establish has expanded and is firm. As reported by one participant, "This seminar has been successful from several points of view, not least of which has been the spirit of sharing knowledge among a truly international group of scientists whose combined expertise over a comprehensive range of disciplines provide a broad base of understanding from which ideas for the development of this underutilized crop will emerge."

Reports were given of experiments in propagation of winged bean by tissue culture — now under way in such diverse, but cooperating centers as the University of Houston, the University of Maryland, and the University of Paris (with interest expressed as well by the Batelle Northwest Pacific Laboratories). Good work is going forward on the nitrogen-fixing properties of winged bean, particularly with the cooperation in the ICDUP program of such centres as the NifTAL Project of the University of Hawaii. Intensive work on the properties and quality of soils and the relationship to yield of winged bean, a hitherto comparatively neglected area, is now underway. Considerable evidence was introduced on the responses of genotype to environment widening understanding of the environmental requirements of the plant. The responses of flowering, pod set and development and tuber initiation and development were reported upon and the controlling effects of photoperiod and temperature confirmed. It was confirmed that shade does not have adverse effects upon flowering in the tropics so that it should be possible to grow winged bean successfully under or in association with other crops.

A certain number of possibly day-neutral plants have been discovered as well as a rather large number of no-shattering varieties. Evidence was introduced indicating possible toleration of some winged bean lines to water logging.

There was evidence of record yields. Reports were given of yields of 22-60 t/ha of fresh green pods, 3-6 t/ha of mature or ripe seed, and 15-17/ha of tubers.

More evidence was introduced on the biology and identification of pests and diseases although more is needed on their relative importance and on their effect on yields

Substantial work was reported on utilization of winged bean for food, on nutritional properties of plant parts, processing methods and products, as well as the use of winged bean parts for animal feed. A considerable amount of information was reported on levels of winged bean protein derived from various plant parts and on fat and other constituents. Further evidence was reported on the clear nutritional benefits of winged bean foods to infants and young children as demonstrated by clinical tests in Czechoslovakia, Vietnam and Ghana. The introduction of winged bean into an African community in the Ivory Coast was reported as having been achieved and evaluation is now underway.

The Planning Session, to which all participants were invited, reviewed the work done, provided an opportunity for an intensive, critical overview of the work done and remaining, and provided an opportunity for consideration of future priorities. Certain important gaps in the work done thus far were highlighted and stress placed on the importance of working in these areas. Thus, it was pointed out that although much remains to be done to assemble germ plasm in scientific and usable fashion, and although good, important beginning work is being done on tissue culture techniques, too little has yet been done on plant breeding. Similarly, although the figures on yields are encouraging, these are based on extrapolations from limited- sized experimental plots.

Some of the participants believed it best to place primary emphasis and resources on the development of the winged bean as a subsistence crop while at the same time providing some, through perhaps lesser resources for the longer-term job of breeding self-standing, determinate varieties suitable for large-scale commercial agriculture. Though this view tended to be supported by many a number of participants believed that we can raise our sights well above the subsistence level without waiting for the self-standing determinate variety to be discovered. It was held that through use of

improved varieties and better cultivation techniques it was possible to secure adequate, regular and large-scale production of winged bean seeds, immature pods, tubers and leaves by relying on farmers with small holdings, and collecting and marketing the harvests following the pattern used, for example, in the Philippines for collecting and marketing fruit. (An experiment among small holders following this pattern is about to be launched in Thailand, with ICDUP support, as described above in the section on priority studies and experiments.)

It was pointed out that the farmer will plant winged bean only if he can make money out of it — and at least secure a return for his energy and resources equal to or better than the return he now receives from other farm products. It was felt essential therefore that the present popular work on utilization of winged bean as a marketable commodity — as a green vegetable, as a processed food and animal feed, as a food constituent, must go on concurrently with efforts to increase yields on small scale plots and to determine how best to introduce the winged bean into existing farming systems so that even as a viny crop it will yield the farmer an economic return. To be competitive the goal must be larger scale, regular and competitively priced harvests on which sellers and processors can depend. Virtually no experimental studies have been undertaken on introducing winged bean into existing farming systems, particularly the farming system of the small holder.

Similarly, it was pointed out that more work must be done on the tuber, on varieties and cultivation methods most likely to result in high yields, on its improved nutritional composition, and on the removal of its antinutritional substances. More work must be done on the nutritional levels of plant parts at different stages of developments. More work must be done to demonstrate the nutritional effects of use of winged bean parts as an animal feed (for poultry, swine, cattle, carabou, goats, rabbits, etc.) to determine the economics of use and to investigate use of winged bean as fodder. Too little is known of the effect on soil fertility and on other crops of use of winged bean as an intercrop, a cover crop, or a fallow crop.

It was unanimously agreed to continue ICDUP's effort to expand its network of specialists and practical agriculturists cooperating informally on winged bean, to continue its existing information and documentation program including publication of The Winged Bean Flyer, to expand winged bean work to areas outside of Asia where substantial interest in winged bean continues to grow, and to plan for future meetings to review accomplishments, share findings, and review the shape of proposed future work. It was agreed to pursue a list of agreed upon priorities for studies and experimentation to hold another and broader international set of selected winged bean trials, incorporating data on soil quality and content, nitrogen fixation, etc., and to proceed as rapidly as possible to establish centers for the collection, evaluation and distribution of winged bean germ plasm.

The Seminar participants briefly reviewed the results of a survey made by the Council seeking nominations by specialists throughout the world of additional underutilized plants which it should consider supporting. The Council had hoped to be able to select between two and three underutilized but potentially promising plants on which to work, once winged bean was well on its way and no longer needed council support. The survey resulted in 69 plants being nominated for further study by an almost equivalent number of specialists. It was agreed that the search should be turned over to a committee designated by the council. Three criteria were proposed: that at least one plant be a plant to meet world food and nutrition requirements; that another be a plant that would provide a source of scarce and essential energy; and third that at least one of the plants be indigenous to an arid zone.

Preparations are now being made to publish the proceedings of the 2nd International Winged Bean Seminar. With ICDUP's assistance, a grant was secured to meet the editorial costs of the preparation of the papers and this work is now underway. The Council is attempting to secure funds for publication which it is hoped can begin in the autumn of 1981.

Two additional potentially important developments took place during the course of the Seminar. With funds which it was able to secure to support the Seminar and with the support of the joint ICDUP/Sri Lanka Seminar Organizing Committee, a deliberate effort had been made to identify Seminar participants from Africa and from the Latin American region. Separate meetings were held with the participants from Latin American and, subsequently, from the African regions to attempt to determine local interest in greater collaboration between them and the role that ICDUP might play to encourage this. Both groups indicated they had anticipated the usefulness of some sort of informal relationship between them and others in their respective region to work on winged bean and (in the case of Latin America) other underutilized plants that might be of interest in their individual countries, and welcomed the interest of ICDUP in facilitating such cooperation. The local groups each selected a person to undertake the preliminary correspondence to determine the nature of the cooperation sought, the areas of possible collaboration, and the possibilities of coordinated action — advising ICDUP of developments. Depending on the response ICDUP would attempt to provide such support as might be required.

(In the arrangements the Council was able to reach with the Government of Sri Lanka on the financing of the conference, the Government agreed to meet room and board costs of all participants. In all, the Government of Sri Lanka and local Sri Lanka businesses contributed approximately \$39,042. The council was able to raise over \$118,000 for the conference, making it possible to invite participants largely from developing countries, throughout the world. In addition to support for the conference which the Council received from AID, it was able to secure support from FAO, the U.S. National Science Foundation, the Australian Development Assistance Bureau, the Coca Cola Corporation, and the Bank of America Branch in Sri Lanka. The Council also encouraged other organizations to make grants totalling approximately \$25,000. directly to proposed conference participants. These included, for example, the International Foundation for Science (Sweden, 1 grant); the Battele Pacific Northwest Laboratories (1 grant); the University of Houston (partial grant for one faculty member); the University of Florida (grant for one faculty member); Southeast Asian Regional Center for Graduate Study and Research in Agriculture (2 grants); the Rockefeller Foundation (1 grant); the Atkins Group (England - 3 grants); The Asia Foundation (Indonesia program - 2 grants; Korea program - 1 grant); and the Asian Vegetable Research and Development Center (Taiwan - 1 grant). The Council was also instrumental in getting The Asia Foundation, Sri Lanka program, to make two grants, totaling \$15,916, to the Sri Lanka Conference Coordinating Committee to help defray other local costs of the conference.)

The most significant development arising out of the conference, however, was the Council's role in encouraging the President of Sri Lanka to establish an International "Dambala"\* Winged Bean Institute. Several meetings were held with the President during the course of the Seminar. The President, who is a strong supporter of winged bean, stated that he would announce the establishment of the Institute, to be located in Sri Lanka and to be partially supported by the Government. The Council was requested by the President to assist in the organization and establishment of the Institute and its President and Secretary General were invited to sit on the institute's Board.

\* The Sinhalese name for winged bean.

A draft Charter for the Institute was then prepared, with the assistance of the Council.

Announcement of this development was made during the planning Session and warmly welcomed by the participants. The implications of the establishment of the institute and its relations with ICDUP were reviewed. Future information on the emerging Institute was agreed would be made available through The Winged Bean Flyer.

#### G. The International Dambala Winged Bean Institute

Since the announcement by the President of Sri Lanka in January, a number of important steps have been taken toward the establishment of the Institute. Government has agreed to gift approximately 493 acres of prime land to the new Institute. The land is situated near the city of Kandy in the heart of Sri Lanka and adjacent to the farm of the University of Peradeniya. The land is conservatively valued at approximately \$4,200. per acre (over \$2 million in all), excluding the value of the buildings, roadways, electric and telephone lines, and water and sewage systems already in place. The buildings can be refurbished at minimal cost to make them suitable for use as offices, workshops, warehouses, etc.

Coconut, coffee, cacao and rubber grow on part of the land, yielding the Institute some income and also making it possible to test winged bean as a cover crop on such plantation agriculture.

The proposed Charter and the designation of land has now been approved by the Cabinet of Sri Lanka. At present writing the legislative draftsman is preparing the legislation to be introduced in Parliament establishing the Institute. No difficulty is expected in securing passage of this legislation and Parliament is expected to act favorably during August 1981.

At the request of the Government of Sri Lanka, the Council has identified a number of persons, from various parts of the world, who will be named to be members of the Board of Trustees. The President, on the nomination of the Minister of Agricultural Development and Research will, name the first ten members of the Board. The Board is expected to hold its first meeting in the early autumn of 1981. Thereafter, it will assume full responsibility for the Institute, including the naming of additional members of the Board, as it may determine.

The Institute is expected to be funded through contributions from Sri Lanka, bilateral and multilateral institutions and agencies and indications of such interest have been secured from a number.

#### H. Winged Bean Growth Centers

The Council continues to provide support to the Malaysian Winged Bean Growth Center of which it is a cosponsor with the Universiti Pertanian Malaysia (the Agricultural University of Malaysia) for basic studies and experiments applied to the needs of farmers in the region. During the period under review, the Center has continued its collection and evaluation of germ plasm, conducted seed multiplication studies and made preliminary observations of yield, evaluated selected varieties, screened genetic materials for protein, trypsin inhibitor, oil content, photosensitivity, and nitrogen fixing ability, and conducted physiological and agronomic studies.

The Center now has a total of 264 accessions from Nigeria, Papua New Guinea, Burma, Ghana, Sri Lanka, Bangladesh, Indonesia, Thailand, the Philippines, and Malaysia.

Recordings on morphological and agronomic characteristics on each accession were carried out following the "Minimum List of Descriptors" prepared by the Regional Committee for South East Asia of the International Board for Plant Genetic Resources (IBPGR) with whom the Council works closely. Seeds obtained from this planting were used for the screening of genetic materials indicated above.

A total of 96 of the collected accessions were planted in unreplicated 5 meter rows and recording of yield and yield components carried out on a per row basis. The information gathered from this experiment was used to complement those from the Germ Plasm Collection plots for selecting materials for advanced yield trials and for selection of parents for breeding work.

Screening of genetic materials for protein, trypsin inhibitor and oil content was carried out in collaboration with the Department of Biochemistry, University of Malaya. This was done in an attempt to identify genetic materials with high protein, low and heat labile trypsin inhibitor level and high oil content with favorable composition.

The Center is also attempting to identify those of its accessions that may be insensitive to photoperiod. The Center hopes to be able to develop a classification system for winged bean genetic material based on photosensitivity.

The screening process for nitrogen fixing ability will be carried out in cooperation with the NifTAL Project of the University of Hawaii and is likely to follow the acetylene reduction techniques proposed by Wacek and Brill (1976).

A number of physiological and agronomic studies were carried out involving the response of the crop to varying environmental conditions, including change in environment effected through increased plant density.

Future work will include testing of about 15 lines with high seed yield in two locations in Malaysia and genetic improvement work designed to breed genotypes with high seed and/or tuber yield together with good palatability and nutritive value, wide range of adaptability and high nitrogen fixing ability. The data assembled in the Center's Germ Plasm Collection together with some other data from yield trials and physiological studies will be used for this breeding work. Further physiological and agronomic studies will also be carried on to determine the response of the crop to different hormonal sprays and various cultural practices.

During the reporting period the Council made a one-year grant to the Malaysia Winged Bean Growth Center in the amount of \$15,000 to carry out this proposed further screening of genetic materials for protein, trypsin inhibitor, oil content, photosensitivity, and nitrogen fixing ability, for advanced yield trials in at least two locations in Malaysia, for plant breeding to improve genetic lines, and for further physiological and agronomic studies.

#### Additional Growth Centers

Further exploration was undertaken of the possibility of establishing a Latin American Growth Center in Mexico under the joint sponsorship of the Instituto Nacional de Investigaciones Agricolas (INIA) of Mexico and ICDUP.

I. Death of Dr. J. D. Drilon, Jr.

On June 13, after a short illness, Dr. J. D. Drilon, Jr., President of the International Council for Development of Underutilized Plants since its founding, died unexpectedly in Manila. Dr. Drilon, Jr. was one of the founders of the Council in which he strongly believed. He was active in helping bring about the establishment of the new International Winged Bean Institute and looked forward eagerly to helping shape its new work and the nature of its cooperation with the Council.

Dr. Drilon's death is a heavy blow to the Council and he will be missed for his many contributions to the organization, for his wise advice and guidance and for his warm and generous friendship to those who were privileged to work closely with him. But he has left an organization that is well on the way to establishing its reputation for useful work.

At the end of the reporting period, the Board of Directors of the Institute was engaged in a search for a new President of the Council.

As interest in winged bean has grown, the Council is becoming recognized as the center for the latest and most accurate information on winged bean -- varieties available, cultivation and harvesting techniques, nutritional qualities, chemical composition, uses, processing, studies and experiments conducted, and the scientists involved worldwide. The Council has been asked to serve as consultants to such institutions and organizations as the Philippine Council for Agriculture and Resources Research (PCARR, on processing and marketing potential for winged bean in the Philippines), for Appropriate Technology International (ATI), by The Asia Foundation, Pacific Alliance Institute, and as indicated below, by the University of Guam. (See Appendix, Item IV). It now works closely with such distinguished bodies as the International Board for Plant Genetic Resources (IBPGR, which participated in the Sri Lanka conference) and the Tropical Products Institute of Great Britain (TPI), which sent its Deputy Director and a member of its scientific staff to the conference, and which has assisted the Council in redefining its study and action priorities.

INTERNATIONAL COUNCIL FOR DEVELOPMENT  
OF UNDERUTILIZED PLANTS

APPENDIX

- I. Guidelines for Research Grant Submissions  
(ICDUP Winged Bean Steering Committee Projections 1981-84)
- II. The Winged Bean Flyer, Vol. 3, No. 1
- III. Address by Dr. Cyril Ponnampuruma at Opening Ceremony,  
2nd International Seminar on Winged Bean, "The Winged Bean  
and the World Food Crisis"
- IV. Contributions Received and Counterpart Contributions Made  
Since September 29, 1980

RESEARCH THRUSTS

1. Germplasm Collection

A. Objectives

- (i) Determine the range of variability within three species of Psophocarpus ie. tetragonolobus, scandens, palustris.
- (ii) Make materials available to plant breeders.

B. Strategy

- (i) Appoint Germplasm Collection and Screening, Committee to provide leadership and continuity in this effort, which must extend to Asia, SE Asia, Africa and Oceania.
- (ii) Establish a centre for collecting, cataloguing, testing, evaluating, storing and maintaining germplasm.
- (iii) Make materials available to plant breeders.

2. Crop Improvement

A. Objectives

- (i) Homozygous lines for greatly reduced segregation (variability) within lines.
- (ii) Specialised lines and combinations for green pods, dry seeds, storage roots, leaves, for food, feedstuff, oil, forage, soil improvement and ground cover.
- (iii) Dwarf lines - short internodes - determinate -

self supporting for single destructive harvest,  
and lines with minimum or no photosensitivity.

- (iv) Lines with highest nutritional content and lowest proportion of anti-nutritional factors of various plant parts.
- (v) Low pod wall fibre so that pods of large size remain edible and shattering of dry pods is reduced.
- (vi) Seed coats more permeable to water and easier to remove (dehull).

#### B. Strategy

- (i) Indeterminate habit (climbing or trailing) through -
  - (a) Selection and inbreeding
  - (b) Hybridisation and variety synthesis
- (ii) Determinate habit (dwarf type) through -
  - (a) Worldwide search for naturally-occurring dwarf types to be encouraged by cash reward.
  - (b) Mutation breeding coupled with tissue culture technology and genetic engineering.

### 3. Reducing Environmental Stress

#### A. Objectives

- (i) Efficient production (input:output)
- (ii) Local adaptation

#### B. Strategies

- (i) Rhizobium studies
- (ii) Cultural practices, studies, such as:  
crop establishment, supports and vine training,  
irrigation, fertilisation, plant density and  
arrangement, use of growth substances.

- (iii) Studies of effects of moisture, drought, environmental stress.

#### 4. Reducing Biological Stress

##### A. Objectives

- (i) Control of insects, nematodes, diseases, weeds, rodents.

##### B. Strategies

- (i) Resistant, vigorous, well-adapted varieties
- (ii) Chemical protectants
- (iii) Introductions of predators and parasites that feed on harmful insects and creation of conditions favourable to these beneficial insects.
- (iv) Alteration of soil conditions to favour beneficial rhizobia and discourage nematodes.
- (v) Detailed studies of insects, diseases and nematodes affecting winged beans with special attention to viruses that might infect other food plants in areas where winged beans are not now grown ... special attention to Phaseolus beans

#### 5. Harvesting and Handling

##### A. Objectives

- (i) Uniform senescence
- (ii) Non-shattering pods
- (iii) Uniform seed and seed coat maturation and moisture content.

##### B. Strategies

- (i) Variety development
- (ii) Study of differences in permeability to water.

## 6. Post-Harvest Physiology

### A. Objectives

- (i) Prevent loss of dry seeds, pods and edible root tubers to insects and diseases.
- (ii) Prevent loss of food value.
- (iii) Prevent (retard) loss of seed germination.
- (iv) Understand conditioning of seed for planting or for food and feed uses.

### B. Strategies

- (i) Chemical treatment of seeds.
- (ii) Mixing of winged bean seeds with those of other legumes to reduce insect infestation.
- (iii) Controlling temperature and humidity for dry seed storage.
- (iv) Determination of optimum moisture content for stored seed.
- (v) Determination of methods for conditioning stored seed prior to planting and using for food.

## 7. Product Development

### A. Objectives

- (i) Development of wholesome and palatable food and feed products such as: flour, milk, TVP, oil, protein isolates, etc.
- (ii) Combination of winged bean products with more conventional products.

### B. Strategies

- (i) Biochemical and physical analyses of plant parts, plant products and extracts.

- (ii) Determination of available nutrients coupled with animal feeding trials.
- (iii) Screening of selections for special useful attributes.
- (v) Development of methods of removing beany smell and flavour.
- (vi) Development of machinery appropriate for small-scale processing of seeds for oil, flour, milk, etc at the village level.

## 8. Economics and Marketing

### A. Objectives

- (i) Develop model production and distribution enterprise analyses for different locations to estimate resources required for intensive and extensive production.
- (ii) Develop model processing and enterprise analyses to estimate the amount of raw product required for efficient manufacture of various products.

### B. Strategies

- (i) Develop cost of production estimates for various locations, production and distribution systems.
- (ii) Develop cost of manufacture estimates for large and small-scale processing units.

## 9. Outreach Thrusts (Extension and Education)

### A. Objectives

- (i) Popularise winged bean products and increase skills in production and use.
- (ii) Create an understanding of the benefits from eating winged beans.

- (iii) Create an awareness of the financial benefits from growing and selling winged beans.
- (iv) Increase production and distribution of winged bean seeds of recommended varieties.

B. Strategies

- (i) Demonstrations and tests (at no risk to growers).
- (ii) Publications - production guides and recipes.
- (iii) Local workshops to provide information to outreach personnel.
- (iv) Film with soundtrack in different languages (such as film produced in Thailand).

SECOND INTERNATIONAL SEMINAR ON THE WINGED BEAN (DAMBALA)

THE WINGED BEAN AND THE WORLD FOOD CRISIS

Cyril Fonnampereuma  
Professor of Chemistry  
Director, Laboratory of Chemical Evolution  
University of Maryland

Monday, January 19th, 1981

BANDARANAIKE INTERNATIONAL CONFERENCE HALL

COLOMBO, SRI LANKA

I am deeply honoured by the invitation extended to me by the Organising Committee of the Second International Seminar on the Winged Bean to address you this morning. It is a privilege to stand on this platform with the Honourable Mr. Premadasa, Prime Minister of Sri Lanka, with the Minister of Agriculture, the Hon. Mr. Senanayake, and the President of the International Council for the Development of Under-Utilized Plants, Dr. Drilon.

Although my own current research is with problems, perhaps more removed and beyond the earth, during the last few years, I have had the rewarding experience of working closely with the Scientists in Sri Lanka involved in the study of Dambala and shared their hopes and aspirations concerning the development of this miracle bean.

You will pardon me, ladies and gentlemen, if I strike a personal note here and speak to you of an occasion that transformed me into an ardent devotee of this wonder bean. Two years ago I had the opportunity to discuss with his Excellency President Jayawardene various promising potential scientific developments in Sri Lanka. At that meeting, from out of his collection of briefs, he pulled out a cutting from Time Magazine, referring to the Winged bean. This news clipping had appeared soon after the publication of the brochure on the Winged Bean by the United States, National Academy of Science highlighting the incredible potential of this little known plant. He asked me whether I knew about this plant. "Of course", I responded, "this is Dambala which I ate as a child and which grew almost wild in my back yard in Galle." His Excellency was delighted. He responded that he would like to make Sri Lanka the Dambala capital of the world. This pregnant declaration has become a legend before its time. To the already active programme of cultivating Dambala in Sri Lanka headed by the able group of scientists Dean

Senanayake, Professor Herath and Dr. Fernando came a new impetus, new prospects, and a world horizon. Events moved fast after that. The week long workshop in 1979, the intense planning and discussions with Mr. Lazaroff, the Secretary General of the International Council for the Development of Under-Utilized Plants, and now this international gathering. It is perhaps most significant as a meaningful step in this hopeful sequence that the second international conference on Dambala is being held in Colombo. From this would follow the concerted plan of development and the blue print of an International Dambala Research Center in Sri Lanka.\* The moment for deliberations in this context are most timely. The world food crisis has attained uncontrollable proportions. In the year 2000, our planet earth will be the home of seven billion people, double today's population. It is a sobering thought that almost all the females who are going to give birth to those children of Century 21 are already with us. It will not suffice to double our food production. We must at least triple it. Two third's of humanity are already suffering from an 'inadequate protein balance', as the experts say, or in common language 'they are starving.'

In the past twenty years thanks to the green revolution, miracle rice and miracle wheat, we have increased world food production by 40%, but during that period the world population doubled. The gap between the number of hungry people and the amount of food needed to feed them has thus widened. Hunger is spreading, unchecked by marches, fasts, public declarations or charity. Every one supports these noble causes in theory, but, in practice there are no easy

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\*This center, although now only a gleam in the eye of President Jayawardene may one day take its place among the leading agricultural research institutes of the world, be the storehouse of knowledge, the repository of germplasm, and the laboratory from which may come, to use a phrase from Rice Research, the IR8 of Dambala.

solutions to the problem. The reduction of population is an obvious answer, but the numerical stabilization of the human race is not achieved in a decade, in two, or even in half a century. Thus at least for another generation we must turn to science and technology for the solution.

The prognosis is bewildering to the layman. We have on the one hand, rank pessimism, and on the other a certain Utopian scientific optimism. We have the modern echoes of Malthus: the 'population bomb' of Paul Erlich, 'Limits to Growth' by Meadows and Meadows, and other studies by the club of Rome which have highlighted the enormous problem and left many in a state of utter despair. After the World Food Conference sponsored by the United Nations some highly respected world experts even advocated the totally unthinkable and absolutely abhorrent solution of triage. 'Let the hungry die of starvation', they said. 'Let the strong and well of the world conserve the food for themselves'.

On the other hand there were those, who professed a certain exuberant optimism that science can solve all problems. Francis Bacon gave us his idea of Utopia. The modern proponents of this concept quote the great and significant developments in science - the conquest of space, the taming of the atom, as examples. 'If we can land a man on the moon, surely, then we can solve our food problems' The Apollo programme was, without a shadow a doubt, a supreme triumph of science and technology. It will go-down in all human history as one of man's greatest achievements, the casting off of the shackles which bound us to the earth and gave us the exhilarating freedom to explore the universe. But, perhaps, there is a fallacy in this reasoning. The truth may lie between the dismal pessimism and the over-confident exuberant Utopian optimism of some scientists.

The International Union of Pure and Applied Chemistry, the mother organisation of all chemists, in a program entitled

Chemical Research Applied to World Needs, has recently given much attention to the problem of world hunger. The questions which are raised have been looked at in their stark reality. Can we resolve the world food shortage by cultivating unused land and making the desert bloom? If our object is to triple food production the economic obstacles are over-whelming. Every loaf of bread produced requires 3-4 tons of water. Can we instead increase the productivity of the land presently under cultivation? Again a tangible increase would require five hundred million tons more fertilizer per year. How then can we prevent the food gap from becoming an unbridgeable abyss? World food specialists have come forth with new suggestions - create new foods, render edible materials that were formerly discarded, ignored, or underutilized. In this last category what better object for our study than Dambala. ¶ The chemical synthesis of food is a tantalizing area for exploration. If we can make the material of our shirts, we can also make the substance of our breakfast and our lunches! Carbohydrates arise from the fixing of Carbon, Hydrogen, and Oxygen. Proteins, similarly result from the same three elements with Nitrogen thrown into the bargain. The laboratory of nature achieves this result through the complex process of plant photosynthesis and animal metabolism. In the laboratory of modern chemistry the short cut from molecules to meals is within scientific reach. The science fiction story of the eighth floor restaurant serving a gourmet dinner with the only raw material, the coal in its basement, need not be a mere technological fantasy.

The sea which covers 70% of the earth's surface now supplies only 2% of our food. Its productivity can be increased and the ancient art of aquaculture, invented by the Chinese, practiced by the Romans, and assiduously cultivated by the Japanese, can have a major impact on the world's food supply. Algae from the oceans and protein from algae, are slogans

which have more than an empty ring. Single cell protein, biomass production, enzymatic conversion of cellulose into starch are areas of continuing research in the frontiers of food science. Today's epoch making discoveries of "Recombinant DNA" have opened up horizons of mind-boggling proportions. We are on the threshold of major new advances. Scientific knowledge doubles every five years today. A century ago it took fifty years. Today on January 19th 1981, ninety five percent of the science that will regulate our lives in the year 2000 is unknown to us.

In spite of all this hope and expectation and while we are hankering after an International Apollo type, mission oriented program for the conquest of hunger we cannot ignore what Mother Nature through billions of years of evolution has perfected for us like the Dambala in my childhood backyard of Ruhuna. It is not my purpose at this session to attempt to explore even remotely some of the aspects of the cultivation, propagation, and utilization of Dambala. The experts present here will examine, debate and analyze them during the next few days. But, to me, it is a baffling enigma of inscrutable dimensions that a plant of such miracle attributes such as the winged bean has been virtually ignored so long. Could you think of Poland without the potato, or Italy without the tomato? Indeed there were times when before the discovery of the new world these crops were unknown in the regions where they are staples of sustenance or a major part of the food inventory. The analogy is self evident. It is not often given to man to rediscover a crop like rice or wheat or maize. Ladies and Gentlemen we are privileged to be partners in a monumental act of Regeneration. We are indeed thrilled that from this dark obscurity Dambala has now achieved a meteoric international standing as a potential world food source. The impartial scrutiny by scores of competent international investigators has not only held up

its high expectations, but has further enhanced its reputation as a valuable world food crop ready to be exported. The papers presented in Manila in January 1978, brought together results of the early research. Today only 3 years later, a wealth of data will be presented to this conference. Over a hundred representatives from 30 countries have assembled together to explore further what needs to be done in research, institution building, development, popularization, propagation, marketing and appreciation of Dambala. Ladies and Gentlemen, participants of this congress, I am confident that your deliberations during the next four days will have a profound impact on the place of Dambala in Sri Lanka and the rest of the world. The world looks to you in the hope that one more decisive and deliberate step will be taken in the conquest of hunger and avert the single most important crisis that will face the developing world of the twenty first century. It is to us a gratifying prospect that this major contribution will come from the third world itself, with Sri Lanka playing a central role. May I conclude with a refrain from the lines of the well known scientist, inventor, humanist and poet who enamoured of Dambala after the 1st Seminar wrote the following lines,

Dr. Buckminster Fuller of California:

Noduled tuber  
 Pole bean tall  
 Flower, Seed Pods  
 Edible All  
 Who's the Fairest  
 Bean of all.....?

DAKBALA

INTERNATIONAL COUNCIL FOR DEVELOPMENT  
OF UNDERUTILIZED PLANTS

CONTRIBUTIONS RECEIVED AND COUNTERPART CONTRIBUTIONS MADE  
SINCE SEPTEMBER 29, 1980

CONTRIBUTIONS

Food and Agricultural Organization (FAO)	\$ 20,000.00
U.S. National Science Foundation	30,000.00
Australian Development Assistance Bureau	11,670.00
The Coca-Cola Company	10,000.00
Bank America Foundation	5,000.00
Bank of America, Colombo Branch	1,500.00
Contributions by Individuals	<u>270.50</u>
TOTAL	\$ 78,440.50 <sup>a</sup>

<sup>a</sup>In negotiations with Pacific Alliance Institute of California, the Council has agreed to provide its services at \$225. per day plus travel, telex and cable costs, and \$75. per month for administrative costs for a period of up to 20 days and beginning c. November 1981, \$20,000 per year for a period of up to 5 years as a retainer for consultancy and advisory services for an Indonesian project expected to begin at that time. (Eight months after the agreement on the retainer goes into effect, the Council may propose renegotiation of the amount if the amount agreed upon has proved insufficient to meet Council costs.) The agreement with the Institute is being drafted for signature.

## COUNTERPART CONTRIBUTIONS

Grants made by other organizations to cooperators in Council's winged bean program on direct request by Council:

<u>Purpose</u>	<u>Grantee</u>	<u>Org.</u>	<u>Amount</u>
Six month research grant to test use of ripe winged bean seed as component of chicken feed, plus cost of services of Philippine research scientist from Dept. of Animal Science, University of the Philippines, Los Banos	Univ. of California Berkeley, Davis	The Asia Foundation	\$10,000
Support for pre-seminar costs of Sri Lanka winged bean seminar committee	Sri Lanka Seminar Committee	Asia Foundation, Colombo	8,030
Support for local costs of Sri Lanka Seminar	Sri Lanka Seminar Committee	Asia Foundation, Colombo	7,886
Winged Bean Growth Center, Malaysia	Agricultural Univ. of Malaysia	Asia Foundation, Kuala Lumpur	10,000

Purpose	Grantee	Granting Org.	
Participation in 2nd International Winged Bean Seminar	Mrs. S. H. Lubis, National Biological Institute, Indonesia	Asia Foundation,	942
"	"	"	
"	Mrs. H. Z. Syukri, Horticultural Research Institute, Indonesia	"	942
"	"	"	
"	Sri Kuntjijati Haryono, University of Gadjah Mada, Indonesia	Rockefeller Foundation, Indonesia	960
"	"	"	
"	Dr. B. S. Jalani, University of Malaysia	Intl. Fdn. For Science	776
"	"	"	
"	Mr. Wilfred T. Smith, Battelle Pacific N.W. Laboratories	Battelle	2,000
"	"	"	
"	Dr. S. Venketeswaran, University of Houston	Univ. of Houston	500
"	"	"	
"	Dr. A. A. Duncan, University of Florida	Univ. of Florida	2,248
"	"	"	
"	Dr. John C. Caygill, Tropical Products Institute, England	TPI	2,535
"	"	"	
"	Dr. N. Jones, Tropical Products Institute, England	TPI	2,535
"	"	"	
"	Dr. Nazmul Haq, The University, Southampton, England	W. S. Atkins Group	2,775
"	"	"	
"	Dr. L. G. Chubb, Livestock feed specialist, England	W. S. Atkins Group	2,775
"	"	"	
"	Mr. Lee St. Lawrence, Intl. Protein Research Co., England	W.S. Atkins Group	2,775
"	"	"	
"	Prof. Kim Ki-jun, Konkuk Univeristy, Korea	Asia Foundation Korea	2,619
"	"	"	
"	Mrs. J. C. Sison, Agricultural Information Bank for Asia, SEARCA, Phils.	SEARCA	962
			\$ 61,260

Brought Forward

\$ 61,260

OTHER COUNTERPART CONTRIBUTIONS TO SEMINAR

Sri Lanka Ministry of Agricultural Development and Research	\$ 19,166
Sri Lanka Department of Agriculture	2,222
Sri Lanka Foundation Institute	6,155
Sri Lanka Agrarian Research and Training Institute	8,400
Sri Lanka National Science Council	833
Haychem (Ceylon) Ltd.	550
Sri Lanka Water Resources Board	1,166
Ceylon Tobacco Company	<u>550</u>

\$ 39,042

GOVERNMENT OF SRI LANKA REQUEST FOR ICDUP SERVICES

The Ministry of Agricultural Development and Research of Sri Lanka requested the services of the Secretary General of ICDUP in the preparation of plans for the proposed International Winged Bean Institute including final review of arrangements for the proposed Charter of the Institute. They agreed to meet all local costs of his visit. The Secretary General was in Sri Lanka from April 20 through May 6, 1981. The total cost incurred by the Government of Sri Lanka is estimated at approximately \$30 per day for 17 days, or a total of

510

Brought Forward

\$ 100,812

COUNTERPART CONTRIBUTIONS ON PROJECTS DIRECTLY FUNDED BY COUNCIL

<u>Purpose</u>	<u>Grantee</u>	<u>Council Support</u>	<u>Counterpart Contribution</u>
International Winged Bean Varietal Trials II	W.B. Growth Center, Malaysia	\$ 3,000	\$15,000 <sup>1</sup>
Research Coordination, Winged Bean Steering Committee	Research Coordinator, Dr. T. N. Khan, Australia	1,285	10,500 <sup>2</sup>
2nd International Winged Bean Seminar, Sri Lanka		109,639	23,000 <sup>3</sup>
Winged Bean Growth Malaysia	Agricultural Univ. of Malaysia	15,000	<u>41,300<sup>4</sup></u>

\$ 89,800

COUNTERPART CONTRIBUTION UNIVERSITY OF CALIFORNIA, BERKELEY, DAVIS

The contribution made by the University of California on both the Berkeley and Davis campuses, to the project referred to on p. 1, above (use of ripe winged bean seed as a constituent of chicken feed) - - in staff, laboratory facilities, equipment, clerical support, etc., over and above the grant received from the outside, is estimated, conservatively, as amounting to

5,495  
\$ 196,107

ADDITIONAL DEVELOPMENTS

The following additional developments, on Guam and in India, may also be considered as affecting the total of "Counterpart Contributions."

1. Services of one research scientist.
2. One-third time of research scientist, office space, equipment.
3. Does not include amount contributed to the Sri Lanka Winged Bean Committee for support of the Seminar, already included in the Counterpart Contributions listed on pp. 1 and 2, above.
4. Total comprises following:
 

2 Research Personnel	\$ 30,000
Laboratory Assistant	2,000
Field Assistants	2,000
Glass house, laboratory space, land, land preparation, cold room storage	5,000
Additional laborers	<u>2,300</u>
	\$ 41,300

The letter of agreement for this grant was signed on March 24, 1981.  
The funds were transmitted in April.

During the past year the Council took the initiative to encourage the College of Agriculture and Life Sciences of the University of Guam to submit its first proposal under the U.S. Department of Agriculture's fund for support of work in tropical agriculture (Section 406 of Public Law 89-808), with a project on winged bean. (The winged bean grows on Guam and has been there probably since the 17th century.) The purpose of the project was to promote knowledge and use of winged bean on Guam and ultimately to make Guam a center from which information on winged bean could be made available to neighboring islands in the South Pacific.

The Council engaged in discussions with people on Guam, with administrators of the USDA's tropical agriculture program who were headquartered in Fresno, California, and at the latter's suggestion, with representatives of the University of Hawaii. It assisted the University of Guam in drawing up a suitable winged bean proposal, helped develop the appropriate involvement of the University of Hawaii, and with the University of Guam, discussed the possible involvement, also, of the South Pacific Commission.

A four-year winged bean project has now been approved by the USDA; funding, which was to begin on June 1, 1981, will amount to something over \$100,000 for the University of Guam over the four years, or \$25,000 per year. The NifTAL Project of the University of Hawaii is also to receive approximately \$70,000 over the same period, of which \$15,000 would be made available during 1981-2. The Council will provide technical assistance in the planning and operation of the Guam project.

The amount thus far contributed by the University of Guam and the NifTAL Project, University of Hawaii in preparing the project, including staff time, clerical help, office space, materials, etc. is estimated at approximately \$3,000.

Total counterpart under the Guam project during this reporting period is estimated therefore at \$3,000 plus \$25,000 University of Guam, and \$15,000 NifTAL Project, University of Hawaii, or \$43,000.

\$ 43,000

At the request of the Indian Council of Agricultural Research and the Indian National Bureau of Plant Genetic Resources (New Delhi), the Council participated in a meeting on winged bean and other underutilized plants of particular interest to India, held in New Delhi, and in a subsequent meeting with officials of the Indian Council and the Indian Ministry of Agriculture. The purpose was to develop local interest in winged bean and other underutilized plants and to encourage government action in support of research on them.

This initial discussion has now resulted in action by the Indian Planning Commission to establish an "All-India Coordinated Program on Underutilized Plants" which includes action on winged bean. Funds for the Program under the four remaining years of the present Indian Five Year Plan are already available. The amount anticipated is Rs. 1,900,000, or approximately \$243,590 over the four-year period; the amount for the first year of the program, beginning April 1981, is expected to be approximately \$61,000.

The Council has been asked to return to India, with costs being met by that Government, to assist in the organization of the program and in the examination of projects submitted by Indian institutions for funding under the program.