AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523

BIBLIOGRAPHIC INPUT SHEET

FOR AID USE ONLY
Batch #35

1. SUBJECT CLASSIFICATION

A. PRIMARY: Serials — Y-AF30-1410-0000

B. SECONDARY: Agriculture--Plant breeding--Leguminous grains and vegetables--Beans

2. TITLE AND SUBTITLE
Evaluation of the potential for improvement of the mungbean as a major food grain legume; progress report,1974

3. AUTHOR(S)
(101) Mo. Univ. Agr.Exp.Station

4. DOCUMENT DATE: 1974

5. NUMBER OF PAGES: 10p.

6. ARC NUMBER: ARC

7. REFERENCE ORGANIZATION NAME AND ADDRESS
Mo.

8. SUPPLEMENTARY NOTES (Sponsoring Organization, Publishers, Availability)
(Adm.summary only)

9. ABSTRACT

10. CONTROL NUMBER
PN-AAB-818

11. PRICE OF DOCUMENT

12. DESCRIPTORS
Beans
Mungbeans?

13. PROJECT NUMBER

14. CONTRACT NUMBER
AID/CM/ta-C-73-36 Res.

15. TYPE OF DOCUMENT

AID 590-1 (4-74)

AID/CM/ta-C-73-36 Rec
PN-AAB-818

EVALUATION OF THE POTENTIAL FOR IMPROVEMENT OF THE MUNGBEAN AS A MAJOR FOOD GRAIN LEGUME

Second Progress Report
Contract No. AID/CM/ta-C-73-36
31 December 1974

Department of Agronomy
College of Agriculture
University of Missouri-Columbia
Columbia, Missouri 65201

Office of Agriculture
Bureau for Technical Assistance
Agency for International
Development
Washington, D.C. 20523

SECOND PROGRESS REPORT
Contract No. AID/CM/ta-C-73-36
December 31, 1974

A. REPORT SUMMARY

1. Project Title: Evaluation of the Potential for Improvement of the Mungbean as a Major Food Grain Legume.

2. Principal Investigator: J. M. Poehlman, 201 Waters Hall, Columbia, Missouri 65201.

3. Contract Period: May 14, 1973 through May 13, 1975.

4. Period Covered by Report: January 1, 1974 through December 31, 1974.

5. Total AID Funding of Contract: $25,000

6. Total Spending Prior to this Reporting Period: $4,853.97

7. Total Spending During this Reporting Period (12/1/73 through 11/30/74): $13,313.36

8. Balance to be Expended During Remainder of Contract Period (12/1/74) through 5/13/75): $6,832.67

B. NARRATIVE SUMMARY OF ACCOMPLISHMENTS AND UTILIZATION

1. Genetic Evaluation of Germ Plasm

One hundred and ninety-five strains of mungbeans were grown in a replicated trial at Columbia in 1974 and over 1200 new introductions were grown in single rows. The new introductions were obtained from Thailand, Taiwan, Nigeria, Philippines, Peru, Papua-New Guinea, Australia, and many other areas. Data collected is being tabulated for distribution to mungbean research workers as in previous years. A heavy virus infection was present at Columbia in 1974 and there was a wide range of reaction among the various strains. Strains which had been resistant in previous years, such as M101, were resistant again in 1974. Duplicate strains from different sources are being identified.

2. International Mungbean Nursery

The Third International Mungbean Nursery was distributed in 1974 to thirty-nine cooperators in eighteen countries. The nursery contained the high yielding strains from the two previous nurseries as well as new strains from Oklahoma, Peru, India, Korea, Thailand, and other countries. Data from the First and Second International Mungbean Nurseries grown in 1972 and 1973 have been published and distributed. Strain M350 from Korea was highest in yield in both nurseries. Other high yielding strains are M317 (China), M409 (Peru), M101 (India), M374 (MG50-10A from the Philippines) and M411 (Hybrid 45 from India). M374 has excellent seed quality. Seeds of three high yielding strains, M350, M317, and M101, have a dull luster which is undesirable in the market. M101 has superior resistance to the virus disease at Columbia.

3. Research on Basic Breeding Problems

Research is being conducted on a range of breeding problems.

(A) Interaction of temperature and photoperiod on growth and flowering of mungbean strains is being studied in the growth chamber. Differential varietal response to photoperiod has already been demonstrated in the IMN and confirmed by growth chamber studies. These studies are providing information useful in understanding the specific adaptation of mungbean strains.

(B) Inheritance of seed color and luster has received attention since several of the highest yielding varieties in the IMN have dull seed luster. A texture layer arising from the inner pod membrane has been identified on the seed surface of dull varieties. If the texture layer is absent or removed, the shiny seed coat becomes visible. Green color is due to presence of chlorophyll in the parenchyma layer. Brown color of seeds is due to presence of a brown pigment in the outer texture layer and masks the color of the shiny seed coat underneath.

(C) A virus disease present in the field at Columbia has been shown to be spread by insect vectors. The virus may be transmitted mechanically, or by the cowpea aphid. There is no evidence of seed transmission.

(D) Crosses of mungbeans with closely related species and with a tetraploid strain are being attempted. Currently we are evaluating embryo culture techniques to grow immature embryos following interspecific crosses.

REPORT FOR PERIOD JANUARY 1 THROUGH DECEMBER 31, 197

A. GENERAL BACKGROUND

The purpose of this contract is to explore the potential of the mungbean (Vigna radiata (L.) Wilczek) as a high protein grain legume crop with a broad climatic adaptation.

B. PROJECT OBJECTIVES

1. To examine the genetic potential within the mungbean species and to identify characteristics of the mungbean plant important for its genetic improvement.

2. To conduct a mungbean screening nursery in cooperation with interested mungbean research workers in other countries and with international research institutes to learn the potential climatic adaptation of selected strains.

3. To conduct research on breeding problems that will contribute to improvement of the mungbean crop.

C. CONTINUED RELEVANCE OF OBJECTIVES

The importance of the objectives have not changed.

D. ACCOMPLISHMENTS TO DATE

Objective No. 1: To Evaluate the Genetic Potential of the Mungbean Species.

This is the fifth year that we have been growing mungbeans for evaluations of their genetic potential. A summary of the number of strains grown during each of the last five years is given below.

Year	Total Number Strains Grown	Number New Strains Grown	Origin of New Strains
1970	321	321	USDA, Oklahoma, RPIP, India
1971	203	43	Korea, Hong Kong, India, Thailand
1972	116	52	Philippines, Canada, Peru, India, Thailand
1973	473	356	India, Thailand, Hong Kong, Philippines, RPIP
1974	1575	1380	RPIP, AVRDC, IRRI, IITA, Philippines, Peru, Papua-New Uinea, Australia

Of the new entries grown in 1973, 228 came from the collection returned to the U.S.D.A. when the Regional Pulse Improvement Project (R.P.I.P.) in Iran was terminated. The large number of new entries in 1974 included 256 additional strains from the RPIP project, about 100 strains collected by Earl Watt in Thailand, and collections sent from the Asian Vegetable Research and Development Center (AVRDC) in Taiwan, from the International Rice Research Institute (IRRI) in the Philippines, and from the International Institute of Tropical Agriculture (IITA) in Nigeria, as well as other sources.

The evaluation of the germ plasm available is far from complete. The USDA Plant Introduction Station, Experiment, Georgia, has over 1100 strains collected in India with PL480 funds that we have not grown. All new entries that come directly to us are shared with the USDA Plant Introduction Station so that they may be entered into the permanent P.I. collection that they maintain. We are not maintaining a permanent collection of these strains at Columbia, Missouri.

In the past we have taken fairly complete notes on the mungbean strains that we grew, published the data collected, and made it available to mungbean research workers around the world. Our data for 1974 will not be as complete because poor stands were obtained as a result of heavy rains at the time of planting and because of extremely heavy virus damage. While virus was present in previous years the amount of damage in 1974 was much greater and meaningful notes on plant type, height, yield, and primary yield components such as pods per plant could not be taken since they would reflect the virus reaction rather than the genetic yield potential of the strain.

Objective No. 2: <u>To Conduct an International Mungbean Nursery</u>.

Data from the Second International Mungbean Nursery were received from 18 cooperators in 11 countries. The data have been published as Missouri Agriculture Experiment Station Special Report 171, "Performance of the Second International Mungbean Nursery". The test sites ranged from 3° to 49° N. latitude and represented widely different environments. The strain M350 from Korea was the highest yielding variety in the IMN for the second year. M409 from Peru, a new entry, was second in yield, and M317 from China, which ranked second in 1st IMN test was third in yield. Two new entries, M411 (Hybrid 45 from India) and M374 (MG50-10A from the Philippines), ranked 4th and 5th, respectively. M137 was the earliest variety to flower, and M374, M317, and M101 had the largest seed weight. At the low latitudes all strains tended to be short and flower early. Three of the high yielding varieties, M350, M317, and M101 have rough, dull seeds. A virus (or virus complex) was the most common disease being reported from nine locations. Research is needed on identification of mungbean diseases and methods for evaluating disease resistance.

The Third International Mungbean Nursery was distributed in 1974 to 39 cooperators in 18 countries. A performance report will be published when the data is received.

Objective No. 3: To Conduct Research on Mungbean Breeding Problems.

Several areas of basic research are being pursued.

(A) Temperature-Photoperiod Response. Studies of Bashandi and Poehlman (1974) showed that flowering of mungbean was delayed and plant height increased as the photoperiods were increased from 12 to 16 hours. Some strains failed to flower at the 16 hour photoperiod. The results corroborate observations in the First International Mungbean Nursery in which 28 strains grown at low latitudes in short photoperiods had a narrow range in days to flowering, with the range becoming wider with increases in photoperiod at the higher latitudes. Data from both the plant environment chambers and the First IMN emphasize that strain differences in photoperiod response will not be observed when mungbeans are grown in the short photoperiods of the low latitudes. A differential response to temperature among strains was also suggested from the IMN data and this is currently being checked in plant environmental chambers.

(B) Inheritance of Luster and Color in Mungbeans. Three mungbean varieties ranking high in yield in the IMN have seed with a dull luster in contrast to the shiny luster desired in the marketplace. We observed that the dull luster of mungbeans is caused by the presence of an outer texture layer which originates from the inner pod membrane. The texture layer may contain a brown pigment which gives the seed a brown color. In the absence of the pigment the texture layer is translucent and the seed coat color is visible through the texture layer. Inheritance of the brown color in the texture layer is independent of the inheritance of the seed coat color.

(C) Identification of Vectors Transmitting Mungbean Virus. A search was made for possible vectors of the virus present in mungbeans at Columbia. When insects were excluded by growing virus susceptible strains in insectproof cages, the mungbeans remained healthy in contrast to the virus diseased mungbeans growing outside of the cages. It has been shown that the cowpea aphid collected from virus infected mungbean plants will transmit the virus and may be the primary vector. The virus can be mechanically transmitted also, but we have no evidence to support seed transmission. Studies of secondary hosts and studies of the virus particles through electron microscopy are underway.

(D) Inheritance of virus resistance in the mungbean. Inheritance of resistance in mungbean to the virus, or virus complex, present at Columbia is being studied. Strain M101 and M118 have demonstrated resistance to the virus through five seasons. M101 and M118 were each crossed to two virus susceptible strains and parents, F_1 and F_2 populations, and F_3 lines were grown at Columbia in 1974. Data has not been completely analyzed but it appears that resistance is quantitatively inherited.

(E) Embryo Culture Techniques to be Used Following Interspecific Crossing. Several species closely related to the mungbean have disease and insect resistance which would enhance the productivity of the mungbean if interspecific crosses could be accomplished successfully. Since interspecific crosses often result in the production of aborted or immature seeds, the success of these crosses may depend upon culturing the embryos on agar containing a nutrient solution. Experiments are in progress to determine the best crossing procedures to use.

(F) Identification of Duplicate Strains in the USDA Germplasm Collection. The USDA mungbean germplasm collection contains many duplicated strains. We have put information available to us about the strains in the collection on data cards and by processing the cards have identified many of the duplicate strains. This will permit the USDA Plant Introduction Center to reduce the number of strains they will need to maintain without loss of genetic variable.

E. DISSEMINATION AND UTILIZATION OF RESEARCH RESULTS

1. Genetic Evaluation of germplasm.

Results of mungbean strain evaluation trials have been printed and distributed widely to mungbean research workers throughout the world. These reports have resulted in many requests for seed of superior strains. Strains identified as superior through these tests are also entered into the International Mungbean Nursery which makes them available to all of the IMN cooperators.

2. International Mungbean Nursery.

Results of the international mungbean nurseries are being published as Special Reports of the Missouri Agricultural Experiment Station. These publications are distributed to more than 600 agriculture libraries throughout the world. Single copies are sent to mungbean research workers all over the world through individual mailings from the University of Missouri and through U.S. A.I.D. contacts in developing countries.

Major benefits of the International Mungbean Nursery are the exchange and dissemination of germplasm and the dissemination of information on superior strains which may be useful in breeding programs. Cooperators are urged to test local varieties along with the IMN and if the local varieties prove to be superior that they be included in the IMN the following year. Information on the range of adaptation of the local variety will be obtained and the variety will be made available to research workers in other countries. It is our observation that most mungbean research workers in developing countries do not have contacts which enable them to exchange germplasm widely with other researchers.

3. Research on Breeding Problems

Results of research on breeding problems are disseminated by publishing in scientific journals, agriculture experiment station publications, and processed miscellaneous reports. Research results originating from the project have been published in Crop Science, Journal of Heredity, and Euphytica and manuscripts have been submitted to Tropical Agriculture. The International Mungbean Nursery reports are published as Missouri Agricultural Experiment Station Special Reports. Papers reporting on research have been given at each of the last four meetings of the American Society of Agronomy. A seminar was presented at the Asian Vegetable Research and Development Center in Taiwan.

4. Linkages with Other Mungbean Research Workers

Cooperation has been effected with the Asian Vegetable Research and Development Center in Taiwan where a mungbean breeding program is being developed, and with more than 40 mungbean research workers in 20 countries through personal correspondence, exchange of breeding materials, and through the International Mungbean Nursery.

5. Publications in 1974

Bashandi, Moheb M.H. and J. M. Poehlman. 1974. Photoperiod Response in Mungbeans (*Vigna radiata* (L.) Wilczek). Euphytica 23:691-697.

Poehlman, J. M., D. T. Sechler, John M. Yohe, Earl E. Watt, Richard E. Swindell, and Ellis Benham. 1974. Performance of the Second International Mungbean Nursery. University of Missouri, Columbia, Agricultural Experiment Station Special Report 171.

Watt, E. E., Richard E. Swindell, Vas D. Aggarwal, Wachara Purivirojkul, Ellis C. Benham, Dale T. Sechler, and J. M. Poehlman. 1974. Evaluation of Mungbean (*Vigna radiata* (L.) Wilczek) Strains at Columbia, Missouri in 1973. Dept. of Agronomy Misc. Pub. No. 74-6.

Poehlman, J. M., Earl E. Watt, and Richard E. Swindell. 1974. Graduate Teaching in International Agriculture. Agronomy Abstracts, American Society of Agronomy, p. 4.

Watt, Earl E., J. M. Poehlman, and Richard E. Swindell. 1974. Seed Coat Color and Seed Quality of Mungbeans. Agronomy Abstracts, American Society of Agronomy, p. 47.

F. EXPENDITURES ON THIS CONTRACT

Total amount of contract - - - - - - - - - - - - - - $25,000

Expenditures to date:

	5/14/73* through 11/30/73	12/1/73* through 11/30/74	Totals
Salaries and wages	3,805.92	6,230.77	10,036.69
Travel and Transportation	238.79	4,028.74	4,267.53
Equipment and Materials	809.26	3,054.15	3,863.41
	4,853.97	13,313.66	18,167.63

*These dates correspond to the billing periods on this contract.

Unexpended Balance (11/30/74) - - - - - - - - - - - - 6,832.37

G. WORK PLAN FOR 1/1/75 THROUGH 5/13/75

1. Genetic Evaluation of Germ Plasm

Data is being assembled on strains grown in 1974. All strains which did not have P.I. numbers will be sent to the USDA Plant Introduction Station for accessioning into their collections. Plans will be prepared for the 1975 season.

2. International Mungbean Nursery

Questionnaires have been sent to cooperators regarding participation in the 4th International Mungbean Nursery. Seed must be assembled and the nursery distributed in April since many cooperators plant during June. Data is being received from the Third International Nursery and will be processed for publication. Since some nurseries will not be planted until February, 1975, all data will not come in until July or August of 1975.

3. Research on Breeding Problems

The temperature-photoperiod studies are going forward. Forty strains have been grown in three temperature regimes with 12, 13, and 14 hour photoperiods. The 15 hour photoperiod is in progress and the 16 hour photoperiod is still to be grown. Since this study includes all of the entries in the First and Second International Mungbean Nurseries, we will have the opportunity of correlating the results with those from a wide array of environments.

Studies on seed color and luster are being concluded and results will be written up for publication.

The virus studies are being continued in the greenhouse. Possible alternate hosts are being studied and plans are being made for the field research in 1975.

Crosses will begin on the interspecific crossing study as soon as successful embryo culture techniques are learned.