STUDIES ON THE CULTURAL MANAGEMENT OF SOYBEANS (*Glycine max* (L.) Merrill) IN LOWLAND RICE-BASED CROPPING SYSTEM

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Submitted to the faculty of the Institute of Graduate Studies,
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requirements for the degree of

MASTER OF SCIENCE IN CROP SCIENCE
(Agronomy)

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This thesis entitled STUDIES ON THE CULTURAL MANAGMENT OF SOYBEANS (*Glycine max* (L.) Merrill) IN LOWLAND RICE-BASED CROPPING SYSTEM, prepared and submitted by CARLOS C. ABON, JR., in partial fulfillment of the requirements for the degree of Master of Science in Crop Science (Agronomy), is hereby accepted.

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BIOGRAPHICAL SKETCH

The author was born on April 8, 1954 in Balut, Tondo, Manila, Philippines. He is the sixth child of the late Mr. Carlos M. Abon, Sr. and Mrs. Hilaria Cabinian-Abon.

He finished his elementary and secondary education at Muñoz Elementary School and Muñoz Provincial High School, respectively, in Muñoz, Nueva Ecija, Philippines. He obtained his B. S. Agriculture degree major in Crop Protection from the Central Luzon State University, Muñoz, Nueva Ecija.

The author started his professional career on November, 1976 as a Research Assistant in the Research and Development Center, Central Luzon State University, and has worked on the different crop commodities. On November 1981, he was assigned as assistant project leader of the "On Farm Verification Trial" and later as one of the study leaders of the Wheat Pilot Project and Soybean Pilot Project.

On November 1981, he enrolled at the Institute of Graduate Studies as a working student and on October 1984, he was awarded a one year IRRI scholarship to continue his graduate studies and to conduct research studies with specialization on soybean studies under rice-based cropping system.

He is married to the former Miss Marilou Santos Gilo with whom he is blessed with a son, Rhys Carlo (RC).

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The author expresses his heartfelt thanks to all his friends who provided help, advice, fun, pleasure, and companionship in the conduct of his research.

Sincere appreciation is due to all his friends in the Rice Farming Systems Program, IITA and Soil Physics Group: Jun Rebancos, Remy Vivas, Luth Ramos, Susan Maghari and to all the laborers for helping him in his field work; Cesar Maligalig for his assistance in the statistical analysis; and all other researchers for their friendly cooperation.

The author fondly remembers his departed father and his beloved mother who sacrified for his education.

Finally, the author wishes to express his deepest gratitude to his wife, Marilou, his son, Rhys Carlo, brothers, sisters and to all relatives for their love, inspiration, and moral support.

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ABSTRACT

CARLOS ABON, JR. C., Institute of Graduate Studies, Central Luzon State University, Muñoz, Nueva Ecija, Philippines. October 1985. Studies on the Cultural Management of Soybeans (*Glycine max* (L.) Merrill) in Lowland Rice-Based Cropping System.

Major Adviser: Dr. Josue A. Irabagon and Dr. Ram K. Pandey

Field studies were conducted to determine the effects of frequency of irrigation on the growth and yield of soybeans planted after lowland rice in tilled and untilled conditions. It also sought to find out population density, soybean varieties, weed control methods, and rice straw mulch.

Irrigation was found to affect the height of plant at harvest, seed yield, and yield components of soybeans. Irrigation at 30 days after emergence produced higher seed yield than either irrigation at 14 DAE or the control. Tillage and mulch did not significantly affect seed yield.

Under conventional and no-tillage system, differences in soybean cultivars were observed. SJ-2 variety was found to be more productive than UPLSy-2 under no-tillage condition in CLSU. Yield, plant height, LAI, and biomass increased as population density increased. Pod number decreased as the population density increased, Row spacing was not significant at both locations; however, variety and row spacing interaction effect was found to be significant at IRRI.

Use of rice straw mulch and one handweeding at three weeks after emergence under zero-tillage planting was the most effective in controlling weeds and in relatively increasing the yield. Tillage and one handweeding, or one interrow cultivation or burning of rice straw before planting had similar effect on controlling weeds.

The most predominant weed species were *Rottboella exaltata* L., *Echinochloa colona* (L.) Link and *Trianthema portulacastrum* L. The number and weight of weeds were inversely proportional to the control methods employed, indicating that addition of handweeding and/or interrow cultivation at 3-4 week after emergence will increase the yield of soybeans.

Although zero-tillage did not give higher yield, use of this method of growing soybeans will conserve soil moisture and reduce the cost of production.

LITERATURE CITED

ALGREEN, H.L., R.J. DELORIT, and L.J. GREOB. 1974. Soybean Production. In Crop Production, Principles and Practices, Fourth Ed. pp. 405-431. Prentice Hall Inc. Englewood Cliffs New Jersey, USA.

ANNUAL REPORT OF FOOD LEGUMES FOR TROPICAL AND SUBTROPICAL AREAS. 1976. Proceedings. pp. 76-78.

ARELLANO, C.B., and F.S. ROSETE. 1980. Effect on different methods of planting on the yield of mungo. TCA. REs. J. (Phil.) 2(3): 209-214.

ASIAN VEGETABLE RESEARCH AND DEVELOPMENT CENTER. 1976. Soybean Report 1975. Shanhua, Taiwan, Republic of China. pp. 38-39.

_____. 1979. Progress Report for 1978. Shanhua, Taiwan, Republic of China. pp. 76-77.

_____. 1981. 1980 Progress Report (AVRDC Publication 80-155) Shanhua, Taiwan, Republic of China. p. 55.

_____. 1982. 1981 Progress Report (AVRDC Publication 81-168) Shanhua, Taiwan, Republic of China. p. 52.

_____. 1976. Mungbean Report for 1975. Shanhua, Taiwan, Republic of China. p. 40.

BRADY, N.C. 1960. Nature and properties of soil. Ne York. NcMillan Co. 545 p.

BUMPROMA, R. 1978. Effects of plant population density and nitrogen fertilizer application on soybean and sorghum planted as monoculture and intercrops. (Unpublished M, S. thesis. UPLB, College, Laguna.).

BUNTLEY, G.J. 1975. Select soil for higher soybean yield. Better Crops with Plant Food. 69: 21-28.

BUREAU OF AGRICULTURAL ECONOMICS. 1983. Statistical Bulletin.

CASEM, E.O. 1965. Tillage studies at IRRI, IRRI Saturday Seminar Aug. 28, 1965. IRRI, Los Baños, Laguna, Philippines.

CARTTER, J.L., and E.E. HARTWIG. 1962. The management of soybean Adv. Agron. 14: 359-412.

CLAPP, W.C. 1971. What Row Width. Soybean Digest. 31(7): 12.

CULTURAL PRACTICES OF SOYBEAN AND OTHER FOOD LEGUMES FOR TROPICAL AND SUBTROPICAL AREAS. 1975/1976. Annual Report. pp. 21-22.

EGLI, D.B. 1971. No till the fastest take off since hybrid corn. Soybean Digest. 31 (7): 22.

GARRITY, D.C., and J.W. PENDLETON. 1982. A comparison of the rolling injector planter and existing seeding techniques in establishing mungbean after rice. Paper presented at the 13th Annual Science Meeting of CSSP, April 28-30, 1982. Cebu City, Philippines.

GOMEZ, A., and N.G. ZANDSTRA. 1980. Research strategy for rice based cropping systems. A paper presented at the special International Symposium, April 21-25, 1980 on rice research strategies for the future. IRRI, Los Baños, Laguna.

GUANTES, M.M. 1975. Some common weeds associated with cotton. p. 16-18. Crop protection studies on cotton. Research and DevelopmentCenter, CLSU. Annual Report.

JANA, R.K. 1974. Water Management for Soybean. INTSOY SOYBEAN Production Protection and Utilization Proceedings. pp. 55-67.

HANWAY, J.J., and H.E. THOMPSON. 1971. How a soybean plant develops. IOWA State Univ. of Science and Technology Cooperating Extension Service.

HERRERA, W.A.T., R.T. BANTILAN, R.L. TINSLEY, R.R. HARWOOD and H.G. ZANDSTRA. 1976. An evaluation of alternative cropping pattern on rainfed lowland rice area in Pangasinan. IRRI Saturday Seminar. May 8, 1976. Los Baños, Laguna, Philippines.

KANEMASU, E.T. 1979. Irrigation Water Requirements and Water Stress Irrigated Soybean Production in Arid and Semiarid Region. INTSOY Proceeding No. 20. 82 p.

KIPPS, M.S. 1974. Production of field crops. McGraw-Hill Book Co. New York. 399 p.

LEEMAN, W.F., and J.W. LAMBERT. 1960. Effect of spacing of soybean plants between and within the rows on yield. Agro. J. 52: 84-86.

LEUSCHEN, W.E. and D.R. HICKS. 1977. Influence of plant population on field performance of three soybean cultivars. Agron. J. 69: 390-393.

MASON, W.K. 1980. Soybean row spacing and soil water supply. Advances in Agricultural Technology Science and Education Administration. USDA. ISSN. Q193-3701. p. 11.

MCKENZIE, D.R., N.C. CHEN, T.D. LIOU, and B.B. OYER. 1976. Response of mungbean and soybean to increasing plant density J. Amer. Soc. Hort. Sci. 100: 579-583.

McCLELLAN, W.D. 1979. Production Management Techniques for Irrigated Soybeans. Irrigated soybean production in arid and semi-arid region. INTSOY Proceedings No. 20. p. 117.

MOODY, K., C.E. MUNROE, R.T. LUBIGAN, E.C. PALLER, JR. 1985. Weed Science Society of the Philippines. UPLB, Laguna, Philippines. Major Weeds of the Philippines. 329 p.

MORSE, W.J. 1950. History of soybean production. In Soybean and Soybean Products. K.S. Markley Ed. Interscience, New York. Vol. 1: 3-59.

NASEEM, S.B. 1982. Performance of mungbean as influenced by different seeding techniques under varying cultural practices. (Unpublished M.S. Thesis, UPLB, College, Laguna, Philippines).

PANDEY, R.K., W.A.T. HERRERA, and J.W. PENDLETON. 1984. Drought Response of Grain Legume Under Irrigation Gradient: I. Yield and Yield Components. Agron. J. 76: 549-559.

PAWAR, K. R. 1975. Quantitative relationship between plant population and yield of soybeans. Tropical Grain Legume Bulletin. 2: 34-35.

PALADA, M.C., R.L. TINSLEY, and R.R. HARWOOD. 1976. Cropping systems agronomy program for rainfed lowland rice area in Iloilo. IRRI Saturday Sem. April 24, IRRI, Los Banños, Philippines.

PHILIPPINE COUNCIL FOR AGRICULTURAL RESOURCES RESEARCH AND DEVELOPMENT. 1976. The Philippine Recommends for Soybean. pp. 42-44.

QUEBRAL, F.C. 1984. Soybean as a crop in the Philippines. Paper presented in 1st Orientation Training/Seminar on Soybean Production Technology for Rice-Based Areas. December 11-13, 1984. PCARRD, Los Baños, Laguna, Philippines.

RESEARCH AND DEVELOPMENT CENTER. 1983. Annual Report for Soybean Pilot Production Program. CLSU, Muñoz, Nueva Ecija.

SCOTT, W.O. and S.R. ALDRICH. 1970. Modern Soybean Production, S & A Publication Champaign Illinois, USA. 191 p.

SUKAPONG, C., S. RANVIRIYAPAN, and CHANDRAPANYA. 1982. Cropping systems research. Proceedings of the 13th Cropping Systems Working Group held at Thailand. Oct. 11-15, 1982.

UICHANCO, E. 1959. Philippine Agriculture. UPCA, Los Baños, Laguna. pp. 547-554.

THAIPANICH, N. 1978. Effects of fertilizer, inoculation plant population, row spacing and previous soybean crop on soybean yield and dry matter accumulation. (Unpublished M.S. Thesis, UPLB, College, Laguna, Philippines).

WEBER, C.R. 1966. Nodulating and non-nodulating soybean isolines II. Response to applied nitrogen and modified soil condition. Agron. J. 98: 46-49.

WILCOX, J.R. 1974. Response of three soybean strains to equi-distant spacing. Agron. J. 66: 409-412.

ZANDSTRA, N.G. 1980. Effect of soil moisture and texture on the growth of upland crops after wetland rice. Paper presented at the cropping systems conference. March 3-8, 1980. IRRI, Los Baños, Laguna, Philippines.