

EFFICACY OF DEEP-WELL PUMP IRRIGATION SYSTEM
IN IMPROVING RICE-BASED FARMING IN
NUEVA ECIJA, PHILIPPINES

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ABSTRACT

ISLAM, MD. RAFIQU, Institute of Graduate Studies,
Central Luzon State University, Muñoz, Nueva Ecija,
Philippines, November, 1986. EFFICACY OF DEEP-WELL PUMP
IRRIGATION SYSTEM IN IMPROVING RICE-BASED FARMING IN
NUEVA ECIJA, PHILIPPINES.

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The study sought to determine the level of inputs used, resource productivity, cropping intensity and income level as influenced by some selected variables and the changes in DWP irrigation command area as affected by various socio-economic problems.

The analysis was based on primary data collected through personal interviews with 240 randomly selected farmers, which was made up of 120 farmers from DWP-irrigated and 120 from rainfed areas. The study was conducted in Guimba, Nueva Ecija.

Mean, percentage, multiple regression analysis and production function were used to achieve the study objectives. The major findings of the study are: (1) irrigated farms used higher level of inputs, higher yield and cropping intensity achieved by small farmers

resulting in a decrease in the income gap between the small and large farmers, (2) cropping intensity is an important/significant determinant of both family and hired labor employment, (3) land ownership pattern has significant influence on inputs used as well as cropping intensity, (4) effective family size has significant positive contribution to cropping intensity while farm size has significant inverse relationship with cropping intensity and inputs used which resulted in lower productivity. Meanwhile, input-output price ratio has highly significantly inverse effect on cropping intensity, (5) the inputs like insecticides, irrigation and labor had significantly increased productivity in wet season. However, a higher rate of productivity was observed at small farm level as compared to large farms, (6) in dry season, significantly higher marginal productivity of labor was observed among large farmers while insecticides had negative effect on productivity in both small and all farms, (7) non-farm income is another important significant determinant of productivity, (8) available irrigation water during dry season has increased the farm income of small farmers over and above the large farmers lowering the income gap between the small and large

farmers, (9) the socio-economic problems like conflict with FIA, high irrigation water charge, inadequate agricultural credit, problem in water distribution, fertilizer non-availability, high cost of fertilizers have influenced farmers to decrease their irrigated area.

LITERATURE CITED

- ADB. 1980. Key indicators of developing member countries of Asian Development Bank (ADB), 9(1), April, 1980.
- ADRIANO, M.S. 1980. The impact of an irrigation project on labor intensity and the distribution of income. The case of the Sibalom Irrigation Project in Iloilo, Philippines. Doctoral Disseration, Purdue University, U.S.A.
- AMIHAN, B.T. 1975. Leyte farmers' perception of and expectation from the national coconut planting and replanting program. Unpublished MS Thesis. UPIP, College, Laguna.
- ANIEVAS, G.T. 1975. A study of copra marketing practices on the farm level in Surigao del Norte. An abstract of the results of research projects, UPLB, College, Laguna.
- BARKER, E. 1970. Researches relating to the economics in rice production. Staff paper series No. 102. Department of Agricultural Economics, UPLB, College, Laguna.
- BATTAD, F.A. Factors associated with the adoption of rice technology in Cotabato. Unpublished Ph.D. Disseration, UPLB, College, Laguna.
- BHAGWATI, J.N. and S. CHAKRAVORTY. 1969. Contributions to Indian economic analysis: a survey. American Economic Review (Supplement) 59: 1-73.
- BES. 1977. Statistical abstract on Andhra Pradesh. Bureau of Economics and Statistics. Government of Andhra Pradesh, India.
- CACERES, B. 1974. Explanatory study on an accelerated manpower training in Laguna. M.S. Thesis, UPLB, College, Laguna.
- CASTILLO, G.T. 1966. Profitability to invest in agriculture: observations from a developing country, the Philippines. UPCA, College, Laguna.
- CHU, E.C. 1973. High-yielding rice varieties at the cross-roads: three post-trial alternative decisions among farmers. Unpublished M.S. Thesis, Cornell University, Ithaca, New York.

- COPP, J.H. and M.L. SILL. 1968. The function of information sources in the farm practice adoption process. *Rural Sociology Journal*. 23:146-147.
- COVAR, P.R. 1960. The Masagana/Margate System of planting rice: a study of agricultural innovation. UP-CDRC Study Series No. 5. UPLB, College, Laguna.
- DESAI, D.R., G.A. PATEL and R.J. PATEL. 1970. Income of modern farming technology on rural development in Saurashtra. *Indian Journal of Agricultural Economics*. 25(3): 33-39.
- DUA, K.O. 1982. The role of agricultural extension in the adoption of innovations by coca growers in Ghana. *Rural Sociology*. University of Kentucky, Lexington. 43(1): 73.
- EVANGELISTA, D.L. 1974. The economics of pump irrigated palay production in Batangas province, Philippines. Unpublished M.S. Thesis. Australian National University.
- FELICIANO, G.D. 1968. Correlates of productivity among tobacco farmers in Isabela. Unpublished PhD Dissertation. UPLB, College, Laguna.
- FERGUSON, G.A. 1981. Statistical analysis in psychology and education. 5th edition. New York: McGraw-Hill, Inc.
- FAO. 1974. Monthly bulletin of agricultural economics and statistics. 9(23). FAO, Rome.
- GROSS, N. and M. TALES. 1952. Characteristics associated with acceleration of recommended farm practices. *Rural Sociology*. 17(4): 321-327.
- GUZMAN, A.M. DE. 1973. Corolan rice farmers' response to change in cropping patterns. A Case Study. (Mimeographed).
- HOSELITZ, R.F. 1956. The process of economic development. *Format of Economic Development and Cultural Change*. 3:193-215.
- HSIEH, S.C. 1965. Agricultural development programs at the farm level. *The Rural Banker*. Vol. 10.

- ILLO, J.F.I. and F. LYNCH, S.L. 1976. Pattern of income distribution and household spending in the Bicol River Basin. Social Survey Report Series, No. 13 (Revised Edition), Bicol River Basin Development Program, Naga City. Camarines Sur, Philippines.
- JULIANO, C.P., JR. 1967. The relationship between some characteristics of rice farm operators and adoption of some recommended practices in rice production in seventeen barrios of Laguna. Unpublished M.S. Thesis. UPCA, College, Laguna.
- KHOJU, M.R. 1982. The economics of pump irrigation in Eastern Nepal. Research Paper Series, A/D/C Project on Strengthening Institutional Capacity in the Food and Agricultural Sector in Nepal. Katmandu, Nepal.
- KONGKAEW, W. 1978. The adoption of farmers' association among farmers in Pila, Laguna, Philippines. Unpublished M.S. Thesis, UPLB, College, Laguna.
- LALL, B.S. 1973. Role perception and in-service training needs of rural life program workers of church projects of rural uplift in the Philippines. Unpublished M.S. Thesis, UPLB, College, Laguna.
- LIONBERGER, H.F. 1960. Adoption of new ideas and practices. Iowa: Iowa State University Press.
- LU, H.U. 1968. Some socio-economic factors affecting the implementation at the farm level of rice production in the Philippines. Unpublished PhD Dissertation, UPLB, College, Laguna.
- MADIGAN, F.G. 1968. The farmer said no. UP CRDC. Second Printing.
- MANDAC, F.B. 1984. Evaluation of the technology dissemination program under the Cagayan Integrated Agricultural Development Project. Unpublished PhD Dissertation, UPLB, College, Laguna.
- MARASIGAN, M.S. 1977. Some factors associated with the adoption of recommended corn production practices in Region XI. Republic of the Philippines.
- MARSH, C. and A. COLEMAN. 1955. The relation of farmers' characteristics to the adoption of recommended farm practices. Rural Sociology, 20(4): 286.

- MISHRA, G.P. and VIVEKANANDA. 1979. Impact of canal irrigation in rural areas: a case of Bellary District. Impact of Irrigation. Bombay: Himalaya Publishing House.
- MOORTI, T.V. and I.W. MELLOR. 1972. Cropping pattern, yield and income under different sources of irrigation. Indian Journal of Agricultural Economics. 87(4): 125-177.
- NAIDU, K.M., D. BATHADAM and P. EDWARD. 1981. A note on farm size, cropping intensity and labor use in Cuddapah District. Indian Journal of Agricultural Economics. 36(2): 54-58.
- NEDA. 1980. Statistical profile, Region III CY 1975-80. National Economic and Development Authority (NEDA), San Fernando, Pampanga, Philippines.
- PAHLWAN, A.A. 1986. Determinants of rice farmers' productivity under national and communal irrigation systems in Nueva Ecija, Philippines. Unpublished M.S. Thesis. Central Luzon State University, Philippines.
- PAHUD, S.L. 1969. Some factors associated with the adoption of recommended rice practices. Unpublished M.S. Thesis. UPCA, College, Laguna.
- PASCUAL, N.P. 1971. The adoption of some recommended corn production practices among corn farmers in Leyte. Unpublished M.S. Thesis. UPCA, College, Laguna.
- PATEL, A.S. 1981. Irrigation: its employment impact in the command area of medium irrigation projects in Gujarat. Indian Journal of Agricultural Economics. 36(4): 20-30.
- PHAUNGRAUNG, C. 1980. Training needs of farmers in CLSU Technology Packages project barangays. Unpublished M.S. Thesis. Central Luzon State University.
- RDC. 1978. Regional development plan: Region III CY 1978-77. Regional Development Council (RDC), San Fernando, Pampanga, Philippines.
- REISS, A.J., JR. 1961. Occupation and social statistics. New York: The Free Press.

- SALCEDO, R.N. 1972. Instructional needs of adult farmers in Leyte. Unpublished MS Thesis. UPLB, College, Laguna.
- SAMONTE, V. PB., L.A. PERAZ and R.M. MACASAET. 1976. Social communication factors and agricultural innovativeness of coconut farmers. Unpublished Staff Research Paper. Department of Development Communication. UPLB, College, Laguna.
- SANDER, W. 1983. Irrigation development and non-farm employment changes in two communities in the Philippines. Indian Journal of Agricultural Economics. 38(1): 1-14.
- SHARMA, K.C. 1985. Rice farmers' perception of training needs in Tanahun District, Nepal. Unpublished M.S. Thesis. Central Luzon State University, Philippines.
- SIBAL, V.V. 1980. The impact of small irrigation on production, employment and income distribution: an empirical analysis. Unpublished M.S. Thesis. UPLB, College, Laguna.
- SINGH, K. 1973. The impact of new agricultural technology on farm income distribution in the Aligarh District of Uttar Pradesh. Indian Journal of Agricultural Economics. 28(1): 1-11.
- SINGH, K. and A.S. KAHLON. 1973. Resource productivity comparisons at varying levels of technology in the Punjab. Indian Journal of Agricultural Economics. 28(2): 12-25.
- SINGH, K.N., E.S.S. RAO and B.N. SAHAY. 1970. Research in extension education for development process. FART, New Delhi, India.
- SITISARA, A. 1972. Factors associated with the adoption of rice farm practices in Kampangsaen secondary school in Thailand. Unpublished M.S. Thesis. UPLB, College, Laguna.
- SISON, J.E. 1983. The effect of small farm mechanization on production, income and employment in selected rice growing areas in the Philippines. Unpublished PhD Dissertation. University of Manitoba, Canada.

- STOGHILL, R.M. 1962. Intergroup and intragroup theory and research. In Masraf Sherif (Ed), Intragroup relationship and leadership. New York: John Wiley and Sons, Inc.
- TADARO, MICHAEL P. 1977. Economics for a developing world. London: Longman Group Ltd.
- TOQUERO, Z.F. 1969. Pump irrigation in Laguna, Batangas and Quezon, 1967-68. Paper presented at a conference in IRRI. Philippines.
- WILKENING, R.E. 1955. Informal sources in the acceptance and use of fertilizers in Iowa. TVA, Division of Agriculture Extension Services.
- WORCHELL, P. and DONE E. BYRNE. 1964. Personality change. New York: John Wiley and Sons, Inc.