

**LABOR AVAILABILITY, TECHNOLOGY USE in CROP PRODUCTION and  
INDIVIDUALS' ATTITUDES toward CONTRACEPTIVE USE in NEPAL**

Prem Bhandari

Doctoral Candidate, Rural Sociology and Demography

Department of Agricultural Economics and Rural Sociology and The Population  
Research Institute, The Pennsylvania State University, 307 Armsby Building, University  
Park, PA 16802

e-mail: [pbb115@psu.edu](mailto:pbb115@psu.edu)

Sundar. S. Shrestha

Ph. D. Student, Agricultural, Environmental, and Regional Economics & Demography

Department of Agricultural Economics and Rural Sociology and The Population  
Research Institute, The Pennsylvania State University, 308 Armsby Building, University  
Park, PA 16802

e-mail: [sss190@psu.edu](mailto:sss190@psu.edu)

**Short Abstract**

We empirically investigated two research questions: (i) *does the availability of labor force in a household influence the use of technological inputs in crop production?*, and (ii) *does the use or non-use of inputs differentially shape individual attitudes toward contraceptive use?* We used 1996 household and individual level data from the western Chitwan Valley of Nepal. The results showed that (i) an increase in labor availability per unit of cultivated land strongly and negatively contributed to the use of technological inputs in crop production; (ii) individuals who lived in a household that used technological inputs were significantly more likely to approve of contraceptive use to delay or avoid pregnancy compared to those from households that did not use inputs. These findings provide evidence of the existence of an important link between population and agriculture in Nepal thus providing a basis for integrating population and agriculture development policies.

# **Labor Availability, Technology Use in Crop Production and Individuals' Attitudes toward Contraceptive Use in Nepal**

## **Extended Abstract**

### **INTRODUCTION**

#### **Population and Agriculture in Nepal**

Nepal's population is growing very rapidly. The 2001 census recorded a total population of over 23 million in the country. During 1991-2001, population grew by over 2.27 percent per year. On average, a woman of reproductive age gives birth to more than four children (total fertility rate = 4.5). The use of contraceptives is also low. Only 39 percent of the currently married non-pregnant women of child bearing age use any modern method. Both of these trends are among the worst after Pakistan in the South Asian region (PRB, 2003).

As a result of high population growth, the pressure of population on the land is increasing over time. For instance, a population density of only 102 persons per square kilometer of land recorded in 1981 increased to 158 persons per square kilometer in 2001. This increased pressure on the land has reduced the per capita land availability, which has further led to the extension of marginal land under cultivation, thus resulting in a decrease in agricultural yield (production per unit of area) (Chitrakar, 1990).

Economically, Nepal is an agriculturally based country. A large majority (4 out of 5 persons) of the economically active population still depend on agriculture for their livelihood. However, production of food is not increasing as targeted by the national plans and has barely matched the rapidly growing population. The use of technological inputs in crop production is also low. For instance, the average use of chemical fertilizer is only 31 kg/hectare, one of the lowest among the neighboring countries in 1990 (e.g. China, 282 kg/ha, Bangladesh, 101 kg/ha; Pakistan, 91 kg/ha and India, 71 kg/ha) (APP, 1995). Moreover, only about half of the paddy and wheat growers used fertilizers in 1991/92 (CBS, 1993), and the users of improved varieties of seeds and pesticides remain low (Bastola, 1998). Only 17 percent of the cultivated land is provided with a year-round irrigation facility. As agriculture is the primary source of livelihood to a rapidly increasing population, it is realized that improvement of this sector are key to solving the problem of poverty particularly resulting from food scarcity in the country (NPC, 2003).

#### **The Policy Context**

The government of Nepal announced its first population policy during the third national development plan (1965-1970). The aim of this policy was to bring down the birth rate by providing family planning services. The subsequent plans also continued policies to reduce the high population growth. Efforts such as the provision of family planning and maternal child health services were made to meet these goals. The Ninth plan (1997-2002) further advanced a 20-year population policy to encourage couples to reduce family size and bring down the fertility rate to a replacement level (2.1 children per woman) within 20 years. The current Tenth plan (2003-2007) has also continued this policy and targets the reduction of the fertility rate to a replacement level by the year 2015 (NPC, 2003).

On agriculture, the government emphasized the development of agriculture sector since the very first national development plan (1956-1961) (Pant and Jain, 1969; NPC, 2003) and accorded top most priority for the development of this sector after the fifth national development plan (1975-1980). Farmers were encouraged to use modern inputs such as high-yielding varieties of seeds, fertilizers, irrigation, tractors, pumpsets and farm implements, and pesticides. Subsidies were provided to fund various inputs. Farm credit was made available to the farmers at subsidized rates. Extension services for the dissemination of information and markets for the distribution of inputs and outputs were emphasized. In 1995, the government implemented a twenty-year Agricultural Perspective Plan (APP) to meet the food demand of the ever-increasing population and raise their collective socio-economic base (NPC, 2003). The APP considers the increased use of technological inputs as a vehicle to increase agricultural production and focuses on encouraging farmers to use inputs such as irrigation, fertilizers, and improved varieties of seeds. Both the Ninth and the Tenth plans focused on the APP strategy to reduce poverty by increasing the income of farmers through agricultural development.

### **Problem and Research Question**

Although the rate of population growth and the total fertility rate are declining over time, the pace of decline of total fertility rate and the pace of increase in the use of modern contraceptives is very slow (UN, 1997; PRB, 2003). On the other side, the performance of the agricultural sector is also not encouraging. Although the total food production increased over time, the crop yield remained almost stagnant or even declined in some years during the last three decades (Chitrakar, 1990; Karan and Ishii, 1996). The increase in food production was mainly attributed to the expansion of land under cultivation rather than technological breakthrough (Chitrakar, 1990; Karan and Ishii, 1996). The scenario of population growth and food production in Nepal necessitates an understanding of whether any link exists between the high growth of population and the slow growth of food production. Given this background, in this study, we attempted to answer two important questions: (i) *does the availability of working labor force in a household influence the use of technological inputs in crop production?* And, in turn, (ii) *does the use or non-use of inputs differentially shape individual attitudes toward contraceptive use?*

### **THEORETICAL FRAMEWORK**

As the land for cultivation is limited, increases in food production in the future are likely to come from more intensive use of available farm lands (De Souza, Williams, and Meyerson, 2003). Despite the health risks, use of modern inputs such as the use of chemical fertilizers and pesticides is one way to increase food production in land scarce areas like of Nepal. This strategy increases food production per unit of land, thus improving the overall yield. However, the use of inputs in the Nepalese agriculture is very low. Available studies primarily focus on various economic factors such as farm size, income, and supply aspects as the key factors determining input use in farming (APP, 1995; NPC, 2003; Feder and O'Mara, 1981; Rauniyar and Goode, 1996). Moreover, studies report that low or no use of inputs in Nepal is mainly due to an inadequate and untimely supply of these materials (APP, 1995; NPC, 2003; Pant and Jain, 1969; Chapagain, 2001). Based on this idea, the country's national development

plans including the APP have emphasized ensuring a timely and adequate supply of these inputs with the assumption that “supply creates its own demand.”

The low quantity of input use might be due to the untimely and/or inadequate supply of these materials. However, in a setting where family labor is the major source of farm labor, we argue instead that non-use of these inputs is associated with labor availability in a household. Although labor sharing (also called *parma* in Nepali) and hiring among households is also practiced in the Valley, such a labor hiring system is commonly practiced in activities such as rice transplanting, harvesting, and threshing, when there is a high demand for labor for a short period of time (Bhandari, et al., 1996-97). Households commonly use bullock power to plow crop fields and human labor to apply farmyard manure and remove weeds and disease/insect infested plants. Since inputs such as tractors, fertilizers, pesticides, and high yielding varieties of crops are labor-saving in nature (Boserup, 1965), they are often used to substitute limited labor. If a household already has sufficient labor to carry out farm activities such as land preparation, manure application and weeding, the household might be reluctant to use costly labor saving inputs. Moreover, some farming activities are gender specific (Boserup, 1965; Kumar and Hotchkiss, 1988). For example, plowing of land is performed by males, while manuring and weeding are usually performed by females. Therefore, gender specific labor availability might also have an important influence on input use.

It is obvious that if households use more hands to produce more food, there is a high value of human labor involved. Moreover, children are widely used in carrying out farming and household activities (Bhandari et al. 1996; Chitrakar 1990; Filmer and Pritchett 1997; Karan and Ishii 1996; Kumar and Hotchkiss 1988; Loughran and Pritchette 1997). The demand for child labor in a household is one of the explanations for high fertility among individuals of agrarian societies (Filmer and Pritchett 1997; Loughran and Pritchette 1997; Rosenzweig 1977; Rosenzweig and Evenson 1975). Therefore, it is expected that individuals living in households that use human labor might prefer to have a larger family size to ensure future labor demand. As a consequence, the individuals living in households that used human labor instead of inputs may prefer to have more children and therefore, they may have a negative attitude toward contraceptive use. This might lead to a situation of a lower contraceptive use and a higher human fertility rate.

## **DATA AND METHODS**

We used the household and individual level data from the western Chitwan Valley of Nepal collected by the Population and Ecology Research Laboratory (PERL) in 1996. The household level data were collected prior to the individual level data. At the household level, I used the census and baseline agriculture data. Data was collected from a total of 1,583 households; however, we used information from over 1,200 farm households because of missing data in a few cases. Individual level data was used to examine the impact of input use in shaping the attitudes of individuals toward contraceptive use. This dataset provided information on the attitudes of individuals toward contraceptive use and other background information. We utilized information from currently married individuals of between 15 and 45 years of age and are living in farming households.

We used a package of three inputs- tractors, chemical fertilizers, and pesticides/herbicides used by a farm household in crop production as technological inputs. An index of technology use was created by adding up the survey responses for whether a household used any of these technologies in crop production. The index ranged from 0-3 points. A household with an index value of 0 indicates that the household did not use any inputs, while a household with an index value of 3 used all the three inputs mentioned above.

Labor availability is defined as the presence of working age (15-64 years) male and female members in a household. For analysis, we used household labor availability per unit of cultivated land. Attitude of individuals toward contraceptives use was measured by asking, *“It is wrong to use contraceptives or other means to avoid or delay pregnancy. Would you say you strongly agree, agree, disagree or strongly disagree?”* We recoded this variable into two categories referring to a positive attitude (strongly disagree or disagree) and a negative attitude (strongly agree or agree) toward contraceptives use.

We used multivariate analysis techniques, ordinary least square (OLS) and logistic regression, to analyze the data. As many factors other than those of interest to this study might also influence the use of inputs in agriculture as well as in shaping attitudes of individuals toward contraceptive use, we controlled various other factors to net out the effects of major independent variables.

## **PRELIMINARY RESULTS**

**Effect of Labor Availability on Input Use in Crop Production:** The results suggest that the number of laborers available per unit of land in a household significantly and negatively influenced the use of inputs in farming net of other socioeconomic factors. By gender (sex), availability of both male and female labor significantly and negatively impacted the use of inputs in crop production. However, the effect of the availability of female labor was much stronger than that of male labor.

**Effect of the Use of Inputs in Shaping Individuals’ Attitudes toward Contraceptive Use:** Overall, the use of technological input in farming contributed to shape positive attitudes of currently married individuals of 15-45 years of ages toward contraceptive use. The gender disaggregated analysis also showed that the use of input significantly and positively shaped the attitudes toward contraceptive use among females. However, input use was not a strong contributor to shape attitudes toward contraceptive use among males.

In conclusion, there is evidence that population and agriculture are linked. Net of the effects of other factors such as land size, land ownership, education of the household head and proximity to the market center, the more the availability of labor per unit of cultivated land in a household, the less the use of inputs in crop production. Moreover, the effect of the availability of female labor per unit of cultivated land in a household was much stronger than the availability of male labor. This might be due to the fact that women spend more time in farming compared to their male counterparts (Kumar and Hotchkiss, 1988). On the other hand, individuals who lived in households that did not use inputs were less likely to approve of contraceptive use as compared to those who lived in households that used inputs in crop production. These findings provide evidence of the

existence of the link population and agriculture in a context where labor market is not well developed and agriculture is subsistence based. These findings provide a basis for integrating population and agricultural development policies in Nepal.

### References:

- APP, 1995. Nepal Agriculture Perspective Plan. Agricultural Projects Services Center, Kathmandu and John Mellor Associates, Inc, Washington, D.C.
- Bastola, Tunga S. 1998. "Agro-Biodiversity". A Compendium on Environment Statistics 1998, Nepal. Central Bureau of Statistics, National Planning Commission Secretariat (NPCS), His Majesty's Government of Nepal, Kathmandu. Pp. 28-80.
- Bhandari, P., M.R. Kolachchhapati, N.R. Devkota, P. Bhatt, M.Kharel, K. Basnet, M. Sharma and D. Baral. 1996. "Farming-Forestry and Environment: Socioeconomic Study of Makalu Barun Conservation Area Along Genderlines." A Research Report submitted to the Makalu-Barun Conservation Project (MBCP), Kathmandu, Nepal.
- Bhandari, P., P. Chaudhary, S. Shrestha, and P. R. Tiwari. 1996-97. "The Naike System: Hired Labor Mobilization in Rice Production in Western Chitwan." *J. Inst. Agric. Anim. Sci.* 17-18:65-70.
- Boserup, Ester. 1965. The Conditions of Agricultural Growth: The Economics of Agrarian Change under Population Pressure. Chicago and George Allen and Unwin Ltd: Aldine Publishing Company.
- CBS, 1993. National Sample Census of Agriculture, Nepal, 1991/92. Central Bureau of Statistics (CBS), National Planning Commission Secretariat (NPCS), His Majesty's Government of Nepal, Kathmandu.
- Chapagain, Devendra P. 2001. Land and Agriculture. National Strategy for Sustainable Development (NSSD), Status Review and Dialogue. Submitted to World Conservation Union (IUCN) Nepal.
- Chitrakar, P.L. 1990. Planning, Agriculture and Farmers: Strategies for Nepal. Publisher: Mrs. Ganesh Devi Chitrakar, Kathmandu, Nepal.
- De Souza, Roger-Mark, John S. Williams, and Fredrick A. B. Meyerson. 2003. Critical Links: Population, Health, and the Environment. Population Bulletin - A Publication of the Population Reference Bureau, 58(3).
- Feder, Gershon and Gerald T. O'Mara. 1981. "Farm Size and the Diffusion of Green Revolution Technology." *Economic Development and Cultural Change*, 30:59-76.
- Filmer, Deon and Lant Pritchett. 1997. "Environmental Degradation and the Demand for Children: Searching for the Vicious Circle." *World Bank Policy Research Paper Number 1623*. World Bank. Washington, D.C.
- Karan, Pradyumna, P. and Hiroshi Ishii. 1996. Nepal: A Himalayan Kingdom in Transition. Tokyo, New York, Paris: United Nations University Press.
- Kumar, Shubh K. and David Hotchkiss. 1988. Consequences of Deforestation for Women's Time Allocation, Agricultural Production, and Nutrition in Hill Areas of Nepal. International Food Policy Research Institute. Research Report 69, Washington, D.C.

- Loughran, David and Lant Pritchett. 1997. "Environmental Scarcity, Resource Collection, and the Demand for Children in Nepal." World Bank.
- NPC, 2003. The Tenth Plan: Poverty Reduction Strategy Paper 2002-2007. Summary. His Majesty's Government of Nepal, National Planning Commission, Kathmandu, Nepal.
- Pant, Y. P. and S. C. Jain. 1969. Agricultural Development in Nepal. Bombay: Vora & Co., Publishers Private Ltd.
- Population Reference Bureau, 2003. 2003 World Population Data Sheet of the Population Reference Bureau. The Population Reference Bureau, Washington, D.C.
- Rauniyar, Ganesh P. and Frank M. Goode. 1996. "Managing Green Revolution Technology: An Analysis of a Differential Practice Combination in Swaziland." *Economic Development and Cultural Change*, 44(2): 413-437.
- Rosenzweig, Mark R. 1977. "The Demand for Children in Farm Households." *The Journal of Political Economy*, 85(1)-123-146.
- Rosenzweig, Mark R. and Evenson, Robert. 1975. "Fertility, Schooling and the Economic Contribution of Children in Rural India: An Econometric Analysis." Yale Growth Center Discussion Paper no 239, November 1975.
- U.N. 1997. Levels and Trends of Fertility and their Determinants for Small Geographic Areas in the ESCAP Region. Economic and Social Commission for Asia and the Pacific, Asian Population Studies Series No. 146. New York: United Nations.

## **ACKNOWLEDGEMENTS**

We would like to thank Dr. William G. Axinn, Professor of Sociology, University of Michigan, for providing the data used in this study.