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ASSESSEMENT OF THE LEVEL OF THE APPROPRIATE TECHNOLOGY ADOPTION AND ITS IMPLICATION ON MAIZE PRODUCTION IN CHITWAN

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ABSTRACT

This study was conducted to find out the adoption of various agro technologies in Maize production in Chitwan district. The study area was divided into 3 clusters and 60 respondents were taken from each cluster using a pre-tested questionnaire. The result showed that the adoption level for various technologies in maize is around 60%, with the A.I. being around 58.60. The average land holding capacity was around 13 Kattha. The average annual income of Moderate adopters was found to be highest (Rs.422199.16) while that of higher adopters was found to be lowest (Rs.339180.78). The average annual expenditure of low adopters was found to be highest (388574.07) while that of high adopters was found to be lowest (Rs.174607.14). It was revealed that the average cost of production per Kattha was found to be higher among the high adopters (Rs.3147.46) followed by moderate adopters (2788.04) and low adopters (2264.75). It was found that Gross margin of the high adopters was found to be higher (363.00) followed by Moderate adopters (316.78) and Low adopters (284.68). B:C ratio per Kattha was found 1.12. Irrigation followed by Disease, Insect and Lack of quality fertilizer were the major problems. Cost effective technologies should be developed and launched in practice for the overall increase of maize productivity.

Keywords: Technology, Adoption, Adoption Index, B: C ratio, Average Livestock Standard Unit

INTRODUCTION

The economy of Nepal is dependent on agriculture and is characterized by its subsistence nature, low productivity, monsoon dependent, low input based farming system predominated by a food crops with small size of land holding. It has built on the joint foundation of crops, livestock and forestry. It has become a major occupation for 65.6% of Nepalese citizens contributing about

35% of GDP. Only about 21% land has been cultivated and 7% agricultural land remained

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uncultivated. Only 40.5% of total cultivated agriculture land is year round irrigated, about 70% land is potentially irrigated and rest of the land should depend on monsoon for production of crops(AICC, 2071).

Maize (Zea mays L.) is one of the most important cereal crops of the world. It has remarkable production potential in Nepal and is the second staple food in Nepal after paddy in terms of area, production and productivity (MoAD, 2013). At present, the Maize sown area in Nepal is 9,28,761 ha and total production is 22, 83,222 metric tons with productivity of 2458 Kg/ha.

In Chitwan, maize covers total area of 9750 ha with the total production of 29,250 metric tons and productivity of 3,000 Kg/ ha (MoAD, 2014). Among maize growing districts in Nepal, Chitwan enjoys the second position regarding the area and production of maize (MOAC, 2005).

Chitwan is a Terai area and out of total maize cultivated area in Terai region, 95.95 % area is under improved and 4.05 % area under local maize. Maize is cultivated on irrigated /seasonal irrigated land in winter and spring, and on rain fed land in summer. Usually, three crops of maize viz. kharif, rabi and zaid are grown in the country and sowing time differs accordingly. This study has taken main cultivation practices like Improved varieties, Seed rate, Nitrogenous fertilizer, Phosphate fertilizer, Potassium fertilizer, Planting method, Weeding into consideration and have tried to find out the technology adoption level of these factors in central plain of Nepal.

Maize productivity is still in subsistence level in Nepal. The demand for maize is ever on the rise with increasing population, its increasing use in animal and poultry feed as well as in other industrial raw materials like production of corn flakes. Unavailability of quality seed of farmer's preferred varieties, Small Land Holding capacity, rainfed crop, keeping seeds year after year, lack of technology knowhow and reluctant to improved technologies has resulted in low productivity. Along with these, the process of dissemination of improved farming technology is being hampered severely by various obstacles like inadequate extension services, inadequate agro-technical services, lack of appropriate agriculture research, lack of capital and credit, poor socio-economic conditions, defective marketing and pricing system, lack of transportation, small land holdings and defective tenancy system, inadequate agricultural support services provided by various institutions, etc.

Feder, Just, & Zilberman (1985) defined adoption as the degree of use of a new technology when a farmer has full information about the technology and its potential. The technology adoption index is a catch-all measure of technology practices of the farmers (Singh, Kumar, & Singh, 2005; Timsina et al., 2012). Technology Adoption index measures the adoption level of the number of practices of any technology. "The intensity of adoption" is defined by (Wekesa, Mwangi, Verkuijl, Danda, & De Groote, 2003) as the level of adoption of a given technology

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(for example, the number of hectares planted with improved seed or the amount of fertilizer applied per hectare).It is widely recognized that the sustainable flow and use of improved agricultural technology is key to increased growth and agricultural productivity (Ouma et al., 2002) . The research is being held in Chitwan to know various adoption technologies in maize cultivation, to access their implications in productivity and the hindrances in adopting such technologies.

Therefore, the objective of this study was to assess the factors that influence the adoption of technology and its implications as well as economics of maize production More specifically, it examines the current adoption level of maize production technologies and identifies major socio-economic and demographic factors that influence the productivity. This information can be used by policy makers, researchers and extension workers to design a strategy for improving productivity and increasing agricultural production in the country. The research is being held in Chitwan to know various adoption technologies in maize cultivation, to access their implications in productivity and the hindrances in adopting such technologies.

METHODOLOGY

It includes Pre survey field visit, Study of population, sample size and sampling technique, Sources of data, Survey design and method of data collection, Methods and techniques of data analysis.

Maize growing farmers in Chitwan district were the population of analysis of this research. Altogether the sample size represented 180 households (60 from each cluster: eastern, central and western chitwan). Madavpur and Pithuwa VDC of Eastern Chitwan, Vijayanagar and Mangalpur VDC of Central Chitwan, Patihani VDC of Western Chitwan were selected as the site of the study.

Sampling plays an important role in survey research as it saves time and money. The sample size determination and sampling procedure employed in the study are discussed. The target populations were farmer in Chitwan district who grow maize. Respondents were selected from three clusters of Chitwan district viz eastern, central and western part. Therefore, the selection of farmers/respondents was done by cluster sampling to reduce the error and enhance homogeneity. Questionnaires were prepared and selected households were interviewed with semi structured questionnaire for surveyor superiority.

Both the primary and secondary data were used. The pre-tested interview schedule was administered to the sampled farmers for the collection of primary data. These data were supplemented by the information obtained through household survey and consultation with university experts. The secondary information were obtained through review of different

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publication mainly produced by Department of Agriculture (DOA), Ministry of Agriculture and Co-operatives (MOAC), Central Bureau of Statistics (CBS), Agro-Enterprise Centre (AEC), Nepal Agricultural Research Council (NARC), National Maize Research Program (NMRP), Rampur, Chitwan and District Agricultural Development Office (DADO) of Chitwan district.

Primary data were collected through face-to-face interview. Semi structured questionnaires were prepared and later, deployed at interview site. The information on existing production system and various problems of production of maize in the study site was collected. The pre-testing of the interview schedule was carried out on 20 household of Fulbari VDC outside the study area. The required correction of interview schedules was done accordingly. The information collected from the field was coded first and entered into the computer. Data entry and analysis was done by using computer software packages like the Statistical Package for Social Science (SPSS) version 20 and Microsoft Excel.

Collected data were analysed by more descriptive than inferential method. Cross tabulation, comparison of mean, frequency, percentage, chart, graph and indexing were done to draw conclusion.

METHODS AND TECHNIQUES

Cost of production

The variable costs were the farm expenditure on seed, fertilizers, human labour and tractor etc. Total cost of production was calculated by adding all the expenditure on variable inputs involved during maize cultivation from land preparation to final harvest and storage.

Variable cost of maize production= $C_{seed} + C_{FYM} + C_{fert} + C_{tillage} + C_{labor} + C_{other}$

Where,

C_{seed} = Cost on seed (NRs./ha), C_{FYM} = Cost on organic manures (NRs./ha), C_{fert} = Cost on inorganic chemical fertilizers (NRs./ha), $C_{tillage}$ = Cost on tillage used (NRs./ha), C_{labor} = Cost on human labor used (NRs./ha) and $C_{other=}$ Cost on others inputs used

Profit/loss analysis

The profit loss is the difference between the gross return and total variable cost from the maize production. The Gross Margin provides simple and quick method for analyzing farm business. The gross margin analysis of any particular enterprises is defined as the difference between enterprises gross income and variable expenses attributed to that enterprise.

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Gross Margin = Gross Return - Total Variable Cost.

Where, Gross return = Price of maize*Total amount of maize produced

Total Variable Cost = Summation of cost incurred for all variable inputs

Profit/loss = +ve indicates profit
= -ve indicates loss

Benefit cost ratio

A benefit-cost ratio (BCR) is an indicator, used in the formal discipline of cost-benefit analysis that attempts to summarize the overall value of money of a project or proposal. The major purpose is to find the investment made on the resources will yield a reasonable return to the resources engaged (Sapkota, Joshi, Kattel, & Bajracharya, 2017). Benefit Cost Ratio (BCR) is assumed as a quick and one of the easiest method for evaluating the economic performance of a business (Dhakal, Regmi, Thapa, Sah, & Khatri-Chhetri, 2015).

$$B/C\ Ratio = \frac{Gross\ return\ (NRs.)}{Total\ Variable\ Cost\ (NRs.)}$$

Adoption level

Technology adoption is a catch-all measurement of technology practices of the farmers (Singh et al., 2005; Timsina et al., 2012)**.** Different technology adopted by farmers was rated with help of expert from University, NARC and DOA. Technology are from seed to grain production such as seed priming, seed treatment, planting method, irrigation practices, weeding, disease and pest control methods, fertilizer application dose and method, crop residue management, harvesting etc.

Adoption index (A.I) = Score obtained/Higher score assigned.

Adoption Category

The major categories i.e. low, moderate and high were categorized based on the mean and standard deviation.

Low adopters= ≤ (Mean – S.D.)
Moderate adopters= (Mean ± S.D.)
High adopters = ≥ (Mean + S.D.)

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Indices

It was done for qualitative data based on response frequencies. Weighted indices were calculated for the analysis of farmers' on the crop selection and extent of production of maize. By constructing the scale of priority, problems on production and marketing were presented on the basis of their importance, separately.

High priority = 2

Moderate priority = 1

Low priority = 0

The indexes were computed by the following formula

$$I = \Sigma(s_i f_i / N)$$

Where, I = Priority index

Σ = Summation
S_i = Scale value at i^{th} priority
f_i = Frequency of i^{th} priority
N = Total number of respondents = □ f_i

RESULT AND DISCUSSION

This section includes brief discussion of the study area, general information on population characteristics, and findings pertaining to the objectives of the study.

Description of the study area

General information of Chitwan district

Chitwan district, with Bharatpur as headquarter, covers an area of 2,239.39 sq. Km, is situated in central development region. The district spreads from, 27^0 21' 45" to 27^0 52' 30" north latitude and 83^0 54' 45" to 84^0 48' 15" east longitude. Chitwan valley has subtropical and tropical climate, with hot and moist summer and cool and dry winter (DDC, 2014).

Socio-economic and demographic information

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Out of 180 households surveyed, majority were SLC holders and 140 (77.80%) were headed by male of which 80 percent were moderate adopters and rest 40 (22.20%) were headed by female. Occupation was classified into six major categories among the population based on the contribution to the total family income. Majority of people were involved in agriculture as main occupation (68.30%) which resembles the national scenario of which 71.2 percent were moderate adopters followed by government services (15%). Sample population was categorized into Brahmin/chhetri, janajati, and dalit castes. Brahmin/chhetri were most dominating castes (84.40%) among which 91 percent were moderate adopters and minorities were least dominating. The average age of household head was around 48 years. Adoption of technology was seen in youth than aged group. The older the age, there is decrease in rate of adoption of technology. The family composition was seen to be in equal proportion of around 50% in both Nuclear and Joint family structure. Nuclear families were among higher adopters whereas Joint family were among lower adopters. The average land holding of the household was found to be 13.04 kattha. Farmers having low land holding were found to be higher adopters of technology than farmers having more land holding. The average LSU of sampled household was 4.82. Moderate adopters had 5.19 LSU (highest) while high adopters had 3.76 LSU (lowest).

Income Status

Moderate adopters were amongst the higher earners while High adopters were low earners. It clearly reveals that among income, majority of the share was occupied by Non-Farm sources such as pensions, government service, business and remittances. The low income among higher adopters may due to the technology not being cost effective.

Expenditure Status

The average annual expenditure of low adopters was found to be highest (388574.07) while average annual expenditure of high adopters was found to be lowest (174607.14). Among expenditure, Nonfarm expenditure occupies the pole position. High adopters adopt the technology that reduces the labour cost and others so that the expenditure becomes less while lack of technical knowhow among the low adopters increases the cost of expenditure significantly.

Production Cost Summary

The average cost of production per kattha was found to be higher among the high adopters (3147.46) followed by moderate adopters (2788.04) and low adopters (2264.75). Adoptions of technologies in FYM application, Tillage, Irrigations and so on increases the cost of production among the high adopters. The major cost of production was from Labour in case of low adopters. Similar results with the use of manure accounted the highest share in the production cost

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followed by labor (Paudel & Matsuoka, 2009).

Economics of Production per Kattha

From the analysis of table below, it was found that Gross margin of the high adopters was found to be higher (363.00) followed by Moderate adopters (316.78) and Low adopters (284.68). The B:C ratio was almost similar in all categories of adopters.

Table 1: Economics of production per kattha with respect to adopters

	Low adopters	Moderate adopters	High adopters	Total
Average cost of production	2264.75	2788.04	3147.46	2746.50
Average income	2549.43	3104.82	3510.46	3063.60
Gross margin	284.68	316.78	363.00	317.12
B:C ratio	1.13	1.11	1.12	1.12

Source: Survey 2016

Problems of Maize Production in Chitwan

The table below highlights the major limiting factors behind the low productivity of maize in Chitwan. As we can see, irrigation seems to be the primary issue of concern for the Maize growers in Chitwan district. That was followed by the problem of diseases and insects. There also seems to be a problem of lack of availability of fertilizers, seeds and other inputs during time of need. Availability of technical assistance and adequate irrigation facilities in an areas assist to adopt maize seed production to increase maize production and income (Hintze, Renkow, & Sain, 2003; Rogers, 2003). Hailu, (1992) reported that the lack of agricultural inputs is main bottleneck in maize production and productivity). Other problems were found to be of relatively minor importance.

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Table 2: Problems of Maize production in Chitwan district.

Problem	Value	Ranking
Irrigation	0.183	I
Disease	0.106	II
Insect	0.104	III
Quality fertilizer	0.101	IV
Weed infestation	0.083	V
Seed quality	0.081	VI
Storage of grain	0.072	VII
Climate change	0.064	VIII
Nutrient management	0.059	IX
Availability of input	0.045	X
Crop lodging	0.038	XI
Availability labor	0.025	XII
Drainage	0.024	XIII
Draft power	0.014	XIV

Source: Survey, 2016

Trend Analysis of Area of Production and yield of wheat for the last 25 years in Chitwan

Maize cultivation has been steadily decreasing over the last 25 years. This might be due to the growing interest of farmers in vegetable farming, poultry enterprises and other commercial ventures instead of crop production. The productivity and yield also seem to be in decline. There are various reasons behind this such as irrigation problems, diseases, pest infestations and so on.

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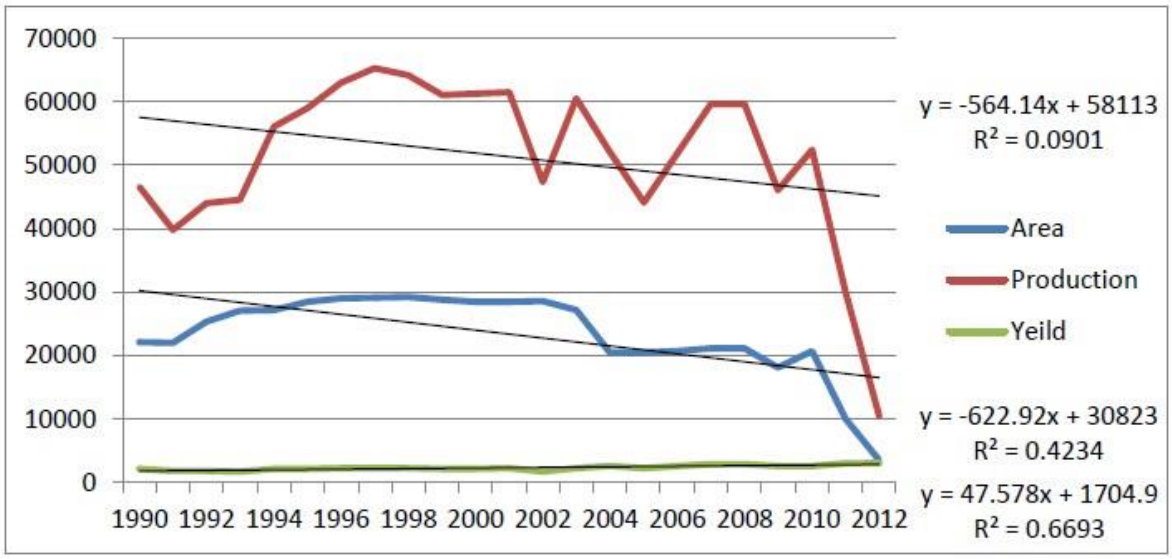
Figure 1: Trend Analysis of Area of Production and Yield of Maize for 25 years



CONCLUSION

Maize is staple crop for the majority of the farmers at Hilly area. The majority of the farmers were involved in maize production in the district with land holding capacity less than the national average of 0.6 hacter. More than 2/3rd of respondents were male and the average Livestock Standard Unit was found to be 4.82. The major occupation of respondents was agriculture resembling the national scenario. The family structures of the respondents were nuclear and joint in similar proportion. The majority of the households were Brahmins / Chhetri. The Technology Adoption Index was found similar to the national average indicating the large scope for yield improvement of the maize in the study area by adopting improved farming technologies. The B:C ratio shows the farmers in profit but was lower than the average ratio for the district i.e. 1.25. Farmers were facing lot of problem during maize cultivation. Irrigation problem followed by Disease problem, Insect problem, Lack of quality fertilizer, Weed infestation are the major problems.

In conclusion, technology adoption in chitwan condition is found to be cost effective. This could be due to effectiveness of yield attributing parameters of maize production. Technologies adoption in maize production has led to increment of production, productivity and as a whole Gross margin. The land of cultivation is constant and the use of technology has positive implication on productivity and overall economics.

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RECOMMENDATIONS

Further study of economic feasibility should be conducted regarding technology adoption and its cost effectiveness. The research finding can be used by the farmers of the Chitwan as the tentative economic guide for better maize production but should cautiously use the research finding out of the Chitwan. Government plan and policies should be directed towards making the necessary and cost effective technologies available.

REFERENCES CITED

AICC. (2071). Krishi Diary. Nepal: Agriculture Information & Communucation Center. DDC. (2014). District Development Committee. Chitwan.

Dhakal, S. C., Regmi, P. P., Thapa, R. B., Sah, S. K., & Khatri-Chhetri, D. B. (2015).

Productivity and profitability of maize-pumpkin mix cropping in Chitwan, Nepal. Journal of Maize Research and Development, 1(1), 112–122.

Feder, G., Just, R. E., & Zilberman, D. (1985). Adoption of agricultural innovations in developing countries: A survey. Economic Development and Cultural Change, 33(2), 255– 298.

Hailu, G. (1992). Availability and use of seed in Ethiopia. Program Support Unit, Canadian International Development Agency, Addis Ababa, Ethiopia.

Hintze, L. H., Renkow, M., & Sain, G. (2003). Variety characteristics and maize adoption in Honduras. Agricultural Economics, 29(3), 307–317.

MoAD. (2013). Annual Progress Book. Nepal: Department of Agriculture, Ministry Of Agriculture Development.

Ouma, J. O., Murithi, F. M., Mwangi, W., Verkuijl, H., Gethi, M., & De Groote, H. (2002). Adoption of maize seed and fertilizer technologies in Embu district, Kenya. CIMMYT.

Paudel, P., & Matsuoka, A. (2009). Cost efficiency estimates of maize production in Nepal: a case study of the Chitwan district. Agricultural Economics, 55(3), 139–148. Retrieved from http://www.agriculturejournals.cz/publicFiles/05385.pdf

Rogers, E. M. (2003). Diffusion of innovations. Free Press. New York, 551.

Sapkota, M., Joshi, N. P., Kattel, R. R., & Bajracharya, M. (2017). Technical Efficiency and Its Determinants on Maize Seed Production in Palpa District, Nepal.

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Volume:03, Issue:05 "September-October 2017"

Singh, R. P., Kumar, R., & Singh, N. P. (2005). Identification of Pulling Factors for Enhancing the Sustainable Development of Agriculture with Special Reference to Maize in India.

Timsina, K. P., Bista, H. B., Gauchan, D., Sapkota, B., Ghimire, Y. N., Shrestha, K. P., & Shrestha, B. (2012). Adoption Analysis of Rice Varieties in Terai of Nepal. In the proceeding of 10th National Outreach Research Workshop held at Regional Agricultural Research Station, Lumle, from February (pp. 27–28).

Wekesa, E., Mwangi, W., Verkuijl, H., Danda, K., & De Groote, H. (2003). Adoption o f maize production technologies in the coastal lowlands of Kenya. CIMMYT.

