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# Technology adoption analysis of improved maize technology in western hills of Nepal

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**ABSTRACT**

The survey was carried out in t wo districts namely Palpa and Bag lung to determine the current level of adoption of improved maize production practices. This study identifies the technology adoption extent and pattern of imp roved maize technologies in Western Hills of Nepal. In each of these districts, two village development committees (V.D.Cs) were surveyed. Deurali and Khasyouli V.D.C fro m Palpa and Kudule and Malika V.D.C fro m Baglung Districts were selected. Structured Questionnaire were admin istered to 30 randomly selected households in each VDC. Altogether 120 Households were surveyed. The degree of adoption was measured on the seed rate, adoption of improved varieties, application of Nitrogenous, Phosphatic and Potassium fertilizer, Weeding and method of planting. The adoption index was used to determine the adoption level of the respondents. There seems to be a gap between the recommended practice and current level of practice at the farmers level in some of the factors like Nitrogenous, Phosphorus and Potassium fertilizers, method of planting .The study revealed that majority farmers belonged to high adoption category (57%) followed by mediu m adoption category(54%) and low adoption category (9%). The Technology Adoption Index (TAI) was found 63% . In nutshell there is still large scope for yield improvement of the maize in the study area by adopting improved maize variet ies.

## INTRODUCTION

In Nepal, maize (*Zea mays* L.) is the second most staple food crops, while in hills it is a principal food crop. Maize is the most important cereal crop in the hills of Nepal, where the grain is used for human consumption and the Stover for animal fodder. It is usually used for food, feed, fodder, and fuel and is a significant source of energy (Adhikari, 2008). Maize cultivation is a way of life for most farmers in the hills of Nepal. It is grown under rainfed conditions during the summer (April- August) as a single crop or relayed with millet later in the season. More than two thirds of the maize produced in the mid hills and high hills is used for direct human consumption at the farm level and the ratio of human consumption to total

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production is higher in less accessible areas (Paudel, 2008). Area under this crop is approximately 9,28,761 ha which is about 28% of total cultivated area . Total production of maize in 2013/14 is 22,83,222 metric tons (MoAD, 2014). Only about 16% of Nepal's total land area is cultivated. Of this, the terai, where 38% of the land area is cultivated, is the most important. Maize is the third most important crop here after paddy and wheat. The second most important agricultural land area is the mid hills where 15% of land is cultivated. Of the total maize area about 78% falls in the hills Area (mid Hills 70%, and high hills 8%). Maize is generally grown under rain- fed condition in Nepal with basal application of low quantity of Farm yard manure. Unavailability of quality seed of farmer's preferred varieties at right time, in desired quantities and at reasonable price is the major constraint for increasing production (Adhikari *et al*., 2003). Most of the farmer keep their own seeds year after year. More than 88% farmers used farm saved seeds (Gurung, 2011). Maize yields fluctuate seasonally and annually especially in the hills. Although maize yields increased slightly over the past five years, there has been very little yield improvement when compared to nationwide yield 30 years ago. This is probably due to the expansion of maize cultivation into less suitable terrain, declining soil fertility, and the adoption of improved management practices. While productivity in the country is almost stagnant, the overall demand for maize driven by increased demand for human consumption and livestock feed is expected to grow by 4% to 6 % per year over the next 20 years. Thus, Nepal will have to resort to maize imports in the future if productivity is not increased substantially. National average yield of maize is 2.5 t/ha. Seed replacement rate in Maize is about 11.3% (Pokharel, 2013). This study has taken seven main cultivation practices like Improved varieties, Seed rate, Nitrogenous fertilizer, Phosphatic fertilizer, Potassium fertilizer, Planting method, Weeding into consideration and have tried to find out the technology adoption level of these factors in Western Hills of Nepal. Where maize is grown, farmers often do not apply adequate amounts of fertilizer. Even when applied, the basal application, which is crucial from the production point of view, is missed. Application of fertilizers is very important for increasing the productivity (Tiffen, 2003). A research conducted by Sharma in 1980 showed that row planting produce the highest maize yield. The maize yield of different maize varieties respond positively to seed rate (Pinter *et al*., 1994). Recommended seed rates rates usually results in increases maize yield (Lucas, 1986). Generally, the presence of weeds for the first six, nine and twelve weeks after sowing and for the entire growing season of maize resulted in estimated yield losses of 36, 61, 80, and 85%, respectively (Assefa,1999). The technology adoption index is a catch-all measure of technology practices of the farmers (Singh *et al.,* 2005 cited in Timsina *et al.,* 2012). Technology Adoption index measures the adoption level of the number of practices of any technology. Very few study have been done concerning the Technology Adoption index in the past which were confined to Rice production technology in terai region. This study tries to explore the adoption level of improved maize technology in Western Hills of Nepal.

## MATERIALS AND METHODS

The study was conducted in two districts namely Baglung and Palpa. Respondents were chosen from both the Outreach site (O.R sites) and Non Outreach sites (Non O.R sites). Deurali V.D.C (O.R site) and Khasyouli V.D.C (Non O.R site) from Palpa, Kudule(OR site) and Malika V.D.C(Non OR site) from Baglung Districts were chosen for sample selection. From each V.D.C

30 respondents were selected randomly using Simple Random sampling among the farmers cultivating maize for at least the previous two years. Therefore, the total sample size for the study was 120. For studying the extent of adoption 7 important cultivation practices i.e. improved varieties, seed rate, and application of nitrogenous, phosphatic and Potassium fertilizers, Weeding and planting method were considered. The recommended dose of Nitrogenous, Phosphorus and Potassium fertilizer for Maize is 104.9, 65.22 and 50 kg per hectare respectively. Recommended number of Weeding is 2. Recommended seed rate is 20 kg/hectare. Recommended method of sowing is line sowing. Different techniques such as interview, group discussions and informal Discussions with farmers were used for the study. The analysis was based on tabular analysis using simple statistical methods like frequency, mean and standard deviation. However to know the adoption pattern of improved technologies the adoption index was calculated. The technology adoption index (TAI) was calculated by using formulae given by Singh *et al.,* 2005 cited in Timilsina *et al.,* 2012).

TAIi= 1/7(AHi/Cai+ Sai/Sri+Nai/Nri+Pai/Pri+Kai/Kri+Wai/Wri+Rai/Rri)
where i= Numbers of farmers say 1,2,3…….n,
Tai = Technology Aoption index of ith farmer
Ahi= Area under improved maize varieties (ha)
Cai= Total Area under improved Maize varieties
Sai=Quantity of seed applied per hectare Sri= Recommended seed Rate
Nai= Quantitiy of Nitrogen applied per ha, Nri= Recommended dose of Nitrogen per ha
Pai = Quantitiy of Phosphorus applied per ha, Pri = Recommended dose of Nitrogen per ha,
Kai= Quantitiy of Potassium applied per ha, Kri= Recommended dose of Potassium per ha
Wai=Number of Weeding applied Wri= Recommended Number of Weeding
Rai= Method of sowing, Rri= Recommended method of sowing

Depending upon the extent of adoption of improved technologies the respondents will be categorized as:
Low adopters (LA) from 0-33 per cent,
Partial adopters (PA) from 34 – 66 per cent, and
High adopters (HA) from 67 – 100 per cent.

## RESULTS AND DISCUSSION

### *Demographic Characteristics*

Table 1 summarizes Demographic characteristics of sample farmers in the Study Area. The mean age of household head in Baglung and Palpa was 55 and 48 yrs respectively. The average size of the family in Baglung and Palpa was 5 &4 respectively. Majority of the household was male headed households. Most of the households belong to Brahmin and Kshetri, Ethinicity. The average size of the lowland was 4.54 ropani in Baglung and 4.25 ropani in Palpa. Likewise the average size of upland was found to be 4.35 ropani in Baglung and 4.53 ropani in Palpa. The educational experience of the household heads in Baglung and Palpa Districts was about 4.3 and 3.4 years respectively.

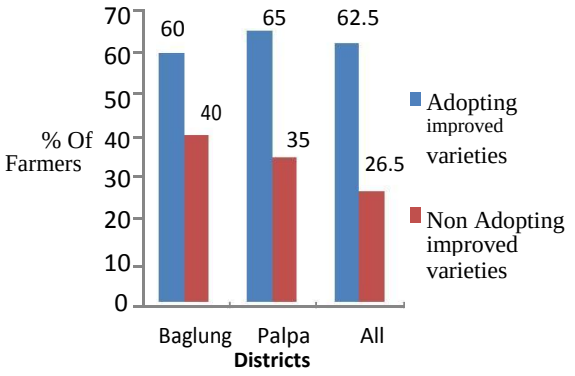
***Pattern and extent of improved Varieties Adoption***

The nature and extent of the modern variety adoption in the field is a good measure of the crop research program. Adoption of crop varieties are generally by two indicators: the proportion of farmers growing modern varieties and the proportion of area under improved varieties. Fig 1 describes the percentage of farmers adopting the improved varieties. The percentage of farmers adopting improved maize varieties was 60% in Baglung whereas it was 65% in Palpa . Overall percentage of the farmers adopting the improved maize varieties is 62.5 %. Fig 2 explains the percentage of area coverage by the improved varieties. Of the total maize growing area in the study sites 61% of the area is covered by improved varieties in Baglung Districts and it is 64% in Palpa District. The most popular improved varieties mainly adopted by farmers in the survey sites are Rampur Composite (40%), ManaKamana6 (40%) & Arun2 (20% ).The main reason for adopting these varieties was because they were less prone to lodging, has good taste and these varieties have higher yield compared to the local one. Despite of the adoption of the variety there were some varieties that were disadopted. The varieties disadopted were Manakamana 1, Manakamana 5. These varieties were disadopted because they were prone to lodging and succeptible to disease and pests.

Table 1: Demographic Characteristics of the study sites

| Socioeconomic characters | Baglung | Palpa |
|---|---|---|
| Age of the Household head | 55 | 48 |
| Family Size | 5 | 4 |
| Male headed Household | 42 | 32 |
| Female headed Household | 18 | 28 |
| Ethnicity(number) | | |
| Brahmin/Kshetri | 51 | 50 |
| Janjati | 9 | 1 |
| Dalit | 0 | 9 |
| Lowland (ropani) | 4.54 | 4.25 |
| Upland (ropani) | 4.35 | 4.53 |
| Education(yrs) | 4.3 | 3.4 |

*1 ha = 20 ropani



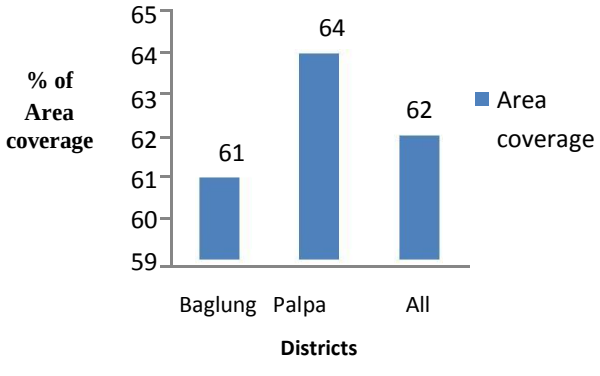




Fig 1: percentage of the farmers adopting improved variet ies Fig 2 : percentage of Area coverage by improved varieties

**Technology Adoption Analysis of Improved Maize technology**

The responses received from the respondents were categorized as low (up to 33.33 %), medium (33.34 to 66.66 %) and high adoption (above 66.66 %). Table 2 presents the current level of practice of the different factors at the study sites taken into consideration. Average Seed rate in Palpa is 40 kg/ha whereas in Baglung it is 49 kg/ha. Average use of Nitro genous, Phosphorus and Potassium fertilizer in palpa is 45,11 and 10 kg/ha respectively whereas in Baglung it is found to be 75,10 and 12 kg/ha respectively. Both the districts are following the recommended number of weeding. Row planting is not followed b y any farmers in both the districts. Practice wise category of adoption of improved maize production technology is presented in Table 3.

With regards to recommended seed rate all respondents in both the District were observed to be high adoption category. Suwar (1981) also found respondents to be in high adoption category regarding adoption of seed rate in . With regards to nitrogenous fertilizers, majority of the farmers in Palpa were from low adoption category whereas in Baglung majority of the respondents were from high adoption category. With regards to phosphatic and Potassium fertilizers all the respondents were from low adoption category. Govereh *et.al*, (2003) in Zambia also found the adoption of Nitrogenous fertilizers to be in high adoption catego ry compared to other chemical fertilizers. None of the farmers were found to practice row planting in both Districts. Ephraim and Featherstone (2001) also found that only 1 % of the total sampled respondents followed the row planting in Tanzania. Data presented in table 4 indicates that majority of respondents were found in high adoption category followed by medium adoption category and low adoption category. Etoundi and Dia (2008) report also found 70% of the respondents to be in high adoption category in adopting Maize improved technology in Cameroon. Low adoption of improved technology is due to non-availability of improved varieties seed at proper time and lack of knowledge. The technology Adoption index in Palpa and Baglung is 61% and 65% respectively.

**Table 2: Recommended practice and current level practice of different factors taken into consideration at the study sites**

| practices | Palpa | | Baglung | |
|---|---|---|---|---|
| | Recommended practice | Current practice | Recommended practice | current practice |
| Seed rate | 20 kg/ha | 40 kg /ha | 20 kg/ha | 49 kg/ha |
| Nitrogenous Fertilizer | 104.9kg/ha | 45kg/ha | 104.9kg/ha | 75kg/ha |
| Phosphorus Fertilizer | 65.22kg/ha | 11kg/ha | 65.22kg/ha | 10 kg /ha |
| Potassium Fertilzer | 50kg/ha | 10kg/ha | 50 kg/ha | 12 kg/ha |
| Number of Weeding | 2 | 2 | 2 | 2 |
| Planting method | row planting | sowing after plough | row planting | sowing after plough |

**Table 3: Frequency and percentage of farmers with different cultivation practices**

| Cult ivation Practices | Palpa | | | Baglung | | |
|---|---|---|---|---|---|---|
| | low adopter | med iu m adopter | high adopter | low adopter | med iu m adopter | high adopter |
| Improved varieties | 10(17) | 20(33) | 30(50) | 6(10) | 24(40) | 30(50) |
| Seed rate | 0 | 0 | 60(100) | 9(15) | 0 | 51(85) |
| Nitrogen | 38(62) | 5(8) | 17(30) | 6(10) | 12(20) | 42(70) |
| Phosphorus | 60(100) | 0 | 0 | 60(100) | 0 | 0 |
| Potassium | 60(100) | 0 | 0 | 60(100) | 0 | 0 |
| Weeding | 0 | 5(8) | 55(92) | 3(5) | 0 | 57(95) |
| Row planting | 60(100) | 0 | 0 | 60(100) | 0 | 0 |

Figure in the parenthesis indicates percentage

**Table4 : Frequency and percentage of farmers with different categ ories of adoption in the study sites**

| Category | Palpa | Baglung | Total |
|---|---|---|---|
| Low adopter(0-33%) | 3(5) | 6(10) | 9(8) |
| Medium adopter (33-66%) | 37(62) | 17(29) | 54(45) |
| High adopter (67-100%) | 20(33) | 37(61) | 57(47) |
| Overall TAI(%) | 61 | 65 | 63 |
| Total | 60 | 60 | 120 |

Figure in the parenthesis indicates percentage

## CONCLUSION

From the study it is revealed that area covered by the improved varieties of Maize was found to be 62% in the study area. It can be concluded that majority of the farmers belonged to high adoption category. Still most of the farmers have been using the different local varieties. The improved varieties like Rampur Composite, Manakamana 6, Arun 2 are popular in the study districts. The contribution of Seed rate in Technology Adoption index was found to be higher followed by Varieties and Nitrogenous fertilizer. There is a greater scope of increasing Technology Adoption index by increasing use of phosphorus, potassium fertilizers and high yielding varieties following row planting method. Also if the rainfed farming can be replaced with irrigation, adoption index can be increased. The study suggests that the practices of applying Nitrogenous, phosphorus, potassium fertilizers, method of planting, which had low adoption by farmers should give due attention by extension agencies, so that the existing level of adoption of such practices can be increased. Efforts should be made to increase the extension contacts of the farmers with extension workers to increase their level of adoption. It can be concluded that despite of the rainfed condition yield of the maize can be increased by using improved varieties, recommended use of Nitrogenous, Phosphorus and potassium fertilizers, seed rate, planting method, weeding.

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## REFERENCES

Adhikari, K., Ransom J.K., & Paudyal, K. (2003). Adoption of improved maize varieties in the hills of Nepal. *Journal of the International Association of Agricultural Economics* 29(3), 299-305.

Adhikari, K.P. (2008). Effectiveness of integrated pest management technology through Farmers Field School on vegetable production in Nawalparasi and Kavre district of Nepal.Thesis,M.Sc. Institute of Agriculture and Animal science, Rampur, Chitwan, Nepal. pp . 29-44.

Assefa,T. (1999). Weed incidence and control in the major crops at Assosa. An overview. In: Fasil Reda and D.G. Tanner (eds.). *Arem*, 5,14-26

Ephraim, M., & Featherstone, A.M . (2001) Crosspollinated crop variety adoption studies and seed recycling: the case of maize in Tanzania. *Eastern African Journal of Rural Development* ,17(1), 25-34.

Etoundi, S.M.N., & Dia, B.K. (2008). Determinants of the adoption of improved varieties of Maize in Cameroon: case of CMS 8704. *Proceedings of the African Economic Conference*. pp. 397-413.

Govereh, J., Jayne, T.S., Sokotela, S., & Lungu, O.I. (2003). Raising maize productivity of smallholder farmers in Zambia: what can fertilizer consumption alone do or not do?

Gurung, K, (2011). Impact Assessment of HMRP J.Agril.Eco.30, pp308-312 *Income Growth. World Development*, 31(8), 1343-1366.

Lucas, E.O. (1986). The effect of density and nitrogen fertilizer on the growth and yield of maize (Zea mays L.) in Nigeria. *J. Agric Sci. Camb*., 107, 573-78.

MoAD. (2014). Statistical information on Nepalese Agriculture . Ministry of Agriculture and Cooperatives. Government of Nepal. Kathmandu, Nepal. pp164-165.

Navaya, J.L., & Gurung, D.B. (2010). Impact of climate change on production and productivity: A case study of maize research and development in Nepal. *The Journal of Agriculture and Environment* , 11, 35-38.

Paudel, P. (2008). Factors influencing of improved maize varieties in Nepal: A case study of Chitwan district. *Australian Journal of Basic and Applied Sciences*, 2(4), 823-834.

Pinter, L., Elfoldi, Z., Burues, Z., & Paldi, E. (1994). Feed value of forage maize hybrids varying in tolerance to plant density. *Agronomy Journal*, 86, 799-804.

Pokhrel, T. (2013). Impact of Maize varieties Disseminated in Chitwan, Nepal. *Economic Journal of Nepal*, 42 (6), 45-53.

Singh, R.P., Kumar, R., & Singh, N.P. (2005). Identification of pulling Factors for Enhancing the Sustainable Develpoment of Agricultural with Special Reference to Maize in India. CAPSA Working paper No88.United Nations,ESCAP.

Suwar, A. (1981) effect of seed rates, sowing methods and fertilization on the performance of forage sorghum (*Sorghum bicolor* (L) Moench) grown on saline-sodic soil M. Sc. thesis, Faculty of Agriculture University of Khartoum.

Tiffen, M, (2003). Transition in Sub-Saharan Africa: Agriculture, Urbanization and Working Paper. Food Security Research Project, Lusaka, Zambia

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 27-28, 2012. Published by Nepal Agricultural Research Council (NARC) & Outreach Research Division (ORD), Khumaltar, Nepal.