

PERCEPTION AND ADAPTATION OF THE PRODUCERS TO THE IMPACTS OF CLIMATE CHANGE IN APPLE PRODUCTION: AN ASSESSMENT OF MUSTANG DISTRICT OF NEPAL

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ABSTRACT

A study was conducted to assess the perception of farmers, researchers and related stakeholders on the impacts of climate change in apple production in Mustang district of Nepal. Focus group discussion (FGD) and key informants interviews were organized to explore the major climate hazards, relationship of climate hazards to apple production, impacts of climate change and potential adaptation measures. Increased temperature, drying up of water resources, increased northern wind, high speed wind, less snowfall and prolonged droughts were found as the major climatic hazards in the district. Use of alternative and/or additional sources of irrigation water; use of low chilling, drought tolerant and early maturing varieties; adoption of efficient irrigation methods and conservation agriculture practices were identified as the important adaptation measures.

KEY WORDS: Climate change, climate hazards, adaptation measures, apple

INTRODUCTION

The climate is changing and weather patterns are becoming increasingly extreme and unpredictable (IPCC, 2007). The global temperatures are likely to increase by 1.1-6.4°C from 1990 to 2100 though the speed at which the temperature will rise is still debated (IPCC, 2002). The IPCC predicted that the atmospheric temperature of Hindu Kush Himalayan Region will undergo an increase of 5-6°C. Mountainous regions in Nepal are experiencing increases in temperature (Shrestha *et al.*, 1999) much greater than the global average (Eriksson *et al.* 2009). Although this increase will provide comparative advantage to some crops in few regions of the world, the overall impacts of climate change on agriculture are expected to be negative, alarming the global food security and malnutrition.

Nepal's economy is dominated by agriculture, which accounts for over one third of GDP and employs more than two thirds of the population (MoAC, 2010). Due to the wide range of climatic variability, Nepal has great opportunity to produce different types of fruits. Changing dietary habits of the people and the increasing awareness on balanced diet has increased the demand of fruits in the recent years (MoAC, 2010). Although the area and production of fruits has been increasing in the country (Table 1), per capita fruit consumption is far below the recommended level and only 45% of the local demand of fruits is met by domestic production. This can be further supported by a study conducted in 2002-2003 which showed that 98.1% of men and 99% of women in Nepal did not have adequate fruit and

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vegetable consumption, even though only 13.7% of the study population was urban (Hall *et al*, 2009).

Table 1. Area and production of fruits in Nepal

Year	Total Area (ha)	Productive Area (ha)	Production (Mt)
2000/01	73775	48166	487326
2001/02	77537	49780	473621
2002/03	80426	51016	518864
2003/04	86707	54111	511406
2004/05	89312	55348	552879
2005/06	91923	56549	535449
2006/07	94901	57595	575095
2007/08	100099	63432	630563
2008/09	103651	68785	686213
2009/10	107322	70722	706972
2010/11	117932	79184	794164
2011/12	139321	101233	1029754

(Source: MoAD 2012)

Apple is one of the high value commodities that could be grown in high hills and mountains of Nepal (FNCCI, 2012). Government of Nepal has given high priority for developing apple production in identified pocket areas. High quality apples could be produced in sub-humid and dry temperate areas in Himalayan region of Nepal ranging from 1800m-2800m above mean sea level. Such rain shadow or low rainfall areas are mostly located in the Western and Mid Western mountainous regions of Nepal (Devkota, 1999). Mustang district is one of them in the Western Development Region. Mustang has already been identified and proved as one of the potential districts for commercial cultivation of apple. Marpha known as delightful apple capital of Nepal is located in Mustang district. The Government of Nepal has established the apple farm in Marpha, Mustang in 1966 realizing the suitability for producing the quality apples. The national as well as international market has recognized the apple produced in Mustang is the finest quality in terms of crispiness and juiciness. The processed apple into alcoholic product from the district has become very popular throughout the country. Other processed products of apple are juice, cider and air dried apple slices which are also becoming popular in the recent years.

Due to the recently opened fair weather road upto the district headquarter, many villages within the district are being accessible gradually. This road access has led the farmers to fetch the good price of their apple at their farm gates. Because of this good market price, more and more farmers are found interested in apple production. Productive area under apple has reached to 5674 ha in 2011 which was 3006 ha in 1997 (MoAD. 2012).

Farmers of Mustang are facing the problems of more frequent and seriousness of diseases and insect pest's infestations in their apple orchards in the recent years. Due to this, the productivity of the apples is in decline. The villages of lower Mustang particularly Lete, Kunjo, Kobang, Tukuhe and Marpha has experienced more infestations in the recent years comparing to the higher altitude areas. Off-season flowering has also been observed in high altitudes crops like peach, pear and apple (Malla, 2008).

Thus, a deeper understanding of the interdependence between changing climatic conditions and apple production together with adaptation options is crucial. Information about farmers' perception of climate change and adaptation approaches would assist policymakers to decrease the farmer's vulnerability to the adverse impacts of climate change.

OBJECTIVE OF THE STUDY

To assess the perception of farmers, extension workers and researchers on climate change and its impacts on apple production
To identify the climate hazards that negatively affects the apple production
To assess the potential adaptation strategies against the negative impacts of changing climate

METHODOLOGY

The study used a focus group discussion in Mustang district with farmers and relevant district level stakeholders held in 2012. The stakeholders were District Agricultural Development Office, Temperate Horticulture Development Centre (THDC), District Development Committee, Annapurna Conservation Area Project, and District Livestock Service Office amongst others. Key informants survey with progressive farmers and technical personnel from District Agricultural Development Office and Temperate Horticulture Development Centre was also conducted to assess in-depth ideas on the impact of climate change in Mustang district in relation to apple production.

RESULTS AND DISCUSSIONS

IMPACTS OF CLIMATE CHANGE

The study found that increased temperature, drying up of water sources, ncreased Northern wind, high speed wind, decreased snowfall and longer drought periods re the major climate hazards in the district particularly in the lower Mustang (Figure1) These all factors are affecting negatively in the apple production both in

terms of quantity and quality (Annex 1).

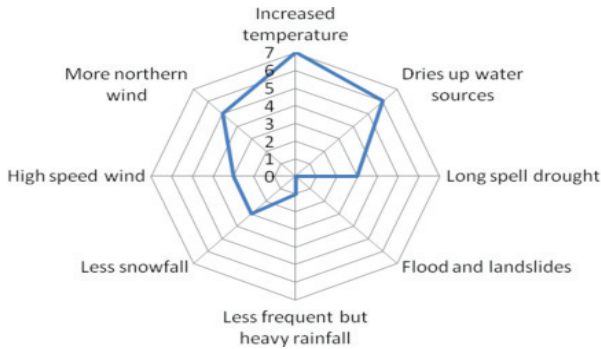


Figure 1. Perceived climate events in the study area (Source: FGD, 2012)

When asked about the impact of climate change in apple production, most of the apple growers responded that the production is reduced. According to them, the reduced snowfall and its change in timing has attributed to this reduced production. It is revealed that the quantity and frequency of snowfall has been decreased significantly over the last decade.

A woman farmer in Marpha recalls: “Till late 1990s, we used to have huge snowfall and all the land used to be covered up with upto 2 to 3 feet of snow in the winter months. Once, I was supposed to visit back my parent’s home in Dhumba immediate after my marriage, I had to cancel because of unexpected heavy snow fall. I remember that was one of the heaviest snowfalls I have ever seen; it went for 4 consecutive days. Before 15-20 years ago, we used to play with snow and enjoy a lot but nowadays that’s a rare dream”.

When talking about the decreasing snowfall, they compare amounts of snowfall at several places in past and present years to indicate a pattern. They professed frequency of early snow events in December and January had decreased over time with snowfall now often occurring in February, March and even April. The apple growers perceived the impact of change in snowfall timing is more crucial than reduction in amount of snowfall. They claimed early snowfall is more beneficial for agriculture. Jeevan Gurung of Pangling village claimed that early snow is more long lasting and melt slowly than late snow which results more infiltration of moisture in soil and increase the soil moisture. Late snow on the other hand, melts faster and there is more surface runoff. This also leads to high humidity in March, April and May which results more conducive environment for disease like apple scab and insect like wooly aphid infestation.

Some apple growing farmers perceive that increase in temperature is also equally affecting apple production in the district. They claimed that this increase in

temperature favors infestation of pest, increased fruit drop, drying up of water resources resulting into shortage of irrigation water. This shortage ultimately results in to the decline in productivity of apple orchards.

The perception of extension worker and researcher is somewhat different than apple growing farmers. They claimed that poor orchard management is the reason behind the decline in productivity of apple in the district, in addition to the changing climate effects. Mr. Dharma Prasad Devkota, Senior Horticultural Development Officer of THDC opines that the increased temperature and change in amount and timing of snowfall has negative impact in apple production. One of the causes of the present decrease in productivity is the lack of pollinizers. According to him, farmers have cut down the pollinizer varieties and planted commercial varieties. Those who are managing their orchards well still get good crops. He further questions, has climate not changed for them? According to the technicians, the farmers have sprayed excessive amount of pesticides in the recent years which also killed the beneficial insects. This also has adverse effect on soil and human health.

The increasing incidence of failure of the apple crop has led to the diversification of cropping pattern in many areas in the lower part of the district. Farmers are now growing medicinal plants, potatoes, beans and vegetables. But in upper areas, the acreage for apple cultivation is increasing in the recent years and more and more farmers have been involved in apple cultivation individually as well as in groups. The changing climate has negative impacts in lower part but positive impacts in the upper part of the district for apple cultivation.

ADAPTATION STRATEGIES

Focus group discussion with apple growing farmers, extension workers and researchers in the district identified eight different strategies to adapt to the impacts of climate change in apple cultivation considering urgency, sustainability and feasibility (Figure 2).

The serious impact of climate change is the lack of irrigation water. Hence, going for alternative source of irrigation was identified as the most urgent need in the district to adapt to the changing climate. FGD participants identified the alternatives for this are either to explore the natural spring sources of water or to pump the water from Kaligandaki River for irrigation. Other important adaptation strategies identified were use of low chilling, early maturing and drought tolerant varieties of apple, use of efficient irrigation methods (e.g. drip irrigation) and conservation agriculture practices.

Pema Dhundu Gurung, an apple growing farmer in Pangling village said confidently that to adapt to the lack of irrigation water we must lift the water from Kaligandaki River and collect in a pond above the village so that we could supply it to the field below. He added, even if they explore other springs nearby, this may dry up quickly in association with less snowfall and prolonged drought as observed in the recent years. Other adaptation measure against increased temperature

could be the adoption of low chilling apple varieties that can give good production comparatively in higher temperature.

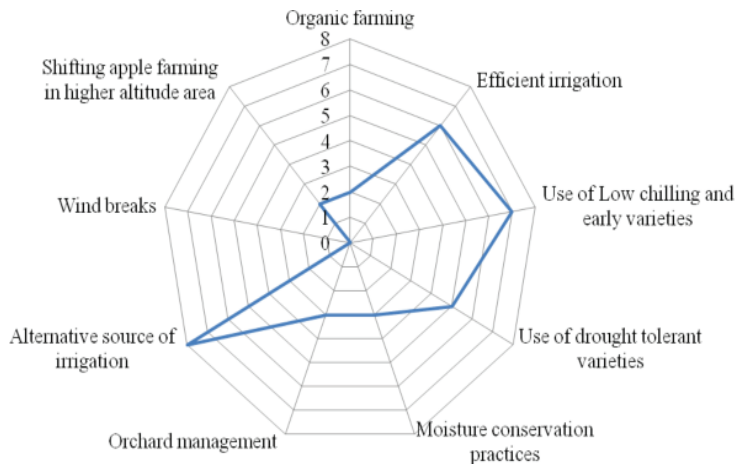


Figure 2. Potential adaptation strategies in the study site (Source: FGD, 2012)

CONCLUSION

Apple is a major fruit of the high hills of Nepal. The yield of apple is low due to various factors. Changing climate particularly increased temperature and resultant shortage of irrigation water seems a major factor among several factors that limits the production. The study indicated that increased temperature, drying up of existing water, frequent and increased Northern wind, high speed wind, less snowfall and long drought spells are the major climate hazards in Mustang district which are contributing to the decreased apple production. As measures, use of low chilling, early and drought tolerant varieties of apple; use of efficient irrigation methods and conservation agriculture practices are the adaptation practices that need to be promoted. Some initiatives have already been taken by local communities in this regards viz; uplifting irrigation water from Kaligandaki to irrigate apple orchard and organizing apple growers in group. The findings of this study may help the authorities in planning and designing climate resilient practices minimizing the negative impacts of climate change in apple production in Mustang and other apple producing districts. This will ultimately help to increase the apple production and productivity that will support the livelihoods of apple growers in Nepal.

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Annex 1. Farmers perception on climate change and apple production

Climatic parameters	Associated climate hazards	Farmers perceived effects in apple production	Coping/adaptation actions acted by farmers	Potential adaptation strategies
Temperature	<ul style="list-style-type: none"> Increased temperature Long spell drought Water resources drying up 	<ul style="list-style-type: none"> More infestation of insects and pest Yield reduction Lack/shortage of irrigation water Decreased quality of production (dull color, malformation, insect and disease attack) 	<ul style="list-style-type: none"> Use of chemical fertilizers Irrigation canal construction Plantation/afore station Plantation, gabion, check dam, water tank 	<ul style="list-style-type: none"> Organic farming, use of bio pesticides, use of well decomposed manure. Efficient irrigation methods Use of low chilling varieties, early varieties etc. Use of drought tolerant varieties Moisture conservation practices like mulching,
Precipitation	<ul style="list-style-type: none"> Long spell drought Dries up water sources Flood and landslides Less frequent but heavy rainfall Less snowfall (change in amount and timing of snowfall) 	<ul style="list-style-type: none"> Increase fruit drop Break down trees and branches. Destruction of water resources and irrigation canal 	<ul style="list-style-type: none"> Nothing is done 	<ul style="list-style-type: none"> Orchard management (appropriate manure application method, training and pruning) Alternative source of irrigation, i.e. pumping water from Kaligandaki river
Wind	<ul style="list-style-type: none"> High speed wind more northern wind 	<ul style="list-style-type: none"> Break down trees. More infestation of insects and pest Increase fruit drop 	<ul style="list-style-type: none"> Plantation around apple farm Wall constructed around farm 	<ul style="list-style-type: none"> Good wind breaks