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ASSESSMENT OF ON-FARM MANAGEMENT AND ASSOCIATED KNOWLEDGE OF AGRO-BIODIVERSITY IN CLIMATE SMART VIILAGES OF NAWALPUR DISTRICT IN NEPAL

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ABSTRACT

The study was conducted in Nawalpur district of Nepal to assess status of on-farm management and associated knowledge of agrobiodiversity. Further, this study identified the farmers perception and their local interventions in on-farm agrobiodiversity conservation and management. The snowball and simple random sampling technique were used to identify the farmers practicing on-farm management and those who do not respectively. The pretested questionnaire was administered to 100 farmers of two villages, 50 from each village, from 2nd to 5th March 2018. Descriptive and analytical statistical tools were used to determine and compare the factors associated with on-farm management of agrobiodiversity. The study revealed that out of 98.0% of the respondents practicing on-farm management, almost all had home garden followed by 74.50% involved in value addition, 59.20% agro-diversity fair, 55.10% Community Biodiversity Management (CBM) and 36.10% travelling seminar. There was a significant relation between the type of the farming system and CBM (at p 0.00), travelling seminar (at p 0.043) and value addition (at p 0.036). The majority of respondents were commercial farmers, they sell what they produce for livelihood, and were practicing on-farm management of agrobiodiversity. Different means of information were used, where major being the information given by the respondents. Lack of government's technical support and information on Community based Biodiversity Management (CBD), were the major reasons for farmers for not being able to acquaint with it, and practice it on local conditions. Proper training and awareness, agricultural promotion programs are the absolute imperative to improve on-farm agrobiodiversity conservation and management status.

Keywords: Agro-biodiversity, Climate smart village, In-situ conservation, On-farm management.

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INTRODUCTION

Nepal predominantly being an agrarian country, agriculture is the mainstay of Nepalese economy, where agriculture share in national GDP is about 27.10% (MoALD, 2019). It is evident that, Nepal is blessed with large diversity of local crop varieties that have capacity of adapt into the their local conditions, and tolerate stress of biotic as well as abiotic nature (Joshi and Upadhya, 2019). Such diversity of crops is being maintained by farmers since long time ago by planting the seed, selection of harvest and exchanging it with other farmers, and replanting them. Unfortunately, due to evolving modern and hybrid varieties of crops, such local diversity is being replaced in present days. In such pretext, since 1995, on-farm conservation and management of local diversity has been practiced by farmers of Nepal (Joshi and Upadhya, 2019). Agricultural biodiversity being a sub-set of general biodiversity (CBD, 2008), constitutes genetic resources for food and agriculture that includes domesticated and non-domesticated crop varieties, breeds of livestock and species of fishes, resources found within field, forest and range land; and non-harvested species and production ecosystems such as soil micro-biota, pollinators, agricultural, pastoral, forest and aquatic ecosystems (FAO, 2004). Methods that can be adopted for conserving food and agriculture genetic resources are in-situ (on-farm), in its place of origin and ex-situ (off-site), outside the origin place (Joshi et al., 2017). On-farm (*in-situ*) conservation is the process in which plant and native wild relatives are conserved in their very place, where they were originated and developed present day characteristics. It can be defined as the choice by farmers to continue managing agricultural biodiversity in their communities, in the agro-ecosystems, where the agricultural biodiversity has historically evolved through human and natural selection process (Bellon, 1991). The use of agricultural biodiversity can contribute to food security, nutrition security and livelihood security (Frison et al., 2011)

Although, agriculture remains as the basis of livelihood and backbone of national economy, all kinds of biodiversity relating to food and agriculture are threatened, while, several losses of agricultural biodiversity are irreversible, with serious negative consequences on environment and livelihoods of people. In this very context, one of the best solutions is conservation of agro-biodiversity on farm, that allows these materials to conserve and make available for crop production. Therefore, this study was conducted to assess the farmers' knowledge, associated practices and status of on-farm management of agrobiodiversity in Nawalpur district of Nepal.

MATERIALS AND METHODS

The study was conducted in Nawalpur district of Gandaki province of Nepal. Since the study was to interview farmers for assessing the agrobiodiversity management and conservation on-farm, of two climate smart villages namely Rajahar (Devchuli Municipality) and Agyouli (Kawasoti Municipality) of Nawalpur district were purposively selected for the study. The district is located in 27.6498°N and

83.8897°E. Farmers of the two climate smart villages were selected purposively, and snow ball sampling technique was used to select the progressive farmers. The total number of 100 farmers were selected from two villages, Rajahar and Agyouli. Primary data were collected by face-to-face interview from farmers during 2nd to 15th March 2018, pretested semi-structured questionnaire was used during the interview. Data on farmers knowledge, practices and measures taken at local level to conserve agro-diversity were taken during the study. Farmers perception about on-farm management, and status of on-farm management were also recorded by interviewing them. These data were supplemented by the information obtained through the secondary source of information (Published journals, articles, Bulletins, etc), and validated by Focused Group Discussion and Key Informant Interview. Data analysis and various comparisons were made to obtain results. The data were entered in Microsoft Excel, SPSS (version 23) and analysis was done by using SPSS. Both descriptive and analytical analysis were done. Mean, Median, Frequencies and Standard deviation were used for the descriptive analysis, whereas Chi-square test, regression and binary logistic were used for analytical statistics.

RESULTS AND DISCUSSION

Know-how of on-farm management

According to the survey conducted, 98% of the respondents had known and practiced on-farm conservation and 2% of them were unknown and had not practiced it (Fig. 1). The reasons for more respondents having knowledge about on-farm management and adopting the methods in their local condition is due to outreach programs like FFT (Farmers Field Trial), Mini-kit demonstrations, Transfer of Technology (TOT) by LI-BIRD and NARC. Almost 100% farmers in the study area asserted that LI-BIRD was the principal organization providing training and technical know-how on the subject matter to them.

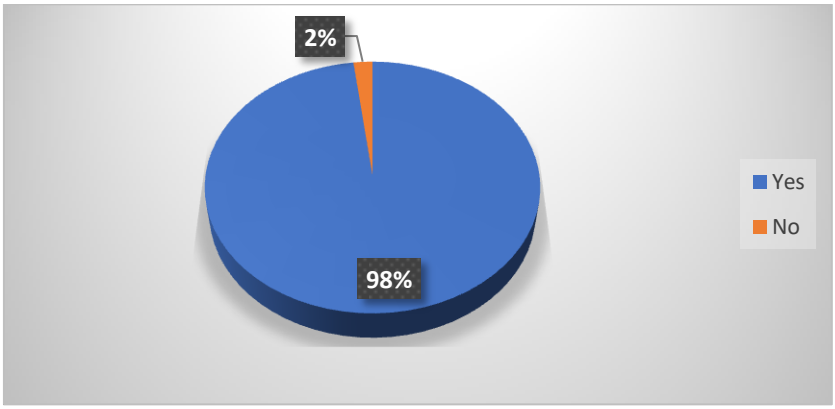

Figure 1. Respondents know how of the on-farm management

Farmers have been conserving the agricultural resources for centuries, they have been planting the same seed that is being already used since long time, which has conserved and maintained genetic diversity at farmers' level (Joshi and Upadhya, 2019). It is only after mid-nineties, farmers were doing the same thing with more systematically and scientifically, with the support of key role players like LI-BIRD, NARC, FORWARD Nepal, etc. There are more than fourteen organizations working on on-farm conservation and management, and has spread over 77 districts through direct, partnership and joint presence. They have got numerous different approaches developed and implemented along with different supporting programs. Among these organizations, LI-BIRD and NARC are some notable organizations performing on-farm conservation strategies by conserving, managing and utilizing agrobiodiversity (Joshi and Upadhya, 2019). Sustainable management of agrobiodiversity has been found instrumental through effective intuitional mechanism of multi-stakeholder partnership approach.

Reasons for practicing on-farm management

From response given by the respondents, 99% of the respondents told that, economic benefits were the reason for practicing on-farm management, 55.10% for social benefits, 77.60% for genetic and 41.80% for ecological benefits (Fig. 2).

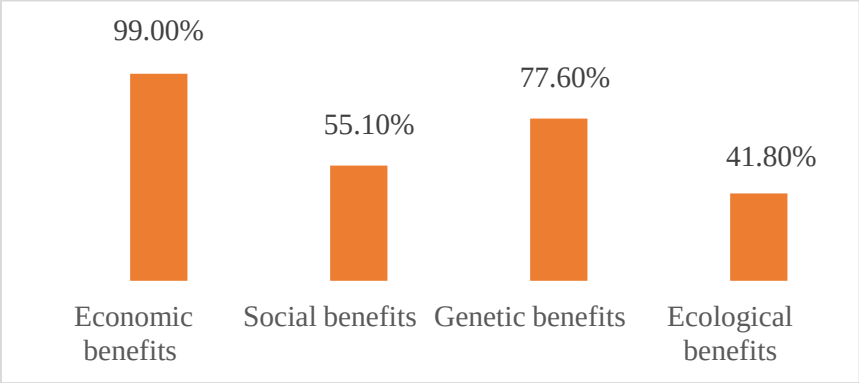

Figure 2. Reasons for on-farm conservation adoption

The farmers stated that, the economic benefits derived were due to production of local crop cultivars that supports food needs of their family (99%). 87.6% of farmers were benefitted by direct selling of their produce in market (Figure 3). In addition to this, conserving the already used cultivars of crops has helped them saving thousands of rupees, which would otherwise be spent on purchasing seeds from the market. The farmers also responded with different associated social, genetic and ecological benefits of conserving and managing the local diversity on their local conditions as in figure 3. Among the social benefits obtained by the respondents, conservation of traditional varieties and conservation of Indigenous Knowledge (IK) accounted for

94.5%. While, increase in social status and use in social rituals were responses of 27.30% and 18.20% of farmers respectively (Fig. 3).

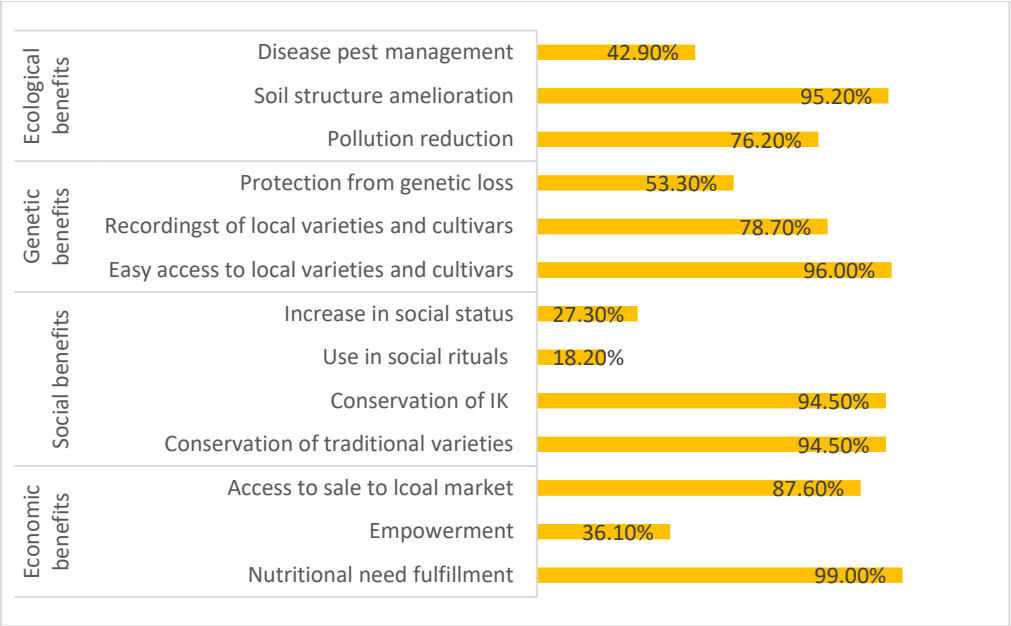

Figure 3. Different economic, social, genetic and ecological benefits derived

Similarly, out of 77.6% of respondents who figured genetic benefits made them practice on-farm management of agriculture diversity, 96% of them found access to local varieties and cultivars as direct genetic benefit. Recording of local varieties and cultivars and protection from genetic loses were advantages as told by 78.70% and 53.30% of farmers (Figure 3). The farmers who responded with ecological benefits found that, soil structure amelioration (95.20% farmers), pollution reduction (76.20% farmers) and disease pest management (42.90% farmers) by conserving and managing local diversity on-farm as in Figure 3.

Sthapit et al. (2006), found that management of agrobiodiversity on-farm has economic, social, genetic and ecological benefits associated with it. There are two options specifically to consider in adding benefits; the first through participatory plant breeding, that provides improved quality, disease resistance, high yield, better taste, and other preferred traits obtained through seed systems and farmers selection (Sthapit et al., 2006). The second through public awareness, marketing and incentives program, that includes value addition of local crop diversity that makes the demand of crop and their product surge upwards. Socioeconomic factors like wealth, education status of decision makers, land holdings, number of livestock reared, type of farming system holds degree of management interventions at household level according to Gauchan et al. (2003).

These diverse options of benefits cannot be achieved unless the local capacities of farmers are recognized and valued. In addition to this, they need to brought into the mainstream of decision making and intervention programs by the concerned institutions and authorities. These players ought to take up the responsibility of monitoring local crop diversity after conservational and managerial interventions.

Land holding of the respondents and on-farm management practice year duration

From the study it was found that average land holding of the respondent was 0.36 ha, and maximum and minimum was found to be 2 ha and 0.03 ha respectively (Table 1). Increasing fragmentation, de-intensification and abandonment of agriculture fields, conversion of agriculture land to settlements, double ownership structure and unclear land tenure rights, and a large landless population are other major problems having to do with land management in Nepal (Paudel et al., 2013).

Table 1. Average land holding of the household and time duration of practicing on-far management

	N	Minimum	Maximum	Mean
Self-cultivated area	100	0.0300	2.0000	0.362626
For how long have you been practicing on-farm	100	1(years)	5(years)	3.09(years}

About 14.7% of land in Nepal is arable (Worldbank, 2016), which is only is 0.81 square kilometers arable land for 1000 people, which is very low when compared with the neighboring countries (Worldstat, 2020). In addition, there are many challenges pertaining to land management, and this has resulted to national average land holding of 0.68 ha (Pandey and Basnet, 2018)

Also, the table shows 3.09 years as the average time duration that farmers have been practicing on-farm management. The maximum and minimum years were found to be 5 and 1 year respectively. The agrobiodiversity, despite being a panoply of diversity for food and agriculture, has been only conserved and managed by the farming communities in the past. Having the history dating back to centuries ago, in conservation of local biodiversity, systematic conservation and management of agricultural biodiversity in Nepal has been initiated only after the establishment of National Agriculture Genetic Resource Centre (NARGC) in 2010 (Joshi and Upadhya, 2019).

Practiced on-farm management method

According the farmers interviewed (Fig. 4), all of them were practicing home garden followed by 74.50% practicing value addition, and none of the farmers were practicing Community Biodiversity Registration (CBR). 55.10% of the farmers were

found to be practicing Community Biodiversity Management (CBM), 36.70% travelling seminar, and 59.20% of the respondents were found to be involved in diversity fair as a measure of on-farm management.

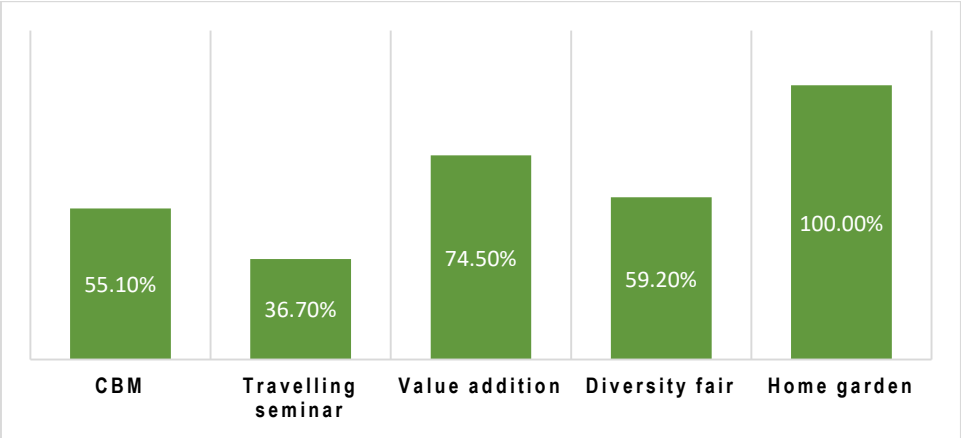

Figure 4. Different on-farm management methods practiced by the respondents

Crop genetic resources can only be managed through the concerted effort of natural and human managed processes. Natural processes such as environmental and biological, and human-managed that is socioeconomic factors, tend to influence the selection and maintenance of the crop cultivar at any time in any farming situation (Jarvis and Hodgkin, 2000). Human managed process either formal or informal are accountable for conserving, increasing or decreasing and modifying the genetics of the crop diversity on-farm.

A three steps conservation ladder is promoted in Nepal; local, national and international level for sustainable conservation of local diversity (Joshi et al., 2017a). There are 14 different methods developed for on-farm conservation, which in fact it self the local level intervention. Among those 14 methods the most common and mostly practiced are community seed bank and community gene bank (Joshi and Upadhya, 2019). According to Sthapit et al. (2006), in a study conducted in Kaski district of Nepal, numerous conservation and utilization practices like community biodiversity register, seed bank, diversity block, diversity fairs, production and marketing of local crop seeds and adding value by processing and marketing the local crop products are being fully institutionalized.

Binary logistic of effect of ethnicity, education and gender on different methods of on-farm management

According to interviewees, gender and literacy are highly related with the type of method practiced for on-farm agrobiodiversity management. The elite groups were practicing almost every and either method of on-farm biodiversity management,

while illiterate group of people were found reluctant towards biodiversity conservation and management. The role of gender in agriculture was found to be differing with the task involved. In more laborious work, males were dominant while females were found be involved more in less demanding work.

According to study, 75.5% of the elite groups were practicing CBM. The role of ethnicity was found significantly affecting CBM with p value 0.04 which is less than 0.05 (Table 2). While other independent variables (gender and education) do not have any significant role on above measures of on-farm management.

Table 2. Effect of ethnicity, education and gender on different methods of on-farm management

Factors affecting	CBM	Travelling Seminar	Value Addition	Diversity fair	Home Garden
Ethnicity (elite=1)	0.18 (-1.67)	1.316 (0.27)	1.30 (0.26)	1.85 (0.61)	39599824.85 (17.49)
Education (Illiterate=1)	0.00 (-21.06)	1.83 (0.604)	10.90 (2.38)	0.42 (-0.86)	0.00 (-18.74)
Gender	1.81 (0.59)	0.67 (-0.39)	1.66 (0.50)	0.78 (-0.24)	3055662.41 (17.23)
Constant	1.68 (0.52)	2.84 (1.04)	0.51 (-0.66)	1.37 (0.31)	0.00 (-33.26)
Model X^2	15.174*	2.089	6.559	3.62	8.472
Negelkerke's R^2	0.207	0.031	0.102	0.053	0.468*
% Correct	66.7	64.4	75.6	65.6	97.8

Note: * represents significant at probability level 5%

Agrobiodiversity has an important role to play in livelihood and traditional culture of the farmers of the particular region. It functions to provide direct beneficial products to human, regulates climate and environment, forms unique culture within farming communities and many other unnoticed functions (Schen et al., 2017). A study on gender and the environment highlights that women are denied equal access and control over the natural resources, including agrobiodiversity management (Bhattarai et al., 2015).

CONCLUSION

The study was conducted to assess the farmers practice and knowledge associated to on-farm conservation and management of the agricultural biodiversity. The study revealed that the majority of the respondents were commercial farmers, whose main occupation was found to be the agriculture, and they were practicing on-farm management of agro-biodiversity in their local conditions for varied reasons like social, economic, genetic and ecological gains. The method of on-farm management was found varying within farmers, the most practiced being the home garden followed by value addition. The study also unveiled that majority of the on-farm

practitioners had higher education, and had attended some sort of training from different institutions, that were supporting local communities with different means, for promotion of on-farm management and conservation of the agricultural diversity. It is imperative to understand the scientific basis of on-farm conservation and management of crop genetic resources, for maintaining genetic diversity, and for their economic, sociocultural, genetic and ecological values, which in other hand aids to formulate development and national research policies for poverty alleviation, food security and sustainable climate resilient agriculture. In this regard, prioritizing the local products and supporting different activities are imperative to encourage farmers for continuation of local diversity.

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