SEED STORAGE AND CULTIVATION: A SURVEY IN GAJURI RURAL MUNICIPALITY OF DHADING

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AN ABSTRACT

of the dissertation of *Sital Rijal* for the degree of *Master in Sustainable Development* (Development Studies) presented on November 3, 2022.

Title: *Seed Storage and Cultivation: Survey in Gajuri Rural Municipality of Dhading*

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Production, selection, and storage of the grain seeds used for cultivation in Nepal have two ways: traditional and modern. Traditional ways of storage and re-use of seed depend upon indigenous and traditional techniques whereas modern techniques depend upon the different agencies performing scientific agricultural breeding and storage techniques. Despite many policies and programs by the agencies, farmers are reluctant to use tradition sources of seed production, storage and cultivation. So, this study aimed to determine the major varieties and sources of seed farmers are using for cultivation, to find to what extent the cultivated varieties are stored and to find out whether the stored seeds are cultivated or not at local level.

The research featured post-positivist approach surveying 171 households by systematic random sampling in Jarebagaiccha and Milanatar village of ward no 6 in Gajuri Rural Municipality of Dhading. Scale of the study was constructed utilizing literature review, in depth interviews; study of previous surveys. The researcher used SPSS version 26 for analyzing and drawing the findings of the 11 cultivated crops

including *Dhan* (rice), *Makai* (maize), *Kodo* (millet), *Gahun* (wheat), *Tori* (mustard), *Aalu* (potato), *Mass*(black lentil), *Bodi* (cowpea), *Bhatmash* (soybean) , *Simi* (beans) and *Masyang* (masyang beans).

The findings determined the majority of the farmers cultivated local varieties of crops by using the informal sources of seed and stored the seed at their own home. Study further highlighted only four local varieties (soybean, *bodi*, potato, mustard) were acquired from agrovet by least of the farmers. The hybrid varieties those were cultivated had a formal sources, and none of the hybrid varieties were stored. The farmers stored nine local varieties using the traditional method for cultivation.

This study provided an insight to seed industries to supply seeds required to the local farmers. The study further paves the path for the local government and non-governmental organizations to help the farmers by establishing a community seed bank to preserve the varieties and store the seed by blending the traditional technique and scientific method.

Keyword: Seed Cultivation, Seed Storage, Sources, Varieties

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CHAPTER I

INTRODUCTION

As seeds seem essential for the cultivation of crops, smallholder farmers receive seeds from various sources that can change over time. Smallholder farmers are becoming more popular as local seed sellers and producers in several nations. This study focuses on the major cultivated crops of the research area, sources of the seed used for cultivation, storage of the seeds and cultivation of thus stored seed after the quality check. The first sections of the study include the introduction, literature review, and research methodology.

This chapter introduces the agricultural context of the present condition of agriculture at Gajuri Rural Municipality of Dhading, Nepal. While there it also embraces the issue, the reason for the research, the research topic, and the significance of the research.

Setting the Scene

Humans and agricultural practices have one to one connection as it offers a realm where grain cultivation is made and human basic needs (foods) are fulfilled. Being the oldest occupation of human kinds, Agriculture provides sources of nutrition for people, and, consequently, no life. Among many economic activities in Nepal, agriculture is one of the most significant economic drivers. Around 8 million people or around two-thirds of the labor force in Nepal are employed in the country's primary industry, agriculture (Gyawali & Khanal, 2021). Only 21% of Nepal's land is cultivated, and 65% of the population works in agriculture, which is their main occupation (Joshi et al., 2020). To carry out farming, one of the most essential

requirements is the seed. It is a prerequisite for crop production. Nepalese farmers cultivate the seeds for planting according to the season. The crops differ according to the season, geography and necessity.

Farmers in nations throughout the world obtain seeds from various seed production sources. These sources can be local (neighbors, family, friends), regional (community seed banks, cooperatives, etc.), national (national seed companies, extension agencies, etc.), or even international (such as a multinational seed company or an international gene bank) (Puskur et al., 2021). In the local context of Nepal, local farmers conserve the seed by producing, selecting, saving and reusing it. They also acquire the seeds in the commercial market and depend upon national organizations and cooperatives for cultivation. The seed supply in the local context of Nepalese farming is informal.

The preserve the seeds to secure a continuous seed supply for the future, and it also helps to conserve genetic diversity. The lack of conservation and cultivation will ultimately lead to the loss of the local natural variant of the seed, which will further lead to scarcity of the seed for cultivation resulting for food scarcity. Similarly, the extinction of the local variety and the traditional knowledge of storage will also impact biodiversity.

Likewise, indigenous and traditional agricultural communities serve as the guardians and managers of local crop types, relying on their expertise to sustain and manage a diversified agrarian production system (Aryal et al., 2017; Piyaluni et al., 2011). The community in Dhading also has both traditional and modern seed conservation practices. The knowledge of agricultural and conservation methods has been gathered through various indigenous and traditional traditions that have been passed down from one generation to the next, from informal experimentation and an

understanding of one's own locality and environment. These practices and knowledge are also very much essential for developing sustainable farming practices.

Most of the Gajuri villagers' primary occupation is agriculture; they harvest their crops seasonally and sell them to make a living. Agriculture is continuous and the variety of the crops changes from season to season. The major crops cultivated in Gajuri Rural Municipality are rice, maize, millet, mustard, soybean, *mass, bodi* etc. The farmers in Gajuri acquire the seed for cultivation from agro vet, from their own homes, and they also share and exchange the seeds in their neighborhood.

Goal-2 Zero Hunger's objectives are to eradicate hunger, accomplish food security, improve nutrition, and advance sustainable agriculture and food system (Sustainable Development Goals / United Nations Development [SDG/UN], n.d.). The cultivation of seeds and its storage plays a direct and indirect role in achieving these goals. A better quality seed must be cultivated for a better yield, which will further contribute to ending hunger by providing adequate crops. Zero hunger, one of the Sustainable Development Goals (SDGs), can only be accomplished when sufficient access to food and nutrition is available. At local, regional, national, and worldwide levels, there is a demand for community seed banks and field gene banks that contain seeds and plants with greater genetic diversity and stress tolerance to biotic and abiotic factors (Gautam, 2017). This types of seed storage facility should be opened here in the agricultural area of Nepal too.

Research Problem

Most of the Nepali farmers used native local seeds just thirty years ago. According to (Lama,2019), up until the 1990s, Nepal exported seeds, and according to agricultural scientists, more than 90% of the vegetable seeds grown nowadays are imported (Joshi,2022). As per (Lama, 2019), around 15% of rice seeds are grown

worldwide, and nearly 30% of the maize seeds are imported. In this scenario, when every farmer relies on the seed supplier for hybrid varieties rather than their local seeds, the market monopoly is very likely to occur, food security will be under threat, and the farmer's rights will not be secured. To fully achieve food security, any nation must be self-sufficient in seeds. A nation cannot be said to as having food security if it lacks seed security (Bishwajit et al., 2013). To achieve this food security and be self-sufficient, the farmers need to be aware of the seeds they use for cultivation.

Many villages of Gajuri Rural Municipality have direct access to the roads, and the markets are nearby. The people of Gajuri Rural Municipality are more into agriculture; they cultivate, harvest and sell their products in the nearby market. The farmers in Gajuri in recent days are seen to be dependent on the seed supplier in the market rather than storing and cultivating the seed for the future. The negative impacts of being totally reliant on seed suppliers for the cultivation of the crops are a market monopoly, unguaranteed seed supply for the subsequent cultivation, loss of native variety, traditional knowledge of storage and impacts on biodiversity. Considering crop maize as an example, the maize breeder relies on imported genetic resources from other countries, with 95–100% of its genetic resources coming from abroad (Kandel, 2021). Farmers in Nepal are increasingly using hybrids, and hybrid maize was planted on 7–10% of the country's farmland in 2010 and is projected to increase until 2022 (Dhakal et al., 2022). Therefore, the trend of use of seed and the behavior of farmers to choose the source of seed becomes relevant when it is directly linked with the availability of seed for future cultivation.

Regarding this context, several questions can be raised. What will the price of seed be in the future? Will the farmers be able to afford seeds in the future? Which sources of seeds will farmers use in the upcoming days? Are the farmers aware of the

source they are using? Will the cultivation status be more prevalent in the future? What varieties of seeds will the farmers cultivate? Will the country be self-sufficient in terms of food availability?

Regardless of the question, this study is necessary to identify the status of cultivation, storage, and sources of the seed the farmers are using, the existing knowledge gap is necessary tot be understood.

Purpose of Study

This study aimed to determine the major varieties and sources of seed farmers are using for cultivation, to find to what extent the cultivated varieties are stored and to find out whether the stored seeds are cultivated or not at Gajuri Rural Municipality of Dhading.

Research Questions

1) What are the cultivated varieties and sources of seeds used for cultivation?
2) Are the cultivated seeds stored?
3) What varieties of seeds are cultivated after storage?

Significance of the Study

This research emphasizes the practices of the farmers of Gajuri Rural Municipality on cultivation and storage of the seeds and their sources for plantation by farmers. Access to high-quality seeds and the ability to afford them is essential for achieving food and livelihood security and ending hunger, especially in developing countries (McEwan et al., 2021). Therefore, strengthening both formal and informal seed systems is essential for the sustainable use of plant genetic resources for food and agriculture (Andersen Onofre et al., 2021), which is also supported by the Food and Agriculture Organization [FAO], 2015). The cultivation practice and the source

of the seed is an essential factor that impacts food and livelihood security. The farmers must be seed secure and have access to quality seeds for better productivity.

Many developing nations lack seed sector rules, so their ability to supply smallholders with appropriate access to quality seed is weakened. The Nepalese seed industry also faces several shortcomings, including a lack of facilities for processing and storing seeds, a lack of efficient seed marketing plans, a low rate of seed replacement, immature seed enterprises, a lack of qualified human resources, and an absence of proper policy and its implications (MOLMAC, 2013). Along with the practices of seed cultivation, and sources used for cultivation and storage, this study also aids in giving policymakers an overview when developing seed policies related to the usage of seed varieties, farmers' choice of source, and consideration of seed storage techniques. Since the research's data shows the status of farmers at the local level, it closes a big gap between farmers and decision-makers.

Additionally, the local administration of the Gajuri Rural Municipality will be able to create plans and regulations by using the information from seed storage, cultivation, and sources used in this study. The farmers can also be made aware of the use of seeds for cultivation, the techniques they are using for storage, and the importance of their variety selection. The primary focus of this research is on local producers and their crop cultivation practices, and this research will also serve as a need assessment for any non-governmental organizations and governmental organizations. Furthermore, the findings of this research can also be helpful to the agriculturist to perform further scientific research.

Organization of the Dissertation

A total of six chapters make up this dissertation. This chapter comprises of an outline of the study including the introduction, research problem, purpose of the

research, research questions, and significance of the study. Similarly, chapter two provides a review of the relevant literature, and chapter three thoroughly explains the research methods used in this research. Next, the results of the quantitative analysis are discussed in chapters four and five. Finally, chapter six discusses the study's findings and their implications.

CHAPTER II

LITERATURE REVIEW AND RESEARCH FRAMEWORK

This chapter consists of an overall image of the literature on the chosen issue including components of reviewing past studies in the subject matter and refers to the literature review. Reviewing the literature is a way to discover what other research in the area of our problem has uncovered (Wolf, 2005). Additionally, the theoretical framework of this study is also presented at the end of this chapter.

Our mother planet, the earth, is a common place for about half a million plants and more or about one million animals. Nepal only makes up 0.1% of the earth's surface, but it is home to 1.1% and 3.2% of the world's recognized flora and wildlife, respectively (Rajbhandary et al., 2020). Nepal is also placed on the list of the top 25 countries on the availability of the number of threatened and endangered species (Upreti & Upreti, 2002). Nepal is home to many fauna and flora and is also vulnerable to extinction, so its conservation is necessary. Extinction of any one species available in our nature is harming itself to nature. The proper cultivation, conservation and harvesting of the plants by the farmers will allow conserving our local varieties, traditional knowledge and biodiversity

Agriculture in Nepal and Major Cultivated Crops

The Nepal Labour Force Survey (2008) found that almost 73.9% of the population worked in agriculture; however, by 2018, the overall number had dropped to 60.4%. The agriculture sector's share of the overall GDP is expected to be 27.7% in the current fiscal year 2019/20, down from 37.1% in the FY 2010/11(Chaudary et al., 2021). Agriculture makes up most of Nepal's economy, accounting for 27.7% of GDP

and employing almost two-thirds of the labor force (Ministry of Finance, 2021). A total of 147,181 square kilometers of land make up Nepal, of which 28% is used for agriculture (including 21% for cultivation and 7% for uncultivated land), 40% is forest, and 12% is used for pasture (Central Bureau of Statistics [CBS], 2013; as cited in Nackoney et al., 2018). In Nepal, a family's average landholding is less than 0.68 ha (CBS, 2013), and this number has been steadily declining over the past three decades. In a similar line, Shrestha (2011) stated that agricultural land has frequently been divided for a variety of reasons, particularly in Nepal's Terai region (plain land). The Terai belt also referred to as the grain basket of Nepal, makes up about 23% of the country's total land area. Hill, which takes up 42% of the total land (Koirala, 2020). The agricultural land in Nepal's urban and semi-urban areas decreased due to the rapid urbanization and construction of infrastructures. Even though for the vast majority of people, farming is their primary source of income, people are increasingly engaging in non-agricultural activities and looking for alternative forms of income.

Agriculture is more prevalent in the Terai and Hilly Region of Nepal due to its topography and suitable climatic condition (Astuti et al., 2015). The cultivation is continuous but varies according to the season. The major crops cultivated in Nepal rice, maize, paddy, wheat, millet, legumes, and cereals (Li & Siddique, 2018). The cash crops grown in Nepal to earn money are jute, sugarcane, tea, tobacco, coffee, and others. Likewise, soybeans, beans and lentils are other crops. There are 15 agricultural products; rice, maize, wheat, potatoes, apples, citrus fruit, bananas, mangoes, coffee, oilseeds, mustard, string beans and soybeans, milk, fish, meat, and honey listed as national priority crops by the government. The cereal crops farmed in Nepal are paddy, wheat, maize, barely, buckwheat, and millet, with the first three taking up 91.31 and 96.67 % of the total area and production of cereal, respectively (MoALD,

2021). For Nepal's food security, significant crops include wheat, maize, and paddy. They are in the top place, second place, and third place, respectively. Paddy and wheat are planted in the Terai valley and on irrigated farms in the highlands, whilst maize is grown in the middle hills of the nation. Regardless of its significance, Nepal is unable to produce enough grain crops to support it (NPC, 2019).

A wide variety of agricultural goods are produced in Dhading, which includes paddy, wheat, millet, rice, potatoes, maize and a variety of seasonal and off-season crops. Additionally, the district is a significant producer of milk and milk-related goods in Nepal (DDC, 2022). The farmers are cultivating local as well as hybrid varieties in Dhading district of Nepal.

Types and Sources of Seed

Both formal and informal seed supply networks exist in Nepal. The official seed system uses vertically coordinated production and recognized quality control standards to deliver examined and registered seeds through government organizations and non-government sectors, including private entities. In this regard, SQCC (2019) presented that the formal system provides only 17% of the primary cereal seeds used in Nepal.

Farmers obtain seeds all over the world from various sources, some of which may vary over time. Many different seed-producing sources provide seeds to farmers in various countries across the world. These sources may be local, regional, national, or even international. The local sources include neighbors, relatives, friends and self-preserved seeds, the regional source includes seed cooperatives or associations and community seed banks, the national source includes a federal extension agency or national seed company and the international source includes, a multinational seed company or a global seed company (Vernooy et al., 2022). The foundation of any

farmer's agricultural production system is the availability of high-quality seeds. Easy accessibility to -quality seed can be ensured only if a robust seed supply system multiplies and distribute seeds that have been purchased or preserved seeds.

The Department of Agriculture (DoA) and its farms, the Agriculture Inputs Company Ltd., research stations, NGOs, agriculture groups, Salt Trading Corporation Limited (STCL), cooperatives, and commercial seed businesses are the primary actors in Nepal's formal seed system. Additionally, an important part of the formal seed industry is an imported seed (Ghimire et al.,2020). Farmers import from other countries.

The formal sector only provides for a small percentage of the country's seed needs, whereas the informal seed system fills 83% of the total demand (Ghimire et al., 2020). In the informal seed system, the cultivators grow and store their seed, trade it with their neighbors, and buy seeds from friends, family members, and other farms. This unofficial system serves as a substantial resource for modern plant breeding and is essential for maintaining the variety of indigenous crops in an integrated manner for varied applications (de Boef and Bishaw, 2008; as cited in Joshi, 2017).

Cross-pollinated plants produce hybrid seeds, and the use of hybrid seeds has enhanced agricultural output during the last of the 20th century (Westar Seeds International (WSI, n.d.).The use of hybrid seeds started as the global population bloomed, and the demand for more food started to hike. Hybrids are usually produced by cross-breeding or cross-pollination, where the best variety of plants is artificially taken for breeding. Similarly, Olby (2011) has highlighted that Sir Gregor Mendel, renowned as the Father of Modern Genetics, first introduced the concept of hybrid plants through the pea plant experiment.

When sowed and harvested, the hybrid seed has fewer chances of crop failures as weak offspring are not chosen. Also, the traits such as better flavor, proper size, better color, and drought/heat/cold resistance are provided to the seed. With these types of pros, hybrid seeds' drawbacks are that they are not available for breeding for their second generation. The seeds should be reproduced from new cross-breeding pair varieties again and again over the years (WSI, n.d.). In recent days, the production of hybrid seeds has been soaring. Various companies compete to produce better hybrid seeds. Commercial hybrids are economical and reliable (Wright, 1980). The farmers can also produce their own hybrids, but they lack the time, capital, technique and tools. As the commercial hybrid seed providers are business oriented, the risk of market monopoly is a threat to farmers as they are unable to produce their own seed. The conservation of seeds is the conservation of the planet (Mehta et al., 2012).

Seed Conservation

Plant seed storage is primarily used to safeguard planting stocks from one season to the next. Proper storage of seeds conserves its vigor and vitality. Depending on the species and the storage conditions, seeds can live anywhere from a year to a century (Seed Quest - Seed Biotechnologies, n.d.). Most seeds would typically last longer in a cold, dry environment than in a warm, moist environment. Usually, most seeds stored in a cold, dry environment would last longer than seeds stored in a warm, wet environment. Still, the storage technique and environmental factors solely depend upon the nature of the seed.

Conservation actively maintains the diversity of the gene pool to use the gene pool (Chidera, 2020). Situ and Ex situ conservation strategies are chosen for seed conservation (UNCED,1992). Ex Situ conservation involves preserving biological

diversity outside of its natural habitat. Whereas In-Situ conservation involves preserving an ecosystem and its natural habitat as well as restoring and maintaining healthy populations of species in their native habitats. (Shrestha et al., 2013). The farmers of Nepal store and preserve the seeds by using their own traditional methods. The conventional storage technique involves manually threshing, winnowing, drying, storing, transporting (from the field to the house) and processing the harvested crops.

The effects are much more severe in developing nations with a food shortage, as farmers struggle year after year to maintain their seeds, which are a crucial component of food crop production. An estimated 25–33% of the world's grain production, including seeds, perishes during storage each year, which substantially impacts food security worldwide (FAO, 2018). Farmers frequently experience 15–30% seed loss in Nepal, a developing nation, as a result of poor storage techniques (Devkota et al., 2018). Pests and diseases in Nepal cause farmers to lose up to one-third of their stored grain. Food insecurity and financial loss follow from this. When a seed reaches physiological maturity or is no longer completely protected by the mother plant and is exposed to the external environment in terms of moisture, temperature, biotic pressures, etc., seed storage truly begins in the field. As a result, the seed's viability and storage capability are greatly influenced by the environmental factors present from seed maturation to physiological maturity and planting. The primary purpose to store of storing the seed by the farmers is to cultivate it for the next season, and the method and types of storage vary according to the type of seed being stored. In order to decrease seed damage and maximize seed viability and vigor during pre-harvest, harvest, and handling, proper care and storage of the seed must be taken. The factors that determine the seed quality and viability during storage are temperature, moisture, and humidity (Delouche, 2021). Therefore, the optimum

temperature and proper storage technique should be used to maintain the seed viability and quality.

Nowadays, in numerous parts of Nepal, community seed libraries (banks) are being practiced. The community seed bank founded by the Agriculture Development and Conservation Society in the Bara district of Nepal is recognized by the local government and provides local-level legitimacy. This seed bank holds greater sociological and economic value for the small stakeholders. Seed banks are like commercial banks where we store and take the seed instead of money. Seed Bank can store genetic resources according to their scale. But at the community level, community seed banks without special infrastructure and technology, traditional knowledge, and locally available infrastructures can be used and the community seed bank workers will ensure whether the seed is properly treated against pests, and monitor the need of the seed and its distribution (Shrestha et al., 2013; Vanaja, 2007). Similarly, the farmers in Gajuri Rural Municipality follow traditional methods of seed conservation, as per my observation in the area; the people conserve the seed of maize, pumpkin, and bitter gourd in the pot by mixing them with the ash, and thus conserved seeds are used for the harvesting.

Traditional Storage Technique and Seed Savers Network in Developed World

Traditional practices for protecting seed material have prevailed since ancient times. Some common techniques include protecting the seeds, grains, and other plant parts by dipping them in oils and ash, which also has scientific principles. Supporting the line, Mehta et al., (2012) presented that the presence of silica in wooden and cow dung ash and red-baked soil prevents egg formation and larvae feeding in the stored seed. Recently, indigenous knowledge has been shadowed, and new generations are not adapting the primitive techniques. Research conducted in Uttarakhand Himalaya,

the farmers there use indigenous plant protection methods (Mehta et al., 2012). For example, the people of Uttarakhand, and farmers from other regions also use and protect indigenous practices.

Farmers employed various techniques for traditional storage practices, including sun drying grains, red soil coating method, plastering of storage bins with cow dung clay, using common salt, ash, turmeric, garlic cloves, stepping, camphor, *tulsi*, and so on (BG, 2016). These types of practices use locally available materials and are indigenous practices whose knowledge transfers from generation to generation.

Even in affluent countries such as the United States, Canada, Australia, the United Kingdom, and other European countries, concerted efforts to conserve and share native (heirloom) types are gaining attraction. Even in the lack of a strong institutional seed system that would allow for controlled seed distribution and exchange as well as the enforcement of intellectual property rights in agriculture, the determined effort to preserve native varieties is pervasive.

The seed savers exchange network in the US first appeared as a non-profit organization. More than 13,000 people are a part of the network, which has more than 24,000 accessions of open-pollinated types. This network, which encourages "participatory preservation," facilitates the exchange of seeds among its members, the majority of whom are farmers and gardeners in order to support the conservancy and usage of heaps of open-pollinated and heirloom varieties each year (Volkening, 2006).

Additionally, Canadian farmers have a network called Seed of Diversity, which only exchanges and sells non-hybrid, non-patented, and genetically unaltered types. This network is dedicated to People Protecting the People's Seeds. It is a

national organization that facilitates member-to-member seed exchanges and depends on the cooperation of farmers, gardeners, seed suppliers, academics, and researchers. Every year, to promote seed exchange, a members-only seed Directory that details the seeds that members are offering is published (Seed of diversity, 2022).

Existing Policies and Seed Laws on Plant Genetic Resources for Food and Agriculture

Crop development along with economic and enough seed supply is critical in developing nations for food security, nutrition, and improved lives. Appropriate policies are thus required to foster seed sector growth and promote the use and interchange of plant genetic resources per national and regional agricultural goals. The ability to provide farmers with adequate access to high-quality seeds and planting materials of the appropriate sorts is constrained in many developing countries due to the lack of a well-designed seed policy and appropriate consultation mechanisms (FAO, 2015). Since 1988, Nepal has produced and managed (PGRPFA) plant genetic resources for food and agriculture and the linked seed industry through a range of Policies, Acts, Strategies, periodic plans, and recommendations.

There are several plans and policies formulated by the government of Nepal and those plans have various features. In the table below the plan and the year along with its major features from the perspective of farmers' seed system.

Table 1:

List of Policies with its features:

Policy and its year	**Major features from perspective of farmers seed system**
Seed Act 1988	To protect the general public's economic

	interests by providing quality seeds
The Agriculture Perspective Plan 1995	A method of agriculture expansion however dismissive of the Farmers' Seed System
Seed Production Guideline 1998	Technical and material support is provided to farmers and farmer organizations for the production and distribution of seeds.
Local Self-governance Act 1998	Levying regional fees on cross-district seed transfers. not now used in practice
National Seed Policy 1999	Protecting national resource rights and indigenous genetic resources.
Act of 2002 Concerning Access to Genetic Resources and Benefit Sharing	Ownership of genetic resources and genetic material by individuals, groups, municipal governments, and other parties. Traditional knowledge rights. Conditions and restrictions for access. To coordinate access and benefit sharing, the National Genetic Resources Coordination Council (NGRCC) will be established. Through local governments, communities provided their prior, informed consent for access to Plant Genetic Resources (PGR).
National Agriculture Policy 2004	To preserve, advance, and wisely make use of

	biological diversity, environmental resources, and natural resources
National Biodiversity Policy 2006	Overall framework for Nepal's agrobiodiversity protection policies.
Agrobiodiversity Policy 2007 and first amendment 2014	To recognize, protect, conserve, advance, and sustainably utilize agrobiodiversity.
Plant Protection Act 2007	To halt the occurrence and spread of pests and diseases through introducing and sending out Plant Genetic Resources (PGR).
2008 Farmer and plant variety protection act	Develop agriculture, support biodiversity and food security, protect plant types, and uphold breeders' and farmers' rights. A balance of rights between farmers and breeders through a genuine sui generis system of Intellectual Property Rights (IPR). Seed saving and local seed exchange.
Guideline for Implementing Community Seed Banks, 2009.	Production and distribution of landrace and enhanced variety seeds at the local level.
Seed Regulation 2013	IPR regime introduction. Rewards for breeders and farmers to boost food output. Achieving a balance between farmers' and breeders' rights

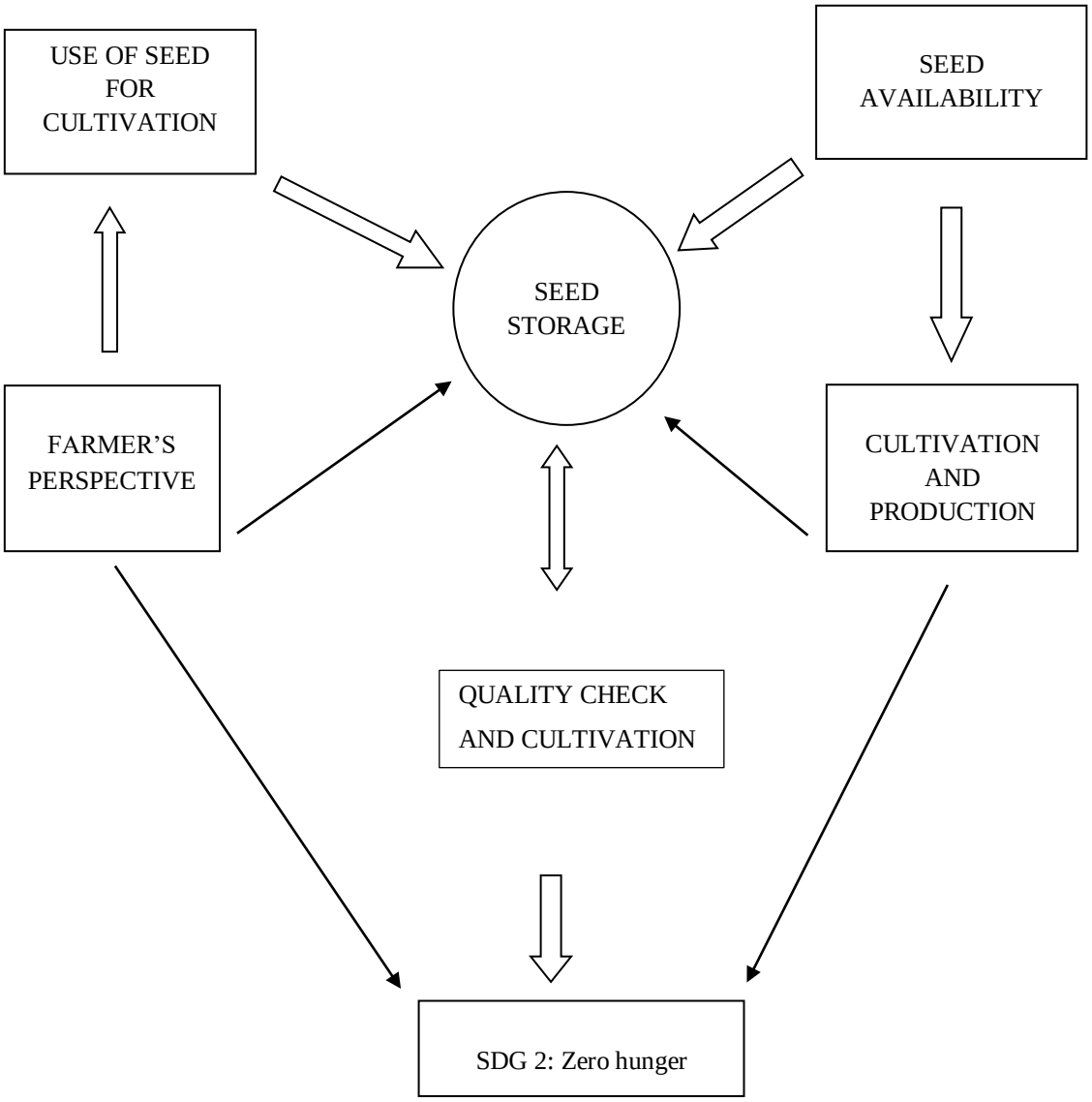
Agriculture Development Strategy 2015	To change Nepal's society such that it no longer relies heavily on agriculture for income and instead relies more on services and industry. Farmers' seed systems are unmentioned.
National Biodiversity Strategy and Action Plan 2014-2020	In accordance with the International Treaty on Plant Genetic Resources for Food and Agriculture, it comprises policies and plans for the protection and utilization of agricultural biodiversity.
National Seed Vision (2013-2025)	To achieve self-sufficiency, one must eliminate all existing gaps in seed policies and guidelines, take advantage of the large agrobiodiversity and ecological diversity, and harmonize policies, guidelines, and other national legal frameworks with development plans.

Source: (ADS, 2015, APROSC-JMA, 1995, National Seed Vision 2013, Joshi et al., 2012, Bhattarai et al., 2016)

A large number of laws, policies, guidelines, plans, visions and strategies were prepared in Nepal, while several were either not implemented or implemented partially, or new policies replaced the old ones too quickly. The political climate in Nepal is what makes the country dynamic. Before being completely implemented,

policies are constantly changing (Joshi et al., 2012). Very few conventional policy instruments brought about significant and long-lasting changes, such as the growth of private-sector seed players and community-based seed initiatives. Based on current agricultural production, a farm household would need 0.64 ha in the mountains, 0.52 ha in the hills, and 0.42 ha in the terai to produce enough food to feed a family of six (NPC/WFP/NDRI, 2010). No policy instruments have considered the implications of such farming realities on farmers' seed systems (Joshi, 2017). Since Nepal is undergoing a significant state restructuring, Provincial and Local Governments will likely introduce new policy instruments, revise existing ones, or replace them in the future. Therefore, any discussion of the suitability or unsuitability of a specific policy instrument at this time may not be pertinent. Because of their strong interconnectedness, official and informal seed networks are a crucial component of production systems and are fully integrated.

Conceptual Framework



Theoretical Review

People in various parts of the world are working to modernize agriculture. Modern equipment, fertilizers, and improvised seeds have made their work convenient, and their productivity has increased. In the context of Nepal, modern agriculture is in the stage of rising where the farmers are more attracted towards gaining better productivity. In the hilly region of Nepal, the modernization of agriculture is also on a spark, where the farmers choose to cultivate better-yielding seeds and saplings. The seed market of the Gajuri Rural Municipality area has started providing them with high-yielding hybrid seeds. In contrast, the area's tradition was to conserve the seed for the next cultivation season. The people's behaviour has been seen to be changed while being adaptive to the modernization of agriculture.

Environmental, personal and behavioral characteristics are the major factors in behavior change theory where the theory tries to explain the change in human behavior (Van Der Linden, 2012). Personal variables comprise instincts, urges, qualities, and other internal motivating forces, whereas environmental factors include situational effects and the setting in which action is performed. The process of human communication is based on the learning and alteration of behavior (Smith et al., 2020). Critical comprehension of "how people make decisions and act on them, how they think about, influence, and interact with one another, and how they acquire beliefs and attitudes" is necessary to achieve long-term goals in the context of sustainable development (UNICEF, 2013). Because of how humans have altered the natural environment throughout history to suit their demands, we are now experiencing issues like climate change, biodiversity loss, ecosystem degradation, ocean acidification, and other issues that are directly related to human impacts on the environment (Klaniecki & Wuropulos, 2019). In relation to this, the farmers in the

hilly region of Nepal, including Gajuri Rural Municipality, are more attracted towards the easily available hybrid seeds. Their behavior of seed conservation and exchange is halted disregarding the future outcomes of their use. But the behavior of the farmers can again be changed once they are made aware of their loss and once they will know that their behavior is affecting the biodiversity in their own native area. Also, when there was no mobility due to the lockdown from the COVID-19 crisis, the farmers of the Gajuri Area had difficulty finding the seeds for harvesting, and the farmers were also somehow cautious of being fully dependent on the seed supplier. Like the farmers have adapted their behavior to using hybrid seeds and neglecting their native ones.

Seeds are the main source of any plant, and in the case of cultivated species, seeds must be conserved so that the species can be harvested again. From the ancient period of time, the seeds have been preserved so that the yield can be obtained. The lack of conservation leads to biodiversity threat, sovarious gene banks in the locality community are established. Nepal, along with many small community seed banks, Nepal Agricultural Research Council (NARC) has a gene bank for preserving and conserving seeds. The largest seed vault lies in Norway, known as the Svalbard Global Seed Vault, which will preserve the biodiversity of the crops for the future generation. Similarly, Gajuri also opena seed bank for the wellbeing of farmers to ensure food security and farmers' rights and to preserve the traditional knowledge of seed storage techniques that the farmers have been passing from generation to generation.

Concluding the Chapter

The use of the source of seed, its cultivation and storage depend upon the behavior and choice of the farmers. Likewise, several factors like age, literacy,

availability of the land, availability of various sources, crop productivity and the rules and regulations play a vital role in the cultivation and storage of the seed. On top of that, the proper policies and their implementation play another important role in cultivation and storage. The local and provincial efforts to identify the needs and problems of the farmers in using the proper quality seed and the farmers at the personal level should put an effort for the betterment of farming by using the proper quality seed.

CHAPTER III

RESEARCH METHODS

This chapter includes the research methods that were used during the research process. It consists of the research paradigm and the research design. The chapter begins with the post-positivist philosophy that guided this study. The survey method is explained along with the content validation process in detail, which was adopted for making the questionnaire. In the middle section, the population of the Gajuri Rural Municipality is explained along with the sample size and sampling method of 171 households. Likewise, the data collection and analysis process is discussed. This chapter concludes with the reliability measures ensuring the reliability, and validity through the content, construct, and criteria-related validity.

Post Positivism: A Guiding Philosophy

This study was carried out to investigate the status of seed cultivation, storage, and the sources of seed used for cultivation in the Gajuri Rural Municipality of Dhading. The post-positivist research approach is used in this study as it is highly structured. During the data collection, the large samples can also be quantified in a calculative way. This approach acknowledges the researcher's influence, theory, idea, and impact on the researcher's conclusions. So, the positivist approach pursues objective answers by attempting to recognize and work with such influence or biases with the theories and knowledge the researcher develops. Instead of performing a study on people, the researcher sees themselves as people who conduct research with them and learn from them (Ryan, 2006). The interaction of the researcher with the research participants on the proper use of flexible and multiple methods in this

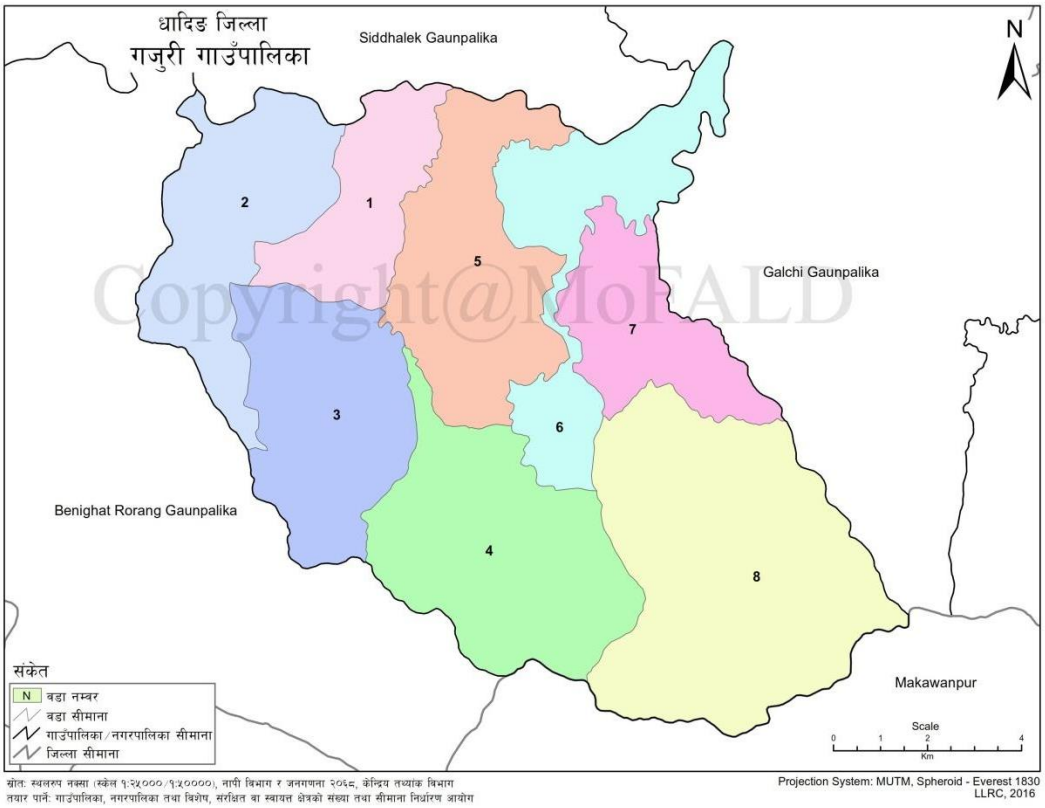
paradigm allows this research to focus on meaning and allows understanding of the situation. The quality standards of this paradigm are objectivity, reliability, and validity, which can also be modified with the triangulation of data, methods, and theories (Taylor & Medina, 2013). Thus, this research paradigm allowed me to regard myself as a person who executes research among other people rather than performing studies on them but by learning from them.

Study Area, Population, and Sample

The area of study was the Gajuri Rural Municipality of Dhading. The people living in this area are mostly engaged in agriculture. The rationale for selecting this area was that the Dhading district is an agricultural area, and people living in Gajuri Rural Municipality engaged in agriculture. There are a total of 8 wards in this rural municipality. Out of these eight wards, I choose ward no 6 for the research. The total population of Gajuri Rural Municipality is 27074, and the entire area of this Rural Municipality is 138.88 sq. km. (MOFALD, 2021). Out of these eight wards, I chose Ward no 6 because the people living here are primarily engaged in farming, the supply is centric to the nearby market, and it is near from Highway - so the farmers seem to be influenced to buy the seed from the readily available market. The Gajuri area covers 88 hectares of area and has three pocket areas (Mathema & Adhikari, 2014). The popular agricultural market of Dhading is also Gajuri, and the government has also launched the pocket package program in the Gajuri area and other areas.

Figure 1:

Map of Gajuri Rural Municipality



Source: (MOFALD,2021)

As a complete census was impracticable and costly (Cochran, 2009), this researcher worked with a sample which is drawn representing the population with careful supervision. While selecting the sample, this researcher followed the "three stages of sampling procedure" (Bhattacherjee, 2012). Firstly, the population of the study was defined. The population of the rural municipality is 27084, whereas the population of ward no 6 is 4565. The probability sampling technique was intended to be used in this study; it is a sampling technique in which each person in the population has a chance of being chosen (McCombes, 2022). Here, the researcher chose systematic random sampling, and households were selected systematically.

According to the census of 2011 (CBS, 2011), there are 300 households in the village of Jarebagaichha and Milantar.

The sample size was calculated from the population (300) by applying the sampling formula of (Yamane (1967)):

$$N_0 = \frac{N}{1+ N * \alpha^2}$$

Where,

N_0 =Sample size

N = Total population = 300

α = Level of significance = 0.05

$$N_0 = \frac{300}{1+ 300 *0.05^2}$$

N_0 = 171 households

Then, the interval of the selection of the house would be the Total household number divided by the sample taken i.e. 300/171, which is approximately 2. Therefore, the researcher chose the next two houses for the respondents.

Once the sample size was determined, the researcher first made a sketch map of ward 6, and then I assigned house numbers to each household so that the researcher was able to reach the houses easily. Then starting from one center point (A big *pipal* Tree), the researcher moved to visit the respondents.

Scale Construction and Data Collection

A survey questionnaire was the scale of this study. While constructing the scale, content validation was done. This researcher followed various steps 1) literature review 2) in-depth interview 3) study of the old survey by NARC (National Agricultural Research Council).

Firstly, literature on seed cultivation, conservation, and storage was studied, then the in-depth interview with the members and scientists of the National Agricultural Research Council, Seed Science and Technology Division. There were four members altogether; two were experts, one was a scientist in the biotechnology field, and one was an agriculturist working in the seed germination sector. The researcher discussed for four rounds regarding the topic and the construct of the questionnaire was prepared accordingly. Once the construct was made, the literature review relating to a similar construct was again studied.

Secondly, the questions relating to the research question were prepared with the advice of the supervisor, where the questions were broader: (a) what are the crops cultivated by the farmers? (b) Do farmers store the seed for the future? (c) Do farmers have access to the seed market? (d) What varieties are expensive or cheap? (e) Is quality a factor that farmers acknowledge? (f) What is the status of ownership of the land (g) what is the motive of cultivation (h) Are the fertilizers used in the process of cultivation?

After preparing these broader questions, the researchers again consulted the experts. These unstructured questions allowed open resources to add richness to the study (Okoli & Pawlowski, 2004). Once the questions were discussed, and expert suggestions were taken. Various constructs, variables, indicative questions, and possible answers were written.

Table 2:

Construct, Variables, and Indicative Questions

Construct	Variables	Indicative Questions	Possible answers
Variety	How many	1) What variety of seeds do you cultivate in one season?	

	Which season	2) Which season gives more yielding? 3) Which season requires more labor?
Accessibility	Source	1) What varieties do you produce yourself? 2) What varieties do you buy? 3) How far is the market? 4) Do you know about the seed bank? 5) Is there any seed bank near your locality? 6) Do you share the seeds with your neighbors as well?
Cost	Expensive/Cheap	1) Which varieties are expensive? 2) Which varieties do you prefer to pay more for? 3) Which varieties are comparably cheaper? 4) How much money is spent on one cultivation?
Quality	Quality	1) Are you satisfied with the quality of the seed either purchased or own? 2) How do you select the best quality seed? 3) Do you specify seed quality when purchasing/selling seeds?

Land	Ownership Type of the land Irrigation	1) Who is the landowner? 2) What is the type of land(*khet, bari, kharbari*)? 3) Is your land properly irrigated? 4) What is the source of irrigation? 5) What is the time for irrigation?
Use of fertilizers in the process of cultivation	Fertilizers	1) What kind of fertilizers do you use? 2) How often do you use it? 3) Which season/ variety requires more fertilizers?
Preservation	Preservation	1)Do you preserve the seed for the next cultivation? 2)Do you supply/share preserved seeds with farmers?

After finalizing the construct, variables and a detailed questionnaire were constructed. Each item was made as simple as possible and intelligible. Questions related to socio-demographic information were kept in the first part, and the yes-no questions and multiple-choice questions were kept in the later part.

The final questions were again shown to the experts, and the feedback was addressed. The questions were constructed in the English language, and they were then translated into Nepali. The translated version of the questions was then verified by the language experts.. Then the questions were asked to the five farmers of Dhading District, and the farmers seemed to understand all the terms in the question.

The question was piloted among 17 farmers, which was approximately 10 % of the total sample (171) of this study (Baker, 1994).

The researcher herself conducted a pilot test. The respondents understood most of the terms, but they often got confused while talking about the quantity and land area ropani. So the researcher was also aware of the local terms like *Pathi, mana, muri, halgoru,* etc., which were used during the question. The data from the 17 respondents were entered into SPSS version 26 software, and the Gutman Split-Half coefficient was calculated. The detail has been explained in the reliability and validity section of this chapter. After the pilot test, the researcher asked two experts so that the validity could be assured. Then, the final questions were printed, and the survey was carried out.

Data Collection and Analysis Process

Data collection is the process of gathering and measuring information on variables of interest in an established systematic model that enables one to answer stated research questions, test hypotheses, and evaluate outcomes (Muhammad, 2016). The researcher started the survey and collected data from household. A questionnaire is a tool used for data collection, where the researcher gathered, measured, and entered data in SPSS after all the information was received from the respondents. The researcher stayed at Gajuri Rural Municipality for 15 days and conducted the survey. On the first day, the researcher went to Milanatar Village, walked around the village, and had an informal conversation with the villagers. On the second day, the researcher tentatively sketched the village map and planned for the survey. The researcher from the third day started collecting data.She first had an informal conversation with the people and took a verbal consent from them. The respondents would be available early in the morning and evening at their house. In the

afternoon, most of the respondents would be working in the field, so the researcher used her maximum amount of time in the morning and evening. The researcher informed every participant that she came from Kathmandu University for her Master's dissertation and also showed her questionnaires to those who were willing to see them.

The researcher also informed the participants that the information she received would be confidential and used only for the analysis of the dissertation. It took around 5 to 8 minutes for each participant to ask the fill in the information. The survey was completed within 15 days, and the researcher returned for the entry and analysis of data.

Data analysis is one of the most essential parts of any research paper after data collection. This study aims to interpret the primary data, i.e. questionnaire, observation, and interviews. The researcher conducted quantitative research, so the data received are quantifiable information used for mathematical calculation and statistical analysis. The received data was coded using SPSS (Statistical Package for Social Science-SPSS) software, and the data were given appropriate categories and heading. According to Creswell (2014), data analysis in quantitative research is the process of representing data in tables and figures and analyzing the results using various statistical models. Further, Creswell states data analysis the systematic use of statistical tools, such as descriptive and inferential statistics, which is used to find answers to questions and test different hypotheses. While data analysis, inferential statistics were used. The researcher developed the database first. She further coded and screened it to ensure the quality of the data. Similarly, missing values were checked, but no such case of missing value was found. Then the data were analyzed with the statistical process drawing the statistical inferences for each of the research

questions. Descriptive analyses, cross-tabulation, and frequency calculations were performed. Several variables were coded, and thus coded variables were again recoded into different variables for the calculation of seed cultivation, sources and storage.

Reliability and Validity

This researcher used quantitative data, so the research followed the principles of reliability and validity. The questionnaire that yields consistent responses when asked multiple items is called reliability. Reliability refers to the consistency of scores or answers from one administration of an instrument and one set of items to another (Jack & Norman, 2006). Similarly, the questionnaire that gets accurate responses from respondents maintains its validity. The most important criterion of research is validity. It is concerned with the integrity of the conclusions that are generated from a piece of research (Bryman, 2008).

The researcher prepared a questionnaire using 'yes/no', and multiple choice questions with the help of the supervisor and the experts. The reliability coefficient of the research tool was calculated using the split-half method, in which the test was divided into two halves. The test items were distributed to seventeen farmers of Dhading, and their responses were entered into SPSS 26 program. In this research, the value of Gutman Split-Half coefficient was 0.8.

The researcher also attempted to establish validity in this research. She approved the questionnaire with the help of her research supervisor and got it verified by other three experts to ensure the questionnaire's validity (Alreck & Settle, 1995). She then went to the research site for data collection. In the case of content validity, the questionnaire prepared for this research covered all areas of research questions.

Content validity was also based on literature review. To approve construct validity, theoretical link, statistical relationship, as well as the interpretation of the table to generalize the results were considered.

Ethical Standards

Research ethics includes the protection of the dignity of the participants and distinguishing between acceptable and unacceptable behavior. The researcher should be careful about respecting the participants, confidentiality, and informed consent (Cohen et al., 2002). The researcher upheld her ethical duty to ensure the respect for human decency and the truthfulness and authenticity of the data and information in all respects (Gravetter & Forzano, 2006). This research assured confidentiality as it is an important part of the research ethics (Babbie, 2010). The researcher took consent from the respondents and provided information about the research and its consequences

Informed consent, beneficence (do good), non-malfeasance (do no harm), respecting autonomy, privacy and secrecy, deception, reciprocity, equity and justice, plagiarism, and other issues are major ethical concerns in doing research (Fouka & Mantzorou, 2011). The major ethical consideration that the researcher followed during the study was taking the respondents' consent while taking their answers, pictures, opinion, and verbal consent to use the information. The respondents that were not willing to open their identities, anonymity and confidentiality were maintained. The researcher equitably selected the participants as a sample through systematic random sampling so that the research would be fair enough without any inclusion or exclusion.

Furthermore, this research is fully guided by the ethical guidelines for research from Kathmandu University and adheres to ethical principles to protect the dignity and rights of research participants

The researcher hereby declares that the research proposal entitled, 'Seed Cultivation and Storage- A Survey in Gajuri Municipality, Dhading is a record of original work. The information and data illustrated in the research are authentic to the best of the researcher's knowledge.

Concluding the Chapter

A quantitative Survey was performed by exploring the status of crop cultivation, its varieties, sources of seed, and the status of seed storage. The study was performed within 171 households of Jarebagaichha and Milantar Village of Gajuri Rural Municipality of Dhading. Construct, variables, and broad questions were first prepared, and content validation was done on the feedback and interactions with experts. After the preparation of the questionnaire, a pilot test was done. The data were collected from the farmers of Jarebagaichha and Milantar villages.

Reliability and Validity were tested, where the value of the Gutman Split-Half coefficient was 0.8, and validity was checked with the help of the supervisor and experts. The ethical standards were followed, and the guidelines from Kathmandu University were followed.

CHAPTER IV

DATA PRESENTATION AND ANALYSIS

This chapter begins with a description of the socio-demographic variables of the farmers, such as age, gender, occupation, literacy, and source of income of the respondents. After the socio-demographic variable, other variables concerning the cultivation status, source of the seed, and storage are presented. The findings of the research are presented in this chapter.

Socio-Demographic Information about the Respondents

To form a general idea of the population's characters, some socio-demographic characteristics are discussed here. These characteristics are age, gender, ethnicity, occupation, source of income, and education.

Age and Gender of the Respondents

Respondent's age and gender play an important role in determining the behavior of seed cultivation and storage. There was no discrimination between males and females in cultivation and storage. Table 1 shows the distribution of respondents' age and gender. Age class denotes the range of the age group.

Table 3**:**

***Age and gender and ethnicity of the respondents (N=171*)**

		Gender of the Respondents		
S.N	Age Class	Male	Female	Total
1	20-25	4 (2.3 %)	6 (3.5%)	10(5.8%)
2	26-35	18 (10.5%)	27(15.38%)	45(26.3%)
3	36-45	13 (7.6%)	23(13.5%)	36(21.1%)

4	46-55	17(9.9%)	17(9.9%)	34(19.9%)
5	56-above	29(17.0%)	17(9.9%)	46(26.9%)
	Total	81(47.4%)	90(52.6%)	171(100%)

Males aged 56 and older made up the most significant proportion of respondents within the study's population, while males aged 20 to 25 made up the minor proportion. The male and females were equal numbers (9.9 %) in the age group 46-55. Overall, it illustrates that the total number of female respondents was more significant than males.

Table 4**:**

Ethnicity of the respondents

S.N	Ethnicity	Frequency	Percent
	Brahmin, Chhetri	107	62.6
	Janajati	43	25.1
	Dalit	20	11.7
	Others	1	0.6
	Total	171	100.0

Regarding ethnicity, the majority of the respondents were Brahmins and Chhetri (62.6%), which was more than 50% of the total respondents, followed by Janajati (25.1 %), Dalit (11.7%) and others(0.6%). Overall, the majority of the respondents were *Brahmins and Chhetri.*

Occupations and Source of income of the Respondents

The main occupations of all the respondents were farming, where the respondent’s family also had multiple sources of income. Occupation also indicates the source of income of that family. They engage in different kinds of occupations for

their livelihoods, like agriculture, jobs, business, foreign employment, wages, and others.

The respondents' sources of income are shown in the table below, where they are further subdivided into primary, secondary, and tertiary sources. The respondent's primary source of income is their primary line of work; secondary is their next source of income, and tertiary is their source of income after primary and secondary. The respondents' data with primary, secondary, and tertiary sources of income is presented in table 5.

Table 5 **:**

***Source of Income (N=171*)**

S.N	Source of Income	Primary Source		Secondary Source		Tertiary Source	
		N	%	N	%	N	%
1	Agriculture	171	100%				
2	Job			39	22.8		
3	Business			9	5.3	1	0.6
4	Remittance			22	12.9	2	1.2
5	Wages			27	15.8	5	2.9
6	Others			39	22.8	6	3.5
	Total	171	100%	136	79.5	14	8.2

Agriculture is the primary source of income for every respondent, accounting for 100% of their total income. In addition, the respondents' secondary sources of income include jobs, businesses, remittances, wages, and others, 39 (22.8%) reported jobs as their secondary source of income. In comparison, 9(5.3%) reported businesses,

22 (12.9%) reported remittances, 27(15.8) reported wages, and 39(22.8%) reported others.

Similarly, the 171 respondents' tertiary sources of income included businesses, remittances, wages, and others; 6 respondents had other sources of income, and 1(0.6%) had business. 2(1.2%) had remittances, 5(2.9%) had wages and 6(3.5%) had another source of tertiary income.

Types of Land of the Respondents

The land is the most important factor required for cultivation, and the farmers of this study also acquired the land, which was categorized into three types. The category of land that farmers had is shown in the table below (Table 6). The types of land categorized in this study are Own land, when the respondents possess the land, and rented land, when the respondents' family must pay the rent for using the land, *Adhiya* when the farmer pays half of harvest from the land from the same land as a payment for using the land.

Also, the following table (Table 7) represents the land area of the respondents, where the land range denotes the area of the land in *ropani* (land measurement unit typically used in a hilly region of Nepal)

Table 6**:**

Types of land (N=171) (Multiple responses)

S.N	Types of Land	N	%
1	Own (N=171)	171	100
2	Own and Rented (N=171)	3	1.8
3	Own and *Adhiya* (N=171)	11	6.4
4	Own, Rented and *Adhiya* (N=171)	2	1.2

The sort of land that the respondents acquire is shown in the above table, which includes their land, Own and rented land, Own and *Adhiya,* Own, Rented and *Adhiya.* All of the respondents had their own land. 3 (1.8%) respondents had both owned and rented land. 11 (6.4%) respondents had both own and *Adhiya,* and 2 (1.2%) respondents had both Own, rented, and *Adhiya.*

Table 7:

Land area own by respondents

S.N	Land area (In Ropani)	N	%
1	0-5	108	63.2
2	5-10	40	23.4
3	10-above	23	13.5
Total		171	100.0

The above table illustrates the land owned by the respondent's family. The highest number of families (N=108, 63.2%) had their own land ranging from 0-5 *ropani* (land measurement unit typically used in the hilly region of Nepal), and the least respondents (N=23, 13.5%) had 10-above range of land area.

Cultivation Status of the Crops

The data concerning crops' variety and cultivation have been analyzed and presented in the following table. The cultivated crops and their variety have been tabulated to understand the crops and their cultivation. Table 8 represents the cultivated status of crops; cultivated crops and their varieties along with their percentage, are presented in the table. The crops were further classified according to their variety as local and hybrid and both (hybrid and local).

Table 8:

Cultivation status of crops (N=171)

	Cultivation		Variety		
S.N	Crops	Total cultivated	Local	Hybrid	Both (Hybrid + Local)
		N N (%)	N (%)	N (%)	N (%)

1	Rice	171	105(61.4%)	20(19.04%)	13(12.38%)	72(68.57%)
2	Maize	171	166 (97.1%)	40(24.09%)	93(56.02%)	33(19.87%)
3	Millet	171	111 (64.9%)	111(100%)	-	-
4	Wheat	171	13 (7.6%)	-	13 (100%)	-
5	Mustard	171	102 (59.6%)	102 (100%)	-	-
6	Potato	171	101(59.1%)	95(94.05%)	6 (5.9 %)	-
7	*Mass*	171	102 (59.6%)	102 (100%)	-	-
8	*Bodi*	171	112 (65.5%)	112 (100%)	-	-
9	Soybean	171	78 (45.6%)	78 (100%)	-	-
10	*Simi*	171	21 (12.3%)	21 (100%)	-	-
11	*Masyang*	171	32 (18.7%)	32 (100%)	-	-

There were a total of 11 crops cultivated by the farmers, and they were rice, maize, millet, wheat, mustard, potato, *mass, bodi,* soybean, *simi,* and *masyang*. Maize was the most cultivated crop (N=166, 97.1 %). The crops cultivated in more than 50% were *bodi* ,millet,rice, mustard, and *mass*. The least cultivated crop was wheat (7.6%).

The varieties cultivated included local, hybrid, and both (local and hybrid varieties). Out of 11 crops, the entire crop's local varieties were cultivated except the variety of wheat. Only local varieties of the following crops were grown: millet, mustard, *mass, bodi,* soybean, *simi,*and *masyang*. 112 of them choose to produce the local variety of *bodi,* making it a highly cultivated local variety.

The crops cultivated using hybrid varieties were rice, maize, wheat, and potato. Maize was the most preferred hybrid crop which was cultivated by 93 farmers (56.02%). The least cultivated hybrid variety was potato, accounting for only 5.9 %. Wheat was the crop whose only hybrid variety was cultivated.

Rice and maize were the crops whose local, hybrid, and both (hybrid and local) varieties were cultivated, whereas the rice variety was mostly produced by the farmers i.e. 68.57%.

Overall, the most preferred local variety was *bodi* , the most preferred hybrid variety was maize.

Varieties of seed by their source

In this study, the varieties of seed categorized and used by the farmers for the cultivation were local and hybrid. The following table illustrates the source of the seed of its respective variety. The sources of seed are divided as, seed from home- when the farmers use the seed they have stored at their own home, neighbors – when the farmers borrow or buy the seed from their neighbors, agrovet- when the farmers buy the seed from the agricultural shop or market and others- when the seed they receive is not from the above-mentioned source. The sources are said to be informal when they are from their own home and neighborhood or relative and formal when they are from agrovet, cooperatives, and seed science divisions.

Table 9:

Varieties of seed by their source

S.N	Crops	Varieties	Seeds from							
			Home		Neighbors		Agrovet		Others	
			N	%	N	%	N	%	N	%
1	Rice	Local (N=20)	20	100	-	-	-	-	-	-
	(N=105)	Hybrid(N=13)	-	-	-	-	13	100	-	-
		Local&Hybrid (N=72)	72	100	-	-	72	100	-	-
2	Maize	Local (N=40)	31	77.5	9	22.5	-	-	-	-

	(N=166)	Hybrid(N=93)	-	-	-	-	93	100	-	-
		Local&Hybrid (N=33)	33	100	-	-	33	100	-	-
3	Millet	Local(N=111)	110	99	1	1	-	-	-	-
	(N=111)	Hybrid	-	-	-	-	-	-	-	-
4	Wheat	Local	-	-	-	-	-	-	-	-
	(N=13)	Hybrid(N=13)	-	-	-	-	-	-	13	100
5	Mustard	Local(N=101)	38	37.62	15	14.85	48	47.52	-	-
	(N=102)	Hybrid	-	-	-	-	-	-	-	-
6	Potato	Local(N=95)	-	-	-	-	95	100	-	-
	(N=101)	Hybrid	-	-	-	-	6	100	-	-
7	*Mass*	Local(N=102)	100	98	2	2	-	-	-	-
	(N=102)	Hybrid	-	-	-	-	-	-	-	-
8	*Bodi*	Local(N=112)	92	82.14	7	6.25	13	11.60	-	-
	(N=112)	Hybrid	-	-	-	-	-	-	-	-
9	Soybean	Local(N=78)	67	85.89	4	5.12	7	8.9	-	-
	(N=78)	Hybrid	-	-	-	-	-	-	-	-
10	*Simi*	Local(N=21)	2	9.5	19	90.47	-	-	-	-
	(N=21)	Hybrid	-	-	-	-	-	-	-	-
11	*Masyang*	Local(N=32)	32	100	-	-	-	-	-	-
	(N=32)	Hybrid	-	-	-	-	-	-	-	-

The source of all the hybrid varieties of seed was agrovet, where out of 166 maize cultivation and 93 hybrid seed cultivation, all of the maize of hybrid variety seed source was agrovet.

The sources of local varieties of seed were home, neighbors, and agrovet. The home was the main source of seed for the crop millet, where out of 171 respondents, 111 were millet cultivators and out of 111 cultivators, 99% of millet cultivator's seed source was their own home and 1% of farmer's source of seed was their neighbor.

The rice seed was not shared among the neighbors, the local rice seed source was from the own home of the farmers, and the hybrid variety were from agrovet. Seven local varieties of crops- maize, millet, mustard, *mass*, *bodi*, soybean, and *simi* were shared in the neighborhood, where the seed source of *simi* was shared in the neighborhood in the highest number (90.47%).

Overall, the source of the seed of 3 hybrid varieties of crops was agrovet and the source of the hybrid variety of wheat was another. The source of local varieties of crops was from the own home, neighbors, and agrovet. Only four local varieties of the crop – mustard, potato, *bodi,* and *simi*- sources were agrovet.

Seed Storage and Method

Seed storage is done by the farmers so that they can use the seed for the next cultivation. The table illustrated below represents the status of seed storage of cultivated crops. The cultivated crops, after harvest, produce seeds that can further be stored in different methods. The method presented in this table is primitive and modern. The primitive method refers to the traditional method used by farmers to store the seed in their own house and the modern method refers to the modern techniques and equipment.

Table 10**:**

Seed storage and method of seed storage

S.N	Crop	Cultivated Variety	Storage		Method of Storage			
					Primitive		Modern	
			N	%	N	%	N	%
1	Rice	Local (N=92)	92	100	92	100	0	0
		Hybrid(N=85)	0	0	0	0	0	0
2	Maize	Local (N=73)	73	100	73	100	0	0
		Hybrid (N=123)	0	0	-	-	-	-
3	Millet	Local(N=111)	111	100	111	100	0	0
4	Wheat	Hybrid(N=13)	0	0	0	0	0	0
5	Mustard	Local(N=102)	98	96.07	98	96.05	0	0
6	Potato	Local (N=95)	0	0	0	0	0	0
		Hybrid (N=6)	0	0	0	0	0	0
7	*Mass*	Local(N=102)	102	100	102	100	0	0
8	*Bodi*	Local(N=112)	98	87.5	98	87.5	0	0
9	Soybean	Local(N=78)	72	92.30	72	92.30	0	0
10	*Simi*	Local(N=21)	2	9.5	2	9.5	0	0
11	*Masyang*	Local(N=32)	32	100	32	100	0	0

Out of 11 cultivated crops and their local varieties, nine local types were stored using the primitive method, and the local potato was only the crop that was not stored using any of the methods. 100% local rice, maize, millet, and *mass* cultivators stored the seed in primitive methods. The least stored local variety was simi which was stored at only 9.5%. Likewise, mustard, *bodi* , and soybean local varieties were also stored using the primitive method, and it was not less than 87.5%. None, of the hybrid varieties were stored by the farmers.

Cultivation after Storage and Quality Check

The farmers first cultivated the crops and then harvested them, and the seed obtained from their harvest was stored so that it could be further used for the subsequent cultivation. Table 11 illustrates the quantity and percentage of the cultivation after the storage and denotes how much quantity of stored seed is cultivated after the quality check.

Table 11:

Cultivation after storage and quality check

S.N	Crop	Stored Variety	Quality check of stored seed		Cultivation after Storage	
			N	%	N	%
1	Rice	Local (N=92)	81	88.04	90	97.82
2	Maize	Local (N=73)	58	79.45	68	93.15
3	Millet	Local (N=111)	85	76.57	111	100
4	Mustard	Local (N=98)	79	80.61	97	98.97
5	*Mass*	Local (N=102)	90	88.23	102	100
6	*Bodi*	Local (N=98)	72	73.46	98	100
7	Soybean	Local (N=78)	69	88.46	78	100
8	*Simi*	Local (N=2)	2	100	2	100
9	*Masyang*	Local (N=32)	2	6.25	32	100

Out of 11 cultivated crops and their varieties, only 9 crops of local varieties were stored for cultivation. The local varieties of millet, *mass*, *bodi*, soybean, *simi*, and *masyang* were stored and cultivated by cent percent. According to the data, the stored varieties are used for cultivation, and their quality check is also done. The maize crop was the least cultivated crop after storage compared to others, where 73 respondents stored the maize seed and only 68 farmers reported cultivating it,

accounting for 93.15 %. However, *simi* was the variety where only 2 farmers stored it and 2 of them cultivated it.

Likewise, all the farmers do not check the quality of the seed before cultivation. *Masyang* was the crop whose quality was checked in the very least amount and soybean was the crop whose quality was checked in the highest amount (88.46%).

Concluding the Chapter

This chapter provides an overview of the analysis of this study including the socio-demographic and other variables. The number of female respondents was greater than males. Likewise, the main occupations of all the respondents were farming, where the respondent's family had multiple sources of income, and they were the secondary and tertiary sources of income, where all the respondents' primary source of income was agriculture, the secondary source income was reported by 136 (79.5%) and 14 (8.2%) reported having the tertiary source of income. Likewise, all the respondents had their own land, and a few respondents had rented, *adhiya* land along with their own land. There were a total of 11 crops cultivated by the farmers; they cultivated hybrid and local varieties of rice, maize, and potato. Wheat cultivation was different from other crops because the hybrid variety was only cultivated by 13 (7.6%) respondents. The sources of cultivated varieties were formal and informal sources. The respondents stored only local varieties of the crops that were cultivated, and those stored varieties were used for the next cultivation.

CHAPTER V

FINDINGS AND DISCUSSION

This chapter includes the summary of the research findings of Chapter IV and emerged during data processing and interpretation. Additionally, the results are also discussed in this chapter.

Statistical Findings and Summary

Most crops are harvested for human consumption or animal feeding, and a few are also gathered from the wild In this research, all the tabulated and analyzed crops are cultivated for human consumption and animal feed. The crops that were cultivated by respondents were Rice (N=105, 61.4%), Maize (N=166, 97.1), Millet (N=111,64.9%), Wheat (N=13, 7.6%), Mustard (N=102,59.6%), Potato (N=101,59.1%), *Mass*(black lentil) (N=102, 59.6%), *Bodi* (cowpea) (N=112, 65.5%), Soybean (N=78,45.6%), *Simi*(beans)(N=21,12.3%) *and Masyang*(masanag beans)(N=32,18.7%).

The cultivation of the crops was further divided according to the type of their varieties. The varieties were local and hybrid. The local varieties of crops cultivated by the farmers were Rice (N=20, 19.04%), Maize (N=40, 24.09%), Millet (N=111, 100%), Mustard (N=102,100%), Potato (N=95, 94.05), *Mass* (black lentil) (N=102,100%), *Bodi*(cowpea) (N=112, 100%), Soybean (N=78,100%), *Simi* (beans) (N=21,12.3%), and *Masyang*(masyang beans) (N=32, 100%).

The hybrid varieties of crops cultivated by the respondents were Rice (N=13, 12.38%), Maize (N=93, 56.02%), Wheat (N=13,100%), and Potato (N=6, 5.9%).

Both (local and hybrid) varieties of Rice (N=72, 68.57%) and Maize (N=33, 19.87) were cultivated by the farmers.

The cultivated crops have their seed source. These are the sources from which the farmers acquire their seeds for cultivation. There were seven seed sources in the questions, including home, neighborhood, agrovet, and seeds from the municipality, agriculture research center, cooperatives, and Others. However, only four sources were reported by the respondents: home, neighborhood, agrovet, and others. Home and neighborhood are the informal seed source whereas agrovet is the formal seed source and others could be any of them.

The source of the hybrid variety of seeds was mostly agrovet. Out of 4 hybrid varieties of seeds, the source of 3 hybrid varieties (rice, maize, and potato) was agrovet. Out of 11 local varieties of cultivated crops, there were only four local varieties of the crop – mustard, potato, *bodi*, and soybean - whose source was agrovet.

The home was the source of 10 local varieties of crops that the farmers cultivated; the Neighborhood was the source of 7 local varieties of crops cultivated by the farmers.

The cultivated crops are stored for future use. Farmers cultivated seeds using both primitive as well as modern methods. None of the hybrid seeds were stored by the farmers. Looking into the local varieties, the rice, maize, millet, and *mass* seeds were stored by all the respondents in this study.. The least stored local variety was *simi* which was stored only by 9.5%.

Only nine crops of local varieties were stored for cultivation. The local varieties of millet, *mass, bodi,* soybean,*simi,*and *masyang* were stored and cultivated by cent percent. The local varieties rice (N=90, 97.82), maize(N=68, 93.15), and mustard (N=97, 98.97) were also cultivated after storage.

Discussions of Findings

This section begins with a discussion of the findings of the research. The main aim of this study was to determine the status of seed cultivation, its source, storage, and cultivation after storage in the Gajuri Rural Municipality of Dhading. This study also explored the relationship between socio-demographic factors, seed cultivation, source of seed, and storage.

In this research, the emphasis was on the 11 major crops cultivated in ward no 6 of Gajuri Rural Municipality of Dhading. Among those cultivated crops, the research focused on cultivation, source of seeds, storage, and cultivation after storage. The participants in this study were the local people of Milantar and Jare Bagaichha villages, and all the participants were involved in farming.

The respondents of this study were from the 20 to 82 years of age group. The participation of female respondents was more than that of male respondents by 5.2%. According to the preliminary report of the Central Bureau of Statistics (CBS,2022), the total population of Nepal is 29,192,480, which have been increased by 10% from the year 201. The ratio of females (51.04%) is greater than that of males (48.96%) in Nepal. Similarly, In Gajuri Rural Municipality, the population of females (50.94%) is greater than that of males (49.05%). The majority of the respondents belonged to the Brahmin and Chhetri community.

The land supports every part of human life. Land serves as the backbone of our society and economy. Farmers need certain land for farming, and in this research, the types of land defined were own land, rented land, and *Adhiya*. All of the respondents had their own land and used that land for farming and shelter. Respondent 3 (1.8%) also rented the land for farming, and *Adhiya* (1.2%) was also taken for farming. Forests cover 39.1% of Nepal, and agriculture makes up 29.83% of

the country (Uddin et al., 2015). It has been observed that there is a severe threat to food security due to the simultaneous rise in population on one side and the decline in agricultural land on the other.

All of the respondents were engaged in farming, and agriculture was the main occupation in that area. The primary source of income was agriculture. However, the farmers also had other secondary and tertiary sources of income. As a result, Out of 171 respondents, 38 reported having a job as their secondary source of income, followed by 11 reporting having a business, 20 reporting having a remittance, 29 reporting having wages, and 39 reporting having other. Therefore, 137 respondents had a secondary source of income apart from agriculture. Similarly, out of 171 respondents, the tertiary sources of income were jobs, businesses, remittances, wages, and others; 6 respondents had other sources of income, 5 had jobs, 2 had remittances, and 1 had a business. Therefore, a total of 14 respondents had a tertiary source of income apart from agriculture and a secondary source of income.

The rural population is now pursuing different careers due to the agriculture industry's poor economic performance. It is found that with the increase in the remittance inflow, there is no further increment of agricultural land (Katuwal Chhetri et al., 2020). As per the data, it is illustrated that 80% of the respondents have a secondary source of income. Farming households in rural areas seek alternatives outside of the agriculture industry and depend more on labor migration and other sources of income, including jobs, business, etc., as subsistence to meet their needs and improve their quality of life. According to Maharjan (2013), the farmers spend less on low-productivity subsistence crop farming and livestock when remittances are relatively large and instead favor the non-farm sector or use remittances more for leisure and consumer items. However, when the remittances are few, farm households

use the additional money to boost their subsistence farming revenue to cover their basic food and non-food needs. The data in the Gajuri Rural Municipality reflected that one-third of the respondents have a secondary source of income, reflecting that the people are more likely to be motivated toward other sources of income rather than agriculture, which can enhance their quality of life and meet their needs.

The farmers of *Jarebagaicha and Milantar* cultivated various crops. There were a total of 11 crops: rice,maize, millet, wheat, mustard, potato, *mass, bodi,* soybean, *simi* and *masyang*. Maize was cultivated by the highest number (N=166, 97.1%) of respondents, and wheat was cultivated by the least number (N=13, 7.6%) of respondents. The second most cultivated crop was *bodi* (N=105, 61.4%).

The variety was classified into two types' local and hybrid. Farmers cultivated local, hybrid, and both (local & hybrid) varieties of Rice and Maize. They produced only a local variety of millet, mustard, *mass*, *bodi*, soybean, *simi,* and *masyang.* Wheat was the only crop whose only hybrid variety was cultivated. Overall, farmers liked both hybrid and local varieties of rice, with hybrid maize being the most popular, followed by the local variety *bodi*.

Being specific to the varieties, out of 11 crops, farmers cultivated 10 crops of local varieties and 4 crops of hybrid varieties. The cultivation of local varieties is very important to ensure the continuous seed supply for the future; the farmers themselves store the local varieties of seed. The market for traditional seeds is also difficult to identify. Almost 90% of the seed utilized to grow rice, in Nepal comes from unofficial farmer-based seed networks, which also manage supply and production. Even in Bara, where many farms are close to research facilities, seed companies, and neighborhood seed sellers. Nearly 96% of farmers use unauthorized sources, including their own harvest, to obtain rice seeds (Gauchan et al., 2016; MoAD, 2013). Likewise, in the

research area, cultivation of local varieties is prevalent, which helps them to secure continuous seed supply for the future as they can store their seed for the next cultivation. Millet and *bodi* were the highly cultivated local variety.

For smallholder farmers in Nepal's hills, millet is a crucial crop for assuring their access to food and nutrition security. Throughout a generation, farmers have preserved a variety of traditional millet types by cultivating, choosing, communally sharing, and conserving them according to their own choices for adaptation, yields, subsistence, and cultural use (Gairhe, Gauchan et al., 2021). Likewise, *Bodi* (cowpeas) is a legume and a portion of staple food and a significant source of protein in many impoverished countries. The *bodi* is cultivated as an intercrop to maize by the farmers, and it is edible as green pods and dried pulse. Farmers in Nepal have cultivated cowpeas in various agroecosystems using native and improved varieties (Bhattarai et al., 2017). Only a small number of variants have been made available for Nepal to produce grains and the local variety is more accessible.

Of 11 cultivated crops, only 4 were of a hybrid variety. Recently, the Nepali government recognized the significance of encouraging high-yielding, high-quality seeds and advocated strengthening the seed supply by creating an effective value chain (MoAD, 2015). The hybrid varieties have certain benefits, including being easier and quicker to grow, adapting to stress better, and producing plants with greater fruit, higher yields, disease resistance, and longer shelf lives. Hybrid seeds also are more expensive, and saving hybrid seeds is usually not practical. The staple crops like rice and maize are cultivated using the hybrid variety by the respondents. These were the crops required for daily consumption for the family and the cattle. The major factors in behaviour change theory are environmental, personal, and behavioral characteristics (Van Der Linden, 2012). The farmers of Gajuri Rural Municipality

chose hybrid maize and rice for a significant amount, which could be due to the high-yielding property of those crops, its availability and the trend of farmers for using those varieties. Hybrid maize is the crop cultivated in the highest amount by the respondents; maize is a crucial crop for both cash and as a staple food. Despite a current anticipated need for 270,000 tons of maize, the animal feed business can only buy 135,000 tons in Nepal. The remaining 135,000 metric tons of maize, worth about 200 million Nepali Rupees, are imported annually. For Nepali farmers, the imports represent a missed opportunity. Furthermore, after a period of yield stagnation, the nation's switch to hybrids was a key factor in the steady advances in maize productivity attained over the past ten years (Seeds That Give, n.d.).

The farmers used local and hybrid seed varieties for cultivation, and the seeds were acquired from different sources, including formal and informal seed sources. The formal seed source is agrovet seed from home, neighborhood, agrovet, and others. The sources of the local variety of cultivated crops were the formal seed source (home, neighborhood), and the hybrid variety was the informal seed source (agrovet). Using the farmer's seed provides the advantages of being easily accessible, affordable, and known quality.

The majority of the farmers use some standards to choose the seed for the upcoming planting. When the seed is chosen from normal crop production, seed production is fully integrated into the harvest that was saved before planting. When the farmers cannot preserve seed after a harvest, they have to choose and find different sources, such as neighbors, agrovet or others. Local millet was cultivated by 111 respondents cent percent of respondents' seed source were informal seed source, 99% of farmers' source was from their own home of the farmers and 1% was from the neighborhood in the research area. Likewise, in a study conducted in the Kaski district

of Nepal, 91% of farmers kept their own seeds for future use. Some of the farmers were responsible for acquiring finger millet seeds from their neighbors and relatives. In this support, McGuire (2016) stated that the study conducted in Africa on 9660 observations of 40 crops showed that farmers access 90.2 % of their seed from informal sources. The foundations of seed flow include purchase, exchange, gift, and free collecting of seeds. Almost 82% of farmers practised changing their seeds at regular intervals (Baniya et al., 2005). Another study on rice and millet showed that Kaski, Bara and Ghanpokhari used informal sources of seed supply, including own, neighbors, and relatives, and Switzerland used only formal seed supply to cultivate rice and millet (Wyss, 2016).Along with improved production, formal seed systems come with risks and drawbacks for small-holder farmers, including increased input prices, reliance on formal seed suppliers, and changes in crop genetic diversity. The factors that influence the choice of seed are accessibility, knowledge, household area, consumption status and the choice of farmers(Ghimire et al.,2015;Suresh et al.,2021)

In this research, the practice of cultivating local varieties is more likely to be from informal sources and, at minimum, from formal sources. The benefit of farmer-managed seed systems is that they are receptive to local requirements and preferences while maintaining crop diversity on farms and nearby communities (Vernooy et al., 2022). The local farm-managed seed system is crucial for the security of genetic resources, food, and seeds.

The source of hybrid cultivated varieties of rice, maize and potato is a formal seed supplier, i.e. Agrovet, here in this research. The informal seed sector cannot produce adequate quality seeds to meet the farmer's needs. Due to their enormous potential for output, hybrid seeds are in extremely high demand in the Nepali market. To meet this need, a substantial amount of hybrid seeds worth millions of rupees is

imported each year. The most cultivated hybrid crop in the research area was maize and 93(100%) of the cultivated hybrid seed source was agrovet (formal seed supply). The study was conducted in Chitwan, Dadeldhura, Dang, Khotang, Lalitpur, and Sindupalchwok, overall, the formal seed for maize makes up 75%, and informal seed makes up around 25% (Gairhe et al., 2021).

The formal seed system consists of government farms, offices, seed companies, and agrovet. The source of 3 hybrid varieties (rice, maize, and potato) was agrovet. According to the Seed Entrepreneurs Association of Nepal (SEAN), a membership organization focused on input retailers, there are more than 2,000 agrovet across the country (USAID, 2016). In the majority of staple crops, the official seed sector's percentage of the total seed supply rarely rises above 10%, with hybrid seed markets for maize and sorghum serving as the primary exceptions (Heisey, 1990; Wierema et al., 1992; Echerverria,1990; & Grossman 1991). Similarly, in a recent study in different districts of Nepal, formal maize seed for maize makes up 75% and informal seed makes up around 25% (Gairhe, Timsina, et al., 2021).

None of the hybrid seeds were stored by the farmers because the hybrid seed did not guarantee a second harvest. For the seeds needed for each harvest, farmers rely on the market. Out of 11 cultivated floras, 9 local varieties were stored using the primitive method; the local potato was only the crop that was not stored using any of the methods. The farmers in Nepal select the seed after harvest and store it separately, or they choose it before or during the harvest by choosing particular plants, roots, ears, or tubers from the field. Reports on regional breeding and selection procedures show that the farming community is home to competent breeders-selectors. Special storage techniques appear widespread, including the use of ashes, calabashes, or sealed containers, storage in the smoke of a kitchen fire, and storage in diffuse light,

etc. (BG, 2016). Farmers are capable of producing high-quality seed, as demonstrated in a series of tests between farmers' common bean seed and "clean" seed. In 11 out of 13 evaluations, the farmers' seed consistently provided similar or higher yields than the researchers' "clean" seed (Janssen et al., 1992). The respondents of the research area also use the primitive method for storing the local variety of the seeds, and they use those seeds for cultivation in the next season.

In Jumla, about 79% of farmers prepare their own self-saved rice seeds. The farmers also acquired rice seeds from relatives and neighbors. About 67% of the farmers in Bara stored their own rice seeds. Neighbors, relatives, the market, and the public sector were the sources of seed, while exchange, gift, purchase, and free distribution were the basic basis of rice seed flow. The formal system was the secondary source of seed, followed by neighbors and relatives (Baniya et al., 2005).

None of the respondents reported that they stored their seed using modern techniques and tools, and it was because the village did not have any facility for the modern storage of the seed. The respondents also reported not having any community seed banks in the area. According to the Center for Crop Development and Agro Bio-diversity Conservation of the Nepali government, 53 organizations in Nepal are currently classified as community-run seed banks (Joshi, 2022). The use of local varieties and storage of those local varieties allows for conserving the local varieties; for instance, Maramche, a village in the Gandaki region in Nepal, established Maramche Community Seed Bank in 2020 to preserve twelve local varieties of rice, cucumbers, and maize, and the local says they have understood the importance of saving local varieties for future (Joshi, 2022).

The local varieties of millet, *mass*, *bodi*, soybean, *simi, and masyang* were stored and cultivated by cent percent. According to the data, the stored varieties are

used for cultivation, and their quality check is also done. In developed countries like Sweden, after harvesting and drying the farmers are subjected to quality checks of the farmed seed done more scientifically. Intellectual Property Rights (IPR) heavily regulate the usage of farm-saved seeds. One illustration of such a right is the requirement for payment when using one's own seeds. The farmer pays the levy if the total area under cultivation for cereals surpasses 23.7 hectares. As a result, the breeders receive a portion of the fees for their research and development work (Lindkvist & Ottosson, 2019). Similarly, in a question to the respondents about how they check the quality of the seed, the majority of the respondents mentioned that they use their traditional knowledge instead of using any scientific method or sending it to the related organization for checking.

At the heart of the Zero Hunger goal is the unchanging principle that nutrition and food security are necessary for human health and well-being. There are other ambitious goals within this goal, such as doubling agricultural productivity and income for small-scale food producers, developing sustainable food systems and ending all forms of hunger and malnutrition. Access to improved seeds to smallholder farmers in rural areas was still enduring interconnected challenges. Although the farmers in the research area cultivate both hybrid and local varieties of seed and they dominantly store the local varieties of seed traditionally, the quality check of the seed, either hybrid, which is acquired from the formal sources or the local varieties acquired from informal source does not have the proper quality checking system. As the farmers mentioned, they check the quality, but it is done with unscientific and traditional methods. Also, the farmers in the research area did not have access to improved and certified seeds. To achieve the target of goal number 2 by 2030, the farmers of the research area must have access to quality and certified seeds.

Furthermore, as per FAO (2022), being specific to target number 2.5 of goal number 2, the targeted to maintain the genetic diversity of seeds, cultivated plants, domesticated animals, and their related wild species by the year 2020, including through well-managed, diverse seed and plant banks at the national, regional, and international levels, and additionally, promote access to and equitable sharing of benefits resulting from the use of genetic resources and related traditional knowledge, as per an international agreement. The indicator 2.5.1. a says, "*Number of plant genetic resources for food and agriculture secured in medium or long term conservation facilities*" are also, the most trustworthy method of genetic resource conservation worldwide is the ex situ preservation of plant genetic resources for food and agriculture in medium or long term facilities (genebanks) (FAO, 2022). Looking into Gajuri Rural Municipality's storage practice, even the proper conservation facility is still unavailable. However, traditional practices are still prevalent. The research area does not fulfill the indicators for achieving the target and must get a proper conservation facility in the future.

Concluding the Chapter

The farmers of Jarebagaiccha and Milantar of Gajuri Rural Municipality of Dhading cultivate both local and hybrid varieties of crops. The cultivation of local varieties of crops is done from the formal and informal sources of seed supply while hybrid varieties are cultivated only from formal sources. Only local varieties are stored using the primitive method and thus stored seed used for cultivation in the future.

CHAPTER VI

SUMMARY, CONCLUSION AND IMPLICATIONS

This chapter begins with a synopsis and concludes with the inferences of the study. The study provides implications of the findings for farmers, academic institutions, employers, future researchers, and policymakers, and finally, the conclusion.

Synopsis of the Study

Agriculture remains the oldest profession sustaining human existence. Without agriculture, there is no food, nothing for humans, and consequently, no life. One of the vital economic contributors to the Nepalese economy is agriculture. Two-thirds of Nepal's labor force, or around 8 million people, work in agriculture, the country's primary industry (Gyawali & Khanal, 2021). The government of Nepal has placed a high priority on the value of agriculture for several years. Various strategies and policies have been put in place to enhance crop yield through the provision of subsidies, the development of irrigation systems, the introduction of improved and hybrid seeds, and the use of contemporary farming methods in Nepalese farms. The use of hybrid seeds is widespread in the commercial agriculture market. Being dependent on the market for seed cultivation is more prevalent regardless of its long-term effect on the environment and genetic diversity. Being based on the market for cultivation and lack of a seeds storage system for the subsequent cultivation can bring severe problems in the agriculture system of Nepal, including market monopoly by seed suppliers, loss of genetic diversity, loss of indigenous practices for seed storage,

and cultivation, etc., and this forces to think about the status of the seed cultivation, its source, and storage in the area of Nepal.

This study aimed to illustrate the status of crop cultivation, the source of the seed used for cultivation, the storage of the same cultivated seed, and the status of cultivation of the stored seeds. Three research questions were constructed to examine the situation of the farmers in ward no. 6 of the Gajuri Rural Municipality of Dhading. The ward has a total population of 4565 people. The sample size was calculated using a 0.05 level of significance and a 95% confidence level relative to the entire population of the ward. Consequently, a sample size of 171 was chosen. A standardized questionnaire was used to survey these individuals.

Rice, maize, millet, wheat, mustard, potato, *mass,bodi*, soybean, *simi*,and *masyang* are the major crops cultivated by the farmers of Jarebagaicha and Milantar village of Gajuri Rural Municipality of Dhading. The farmers chose local and hybrid varieties of the crops for cultivation, and they also chose both varieties when they had to cultivate potato, rice, and maize. The farmers cultivated only the local variety of mustard, *mass, bodi*, soybean, *simi, and masyang*. The most preferred local variety was *bodi*, and the hybrid variety was maize.

The sources of the local varieties of the seed were from formal and informal seed supplies; however, only mustard, potato, *bodi* , and soybean had formal seed sources. The informal seed source includes the own house of the farmer and neighborhood, and the formal source includes agrovet and others. The source of the hybrid varieties that were cultivated of the seed was formal seed supply, i.e. agrovet. Although the source of the hybrid variety of wheat was others.

Farmers store their seeds so they can use them for the following crops. Out of 11 cultivated crops and their local varieties, 10 local varieties were stored using the

primitive method, and the local potato was only the crop that was not stored using any of the methods. None of the hybrid varieties was stored for future cultivation.

The farmers first cultivate the crops and then harvest them, and the seed obtained from their harvest is stored so that it can be further used for the next cultivation. There were only 9 local varieties of crops stockpiled for planting. One hundred percent of the local kinds of millet, *mass*, *bodi*, soybean, *simi*, and *masyang* were stored and grown. The stored varietiess were used for cultivation, and a quality check was also performed manually in the research area.

Conclusion

The respondents of this study involved in agriculture are from 20 to 82 years old. This shows that there is no age bar for working in the field; both young and old people are working in the research area. The primary source of income of the entire respondents was agriculture; however, the respondents were also involved in other work for the secondary and tertiary sources of income. The major crops grown included rice, maize, millet, wheat, mustard, potato, *mass, bodi*, soybean, *simi*, and *masyang*.

The source of hybrid varieties was agrovet, also known as the formal seed supply, and the local varieties were home neighbors and agrovet. Hybrid cultivars were used to cultivate the following crops: rice, maize, wheat, and potatoes. Most of the hybrid varieties of seed do not grow in the second generation, and the source of hybrid seed is agrovet because farmers cannot preserve and grow the hybrid seed at the informal source in the research area. Rice and maize are the staple food crops, and the consumption of those crops is higher. To fulfill the need for the food crop, the farmers look for high-yielding varieties. Only native varieties of mustard, *mass*, *bodi* , soybean, *simi*, and *masyang* were grown by the farmers. Home is the major seed

source for the majority of the local variety. Cultivation of local varieties from the informal source (own home of farmers) helps to secure continuous seed supply for the future as they can use the same stored variety for subsequent cultivation.

The local potato was the only crop that was not saved using any primitive method where nine other cultivated local varieties were stored. The research area did not have any facility for the modern storage technique. The traditional storage technique to store the seeds and thus stores variety was used for the cultivation, the farmers also did manual quality checks before cultivation. The conventional storage technique in the area is transferred from generation to generation, and local variety storage also maintains genetic diversity.

Overall, for staple food like maize, rice, and potato the farmers chose hybrid seed which is said to give more yield. For other crops, the farmers chose to cultivate the local variety of seeds which can be readily available at less cost as the respondents save the seed for future use. Using local varieties allowed the respondents to conserve the genetic resources of that area, helping farmers to be self-sufficient. The farmers should not rely on the market for seed supply. The primitive method of storing seeds helps farmers save their indigenous knowledge and transfer it to younger generations.

The target to meet Sustainable Development Goals is possible only by using certified, high-yielding seeds. The farmers in the research area lack proper storage and quality check. Therefore, to achieve SDG 2, policy-makers, farmers, and local authorities must act accordingly. However, the traditional knowledge of storage and cultivation of local variety is prevalent, and a systematic and scientific method for storage and quality check unit must run in the area.

Implications of the Study

The findings and discussion of this research can be beneficial to agriculturists, academic institutions, employers, policymakers, and future researchers to enhance crop productivity and food sufficiency in that area. The findings can be helpful for the local government to keep data on their ward and further construct the policy accordingly; the data from this research are presented at the grass root level and hence fills the gap between the farmers and policy-makers. The findings from this research can also be advantageous for different government institutions, and non-governmental institutions

Implications to Farmers

Local farmers should be aware of the variety of seeds they are cultivating, the source of seeds they are using, and the techniques they are using for storage. Such awareness will help the farmers choose the seed for cultivation wisely so they can get a better yield from their harvest and hard work. The use of local varieties will help to preserve genetic diversity. As seen in the area, the hybrid variety of rice and maize gives a better yield, and the farmers cultivate the varieties, but the long-term effect and seed security are not guaranteed to the farmers. So this data can be used to make the farmers the farmers aware of the use of the seeds used for cultivation. Additionally, understanding where to improve and what kind of seed is beneficial for them and seeking suggestions from the experts can be done by the farmers.

Implications for the Seed Industry

Industries and seed breeding organizations are producing seeds of high quality, varying in different altitudes, temperatures, drought resistance, etc. The seeds produced by the industries could be hybrid, cross-pollinated, or modified. The hybrid varieties of seeds should be bought every year, and the farmers do not save those

seeds. The industries should understand and perform a need assessment in the area where they sell the seeds so that the farmers get the seeds they require without hindering the farmer's rights and seed sovereignty. The findings from this research will also help the industrialist understand the cultivation status and behavior of the farmers so that they can produce the seeds as per the farmer's requirement.

Implications to Policymakers and Local Government

There are a lot of policies related to seeds in Nepal; however, not all the policies have been implemented. This research has explored the cultivation and storage status of seeds used by farmers. Similarly, this study has explored the sources used by the farmers in acquiring the seed. The pattern and status can vary on geography and the farmers' social status. So, the local government can use the data to review the policy related to seed. For instance, the majority of the crops are cultivated using the local variety so the policymakers can have provisions for preservation and ensure the quality of that variety. Likewise, the farmers are storing the seed in their traditional method; the local government can help the farmers by establishing a community seed bank to preserve the varieties. The establishment of the community seed bank can be done by merging the scientific method with the traditional method that the farmers are now using in the area.

Implications to the Future Researcher

This research explored the status of cultivation, source of seed used by the farmers, storage of the seeds, and cultivation of thus stored seeds. Future researchers can initiate a similar study in the next research area and compare the results. This study can raise the possibility of conducting further research on some of the issues as follows:

a) The genotype of the local and hybrid varieties used to cultivate rice, maize, and potato

b) The source of seed used by the farmers can further be studied in association with the one-one individual crop

c) The quality standard of self-stored seeds can be checked in a scientific manner

d) The flow of traditional knowledge for the storage of seeds.

e) The loss of native varieties of rice and maize

f) Comparative study of varieties in relation to the yield and cost

g) The gaps between the policy maker and the farmer

h) Status of yield from the cultivated variety of crops

i) The reason behind the choice of source of seed.

Concluding this Study

In the end, the researcher feels that agriculture is a significant area of research in the context of Nepal, and much scientific research has been done in the field. This study has covered the major cultivated crops, varieties used for the cultivation of the crops, sources of those varieties, the status of storage of those varieties, and cultivation after storage of those varieties in the study area. Further gaps in terms of genotype, name of varieties, the total cost for cultivation, and harvest after cultivation can also be assessed. Another important aspect indicated by this study is to conduct more research based on social science; Although much research has been carried out, the basic research indicating the status of cultivation and storage was rare. Reflecting on this research journey, the researcher aimed to inform the farmers about the types, the importance of the varieties, and seed conservation. In addition, the researcher is also interested in further study regarding the individual variety concerning the sources of the varieties and cultivation. Furthermore, the researcher is also interested in

carrying out similar research in the high-altitude area of Dhading where the roadways and market are not near.

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APPENDICEX I

Questionnaire for the Study

Department of Development Education

Kathmandu University- School of Education

Masters in Sustainable Development -2020

विउ सम्बन्धी अध्ययन प्रस्नावाली

१. अन्तरबार्ता दिने कृषकको नाम :.....

२. लिंग :.....

३ जातीः . क क्षेत्री/व्राम्हण (ख जनजाती (ग दलित (घ अन्य कुनै (

४. उमेरः.... .....

५ .ठेगाना.....: वार्ड न..... .

६. सम्पर्क न.....

७(.....महिला .....पुरुष).....पारिवारिक विवरण संख्या .

७.१	उमेर अवस्था	परिवारका सदस्य संख्या
क)	१६ वर्ष मूनिका बालबालिका संख्या	पुरुष.....महिला.....
ख)	१६ वर्ष देखि ५९ वर्ष सम्मका संख्या	पुरुष.....महिला.....
ग)	५९ वर्ष देखि माथिका	पुरुष.....महिला.....

७.२	शैक्षिक अवस्था	संख्या
क)	साक्षर (पढ्न र लेख्न सक्ने)	पुरुष .....महिला.....
ख)	पढ्न र लेख्न नसक्ने	पुरुष.....महिला.....

ग)	प्राथमिक तह (५ कक्षा सम्म)	पुरुष.....महिला.....
घ)	माध्यमिक तह (१०कक्षा सम्म)	पुरुष.....महिला.....
ङ)	१२ कक्षा वा सो भन्दा माथि	पुरुष.....महिला.....

७.३	आम्दानीका श्रोतहरु	(छ / छैन)
क)	कृषि	
ख)	नोकरी	
ग)	व्यापार	
घ)	रेमिटेन्स	
ङ)	ज्याला मजदुरी	
च)	अन्य(खुलाउनुहोस)	

८जग्गाको स्वामित्व .

८.१ जमिनको किसिम	८.२ छ / छैन	८.३ सिचाई		८.४ जमिनको क्षेत्रफल
		छ	छैन	
आफ्नै				
भाडामा				
अधिया लिएको जग्गा				

छ ✔

छैन □

८.४ जमिनको क्षेत्रफल सोधेर लेखिनेछ

९. वालि, जात, श्रोत, मात्रा, भण्डारण,खेती गुणस्तर, लागत

क्रम.संख्या	९.१ वाली	९.२ जातको नाम	९. ३ बीउको श्रोत	९ .४ बीउको मात्रा प्रती केजी	९ .५ भण्डारण		९ .६ भण्डारण पछीको खेती	९ .७ गुणस्तर जाँच	९ .८ लागत प्रति केजी
					९ .५.१ आधुनिक	९ .५.२ परम्परागत			
	धान		1						
			2						
			3						
			4						
			5						
			6						
			7						
	मकै		1						
			2						
			3						
			4						
			5						
			6						
			7						
	कोदो		1						
			2						
			3						

			4						
			5						
			6						
			7						
	गहु		1						
			2						
			3						
			4						
			5						
			6						
			7						
	मास		1						
			2						
			3						
			4						
			5						
			6						
			7						
	तोरी		1						
			2						
			3						
			4						
			5						
			6						
			7						

	आलु		1						
			2						
			3						
			4						
			5						
			6						
			7						
	अन्य		1						
			2						
			3						
			4						
			5						
			6						
			7 1 2 3 4 5 6 7						

१०.२ जात को नाम सोधेर लेखिनेछ

१०.३ बिउको श्रोत वीउको श्रोत कोड: १=घरको वीउ २=छिमेकी ३=एग्रोभेट ४= पालिका ५=कृषि अनुसन्धान केन्द्र ६=सहकारी ७. अन्य

१०.४ बिउको मात्रा सोधेर लेखिनेछ

१०.५	भण्डारण	गर्छु ✔	गर्दिन □
१०.५.१	आधुनिक	✔	
१०.५.२	परम्परागत	✔	
१०.६	भन्डारण पछीको खेती	गर्छु ✔	गर्दिन □
१०.७	गुणस्तर जाँच	गर्छु ✔	गर्दिन □
१०.८	लागत	सोधेर लेखिनेछ	