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Potential Role of Traditional Underutilized Food Crops in Achieving Food and Nutrition Security in Nepal

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Executive Summary

The food and nutrition security of a country is addressed in Sustainable Development Goal 2 (SDG 2), which relates to ending hunger, food security, and improving nutrition through sustainable agricultural development. The Government of Nepal has committed itself to SDGs, set targets to achieve those respective goals, defined indicators for those targets, and formulated policies and programs for implementation to achieve the targets. As per the commitment, those targets have been integrated into the 14th and 15th periodic plans and Agriculture Development Strategy 2015-2035.

Seven years have already passed since the SDGs were adopted for implementation by the Government of Nepal, but the indicators in reviews of SDGs, specifically SDG 2, are not very encouraging. The Government's official figure in 2020, even after five years of SDG's implementation, stated that only 48.2% of households are food secure. Furthermore, an alarming increase in farm product import in recent years and months, and over-reliance on limited major food products such as rice, wheat, potato, and corn for staple food has led to a loss of nutritional diversity from the daily diet and at the same time, loss of crop species diversity from the agricultural system, The high hills, and mountains of Nepal, have been facing a food deficit for a long time. However, most of the native and locally adapted species of these areas, such as barley, buckwheat, millets, amaranth, vegetables, roots, and tuber crops, and so on are neglected or underutilized. Besides that, unfounded cultural and religious taboos in some ethnic groups have referred to some crops like millet, buckwheat, and soybean as unholy foods regardless of their superior nutritional status.

Since Nepal adopted a federal system of governance in 2015, all local Municipalities have sovereign power to formulate plans and policies to explore and utilize their resource entitlements and agroecological location advantage. Education and public awareness on locally adapted underutilized crop species and their role on food and nutrition diversification should receive priority of local government policies. The evolution of current staple food choice dependent on limited crop species such as rice, wheat, potato, and a few other crops is not considered sustainable, secure, and balanced from nutrition perspective. Identification of potential ecological zone-specific traditional crops and their breeding and improvement would pave ways to entrepreneurship and investment in such underutilized plant resources leading to commercialization and branding. Strategies adopted by local Municipalities to achieve such policy outcome with the backing of the provincial and federal governments would help localize respective SDGs, including SDG 2, thereby helping to achieve food and nutrition security in the country.

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Introduction

The United Nations' Sustainable Development Summit in New York in September 2015 adopted "Transforming our world: the 2030 Agenda for Sustainable Development" with 17 Sustainable Development Goals (SDGs), which came into implementation from the 1st of January 2016. The heads of state and governments agreed to set 17 SDGS and their corresponding targets as an integral part of the Sustainable Development Agenda 2030. These goals are global and universally applicable, considering different national realities, circumstances, capacities, and levels of development while respecting corresponding national policies and priorities. The SDG targets are defined by each national government by setting its own national targets in line with the global targets.

Figure 1: The 17 Sustainable Development Goals (SDGs) 2030 defined by United Nations
Source: https://microbiologysociety.org/why-microbiology-matters/our-history/75th-anniversary-a-sustainable-future/sustainable-future-the-un-sdsgs.html

The three SDGs (Figure 1): Goal 2 (end hunger, achieve food security and improved nutrition through sustainable agriculture), Goal 3 (ensure healthy lives and promote wellbeing for all at all ages) and Goal 6 (ensure access to clean water and sanitation for all) are intricately related. Secured nutrition focuses not only on the required level of calorie intake, but also the proper balance of food items in a household's food intake. Therefore, food patterns with a high diversity of food items, including that from traditional food crops, and providing a range of micro and macronutrients are essential to achieve nutrition security. For SDG 2, the Government of Nepal has set eight major targets. Of the eight targets, three are related to international cooperation and financial resources, and five are related to food and agriculture.

Food and nutrition are closely linked with agriculture, land, rural life, environment, climate change, and human health (Rasul et al. 2019). Similarly, multiple actors are involved and associated with these diverse sectors, and coordinated efforts are necessary among sectoral line agencies to address the current food insecurity situation. Coherent and well-aligned policies and interventions from the federal and provincial levels are needed to achieve targets specifically at the local levels. Unless the local level government, mainly Municipalities, align their programs and budget with the SDGs, achieving SDGs by 2030 will remain a distant dream, if not impossible, to achieve (NGO Federation of Nepal 2020).

In recent years, an alarming increase in farm product import has climbed to one-fifth of total annual imports, which it has warranted a critical food and nutrition security situation in the general population (Prasain, 2022). In addition to the direct impacts of COVID-19 on human health and labour mobility, 8.7% decline in rice production of Nepal in 2021, a worldwide increase in the cost of chemical fertilizer and petroleum, and recent imposition of 20% tariffs on rice exports by India (Asian Peace Research, 2022) have further aggravated the food availability and affordability situation. Despite a commitment to SDG 2 by the federal government and providing high national priority to agriculture, natural resource management, and farm entrepreneurship in recent periodical national plans, including that in the 15th periodic plan, the country has not achieved significant progress in the indicators of food and nutrition security such as Global Hunger Index (GHI) and Food Insecurity Experience Scale (FIES) (NGO Federation of Nepal 2020).

About 85% of the cultivated crop species in Nepal are neglected and underutilized (Joshi and Gauchan, 2022). Heightened priority from all tiers of government in research, breeding, and extension of those species could directly contribute to achieving the SDGs (particularly Goals 1, 2, 3, 8, 12, 13) and fulfilling national goals of reducing poverty and ensuring food and nutrition security. Developing site-specific staple food crops, nutritious, and climate-resilient varieties and diversified products utilizing rich agrobiodiversity of underutilized crops should be the focus of all tiers of the government. As Nepal adopted a federal system of governance only in 2015, it may take time to identify and adopt best practices within the system. Although numerous programs were implemented to increase the production and achieve national food security in the past, timely identification of policy bottlenecks in broadening staple food base, incorporating locally adapted crop and livestock produce in the daily meals, and implementation of such policies at the municipal level are critical to achieve the food self-sufficiency targets.

Neglected and underutilized species are those crop species that are not prioritized in formal research, education, and development programs but are still cultivated by some growers and are mostly consumed at the household level. About 85% of the total 577 cultivated crops are neglected and underutilized at species level (Joshi et al. 2020), and more than 95% are neglected and underutilized at the landrace level in Nepal. A comparative analysis presented by Joshi et al. (2019) has shown that these species and landraces have greater nutritional composition, local adaptability, tolerance to stresses, and social, cultural, and ecological values than introduced varieties. Some of them are listed below. Table 1. Some prominent underutilized food crops, added nutritional values, and cultivation zone (Joshi et al. 2019)

S.N.	Crop Species		Nutritional /medicinal values	Cultivation zone
	English name	Local name		
1	Tartary buckwheat	Tite Phapar	High lysine, fibre, minerals, lipids	Mid and high hills
2	Grain amaranth	Latte	High protein, folic acid, vitamins	Mid and high hills
3	Foxtail millet	Kaguno	High protein, fat, minerals, gluten free	Mid and high hills
4	Proso millet	Chino	Rich in protein, iron	Mid and high hills of western Nepal
5	Taro	Pindaloo	Rich in minerals	Mostly mid hill
6	Naked barley	Uwa	High protein, fibre, fat, starch	High hills
7	Deltoid yam	Bhyakur tarul	High in carbohydrate	Mid hills
8	Horse gram	Gahat	Rich in protein, iron, good for weight loss	Mid hills
9	Rice bean	Masayang	High lysine, niacin, minerals	Mid hills
10	Linseed	Aalas	Antioxidant, Omega-3 fatty acid	Mid hills
11	Nepali butter tree	Chiuri	Ghee medicinal for rheumatism and headache	Lower mid hills
12	Perilla	Silam	Molybdenum, Omega-3 fatty acid	Mid to high hills
13	Nepali pepper	Timur	Essential oil, vitamin, sulphur	Mid to high hills
14	Fenugreek	Methi	Medicinal value for diabetics	Terai to mid hills
15	Indian gooseberry	Amala	Vitamin C, used for pickles	Terai to mid hills

Policy recommendations

A study in reference to Nepal and Pakistan published in 2017 (Adhikari et al. 2017) mentions that food and nutrition insecurity is more prevalent in the hills and mountains of the Hindu Kush Himalayan region than in the plains In the case of Nepal, not long after that study was published, such insecurity threat looms for the whole country which have been more pronounced in the mid-western hilly districts of Karnali Province for many years. Unless the elected federal and provincial governments bring forward effective policy intervention measures to prioritize traditional underutilized species, the country cannot achieve food and nutrition security agenda 2030. The following policy recommendations are discussed in this policy brief after reviewing prominent published research and review papers, reports, and newspaper articles.

1. Promote agro-ecological zone-specific staple crops

High hills and mountains of Nepal are the most common geographic regions of food deficit. Potato, rice, naked barley, and millets are a few traditional staple crops in those areas. However,

these native species and varieties are often neglected in research, variety development and extension programs of government agencies. The long-held government policy of subsidizing transportation of rice and wheat to remote hilly and mountainous areas has worsened the situation. A study published in 2018 (Joshi et al. 2020) finds that co-ordinated focused programs for developing those native and adapted crop species to cater staple food needs of the agroecological zone would help provide a local solution to this global problem. To make a local native crop a major staple crop in that zone, some research effort has also been initiated on food crops such as proso millet, amaranth, and foxtail millet, in the high elevation farming system of Jumla, Humla, Lamjung, and Dolakha (Gauchan et al.2020). A substantive initiative was made, a few years ago in proso millet crop to get higher yields. A major problem in this crop was dehusking, a highly time-consuming and tedious process performed mainly by women. Because of this, many farmers were not motivated to grow millet crop, even though it was better adapted and relatively higher yielding in this Agro-ecology. A simplified electrical machine introduced by the program for dehusking influenced the farming decision. The study reported that the production of proso millet in the zone is expected to increase gradually as a staple crop of this agroecological zone. Based on this successful example, similar more focussed policy interventions in other locally adapted staple crop species can be implemented.

2. Programs to mitigate loss of agrobiodiversity

Nepal has been ranked 49th in the world for biodiversity richness. Among 24,300 species in the country, 28% are agricultural genetic resources, known as agrobiodiversity. Agrobiodiversity contains six components which are crops, forages, livestock, aquatic animals, insects, and microorganisms. And it has four sub-components namely domesticated, semi-domesticated, wild relatives and wild edible. An estimated 40% loss of agrobiodiversity occurred in Nepal; farmers have even reported up to 100% loss of agricultural genetic resources in particular species (Joshi et al. 2020) Conservation of agrobiodiversity has been initiated since 1986 and four strategies namely ex-situ, on-farm, in-situ, and conventional breeding have been adopted for conservation and sustainable use of agricultural genetic resources (Joshi, et al. 2019).

Factors influencing-farm diversity of the three economically important crops namely finger millet, cold tolerant rice and bean varied by agro-ecological, farming system and socioeconomic conditions of the mountain locations. On-farm conservation of agrobiodiversity in crops such as finger millet, high altitude cold tolerant rice and beans have been initiated by some NGOs in the country since late 1980's, while that for barley, naked barley, proso millet, foxtail millet and grain amaranth (Table 1) are specific to some mountain regions, mainly Humla and Jumla districts initiated in later years. In one study, Joshi et al. (2020) reported that the diversity of cold tolerant rice in all the mountain sites and that of finger millet in Humla showed potential impact in farm production and food security of the mountain households.

The other approach to conserve local germplasm is establishing community seed banks. Seeds of modern varieties are generally available through development agencies, local businesses, and others. However, a formal seed supply system has not been established for local and underutilized crops and landraces. Besides that, organizing a diversity fair where most of the participating farmers can promote seeds for different landraces and provide seed access to anyone in the community who may need them. This helps to exchange seeds, source the crop diversity-rich farmers, and identify rare and endangered landraces. Another approach called diversity field school, could be organized, inviting farmers, local businesses, and community leaders for

community education, and raising awareness. The conventional breeding aspect of conserving agrobiodiversity strategy, seed sector policies and laws implemented after 2013 have made the public sector a facilitating body, and kept the private sector at forefront. Implementing these policies is essential to improve the capacity of private sector stakeholders and speed up seed industry development. The private sector in Nepal seems ready to perform unconventional roles, such as variety development, maintenance, producing breeder seeds, maintaining seed quality through its mechanism, and seed quality testing, which are mostly done by the public sector so far. It would be better for the public sector to work jointly with the private sector and develop the capacity of the private sector to perform these roles independently (Ghimire et al. 2022). Nepalese landraces and their genetic enhancement should be strengthened by using both conventional and molecular techniques focusing on regional and location-specific or niche-based varietal improvement. The application and improvement of tissue culture techniques in vegetatively propagated crops like potato and banana and strengthening of organizational and human resources capacity of relevant agencies would help to adopt these advanced technologies in Nepal.

3. Commercialize underutilized food crops

The evolution of current food habits in Nepal promoting limited choice of cereals, vegetables, and fruits in daily meals is not a healthy trend from the perspective of balanced nutrition, as it lacks some essential micronutrients and fibre in the diet. There have been continued unfounded cultural and religious taboos in some ethnic groups to identify some food crops as unholy or pseudo-grains. This has led to decreased area and production and resultant lower priority in formal breeding programs of locally adapted crop species such as millets, buckwheat, and horse gram. Moreover, the steady remittance source in recent years improved the purchasing power of people enabling them to afford exotic food, but the development and commercialization of local crops and varieties could not catch up that pace inducing consumers to opt for the limited species such as rice, wheat, and potato as a staple source. World Food Program's "food for work" aid in the form of major staple gains and extended road and communication access to rural parts of Nepal have also facilitated to evolution of the current food culture (Lama, 2019). The author cites an example of upper Mustang, a high hill district of Nepal, where the village fields would be lush with barley and wheat in July and August, red flowers of buckwheat would blanket large swaths of fields in November just a couple of decades ago has now become a very rare scene. The overdependence on imported grains and food has made food production and supply systems in Nepal vulnerable.

In addition to the major staple food crops such as rice, maize, wheat, and potato that are grown in Nepal, there are many other crops, 47 underutilized crops among them are listed as future smart crop species with excellent food and nutritional values. But these crops are receiving low priority in research and development. Nonetheless, they have been assessed as important in sustaining Nepal's farming system, human nutrition, food security, and socioeconomic fabric (Joshi et al. 2020). There have been no significant technical and financial investments in the development of underutilized crops by Government and NGOs. Despite many underutilized crop species showing big potential, priority has always been given to a few crop species that are considered staple food crops. Nonetheless, all agricultural genetic resources have important roles in food and nutritional security. The neglected and underutilized species, including buckwheat, amaranth, and millets, are reported to be more nutritious, climate-smart, and farmer-friendly than current staple crops such as rice, wheat, potato, and maize (Joshi et al. 2020). Public awareness and education campaign should be organised regularly at local government levels to explain additive value of underutilized food crops in the daily meal so that proper investment is justified for genetic improvement, product

diversification, and commercialization initiatives by Government and NGOs. Such a shift in policy and strategy could benefit farmers, reduce food imports, and promote sustainable agriculture in the long run.

Another strategy would be the commercialization and branding of local foods, which could attract new entrepreneurs and investors. In a program in Karnali Province, training was organized on making different food items from proso millet. As a result, one participating farmer started a business of food products made from proso millet, as Gauchan et al (2020) reported. The same farmer also participated with those products at the national food fair and won the second prize. This success story illustrates that location-specific underutilized crops should be identified rather than just relying on limited staple food. Similar approaches could be taken to promote such success in other sites in Nepal, as well. Future research and development policy interventions need to focus on diversity rich solutions and technologies tailored to specific crops. It should also be based on farm socioeconomics, agro-ecological conditions, and institutional settings of the mountain households to enhance food security, management of crop biodiversity, and agro-ecosystems.

4. Promote rural entrepreneurship and farm eco-tourism

A recent expansion of transport and communication network in the rural areas in Nepal has encouraged locals to open homestay businesses. As a result, one can find a homestay in many rural villages these days coupled with an internet or Wi-fi connection. The local government could tap this opportunity to regulate the trend and encourage local youth to develop unique agri-businesses of niche items like traditional crop and animal products targeting domestic and foreign tourists. It could be enhanced by providing easy finances, market access to inputs and products, and entrepreneurship training to participating local youth. The programs such as the mandatory inclusion of locally produced plant food, meat, and dairy products in the homestay daily meals and the unique cultural show of the region would attract more tourists to boost income generation. Even though trained human resource is always a major constraint in this sector, an institutional mechanism needs to be established to source diaspora expertise and attract educated youth to develop rural farming and agricultural eco-tourism business.

Conclusion

Since Nepal is relatively new to adopting a federal system of governance, localization of SDGs by the three tiers of government faces many challenges, often due to a lack of clarity on roles to policies and program implementation and monitoring. To address that issue and achieve food and nutrition security, federal and provincial governments should focus on macro level policies and allocation of resources for promoting agrobiodiversity conservation, farming of local species and varieties of crops and livestock, implementing regulation on sustainable harvesting of forest-based traditional food products, and creating national initiative to integrate local food produce in the daily meals of official functions. Similarly, local governments should develop strategies to implement agricultural land consolidation and capability mapping for agricultural and non-agricultural uses. They should train local youth in farm entrepreneurship, ensure market access for the local produce, and promote commercialization and branding of local underutilized food produce. The governments should further support farm machinery purchase and maintenance, ensure supply of inputs such as fertilizers, improved seeds/seedlings/saplings, feedlots, and veterinary chemicals on time.

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