

DOCUMENTING ABUNDANCE AND USE OF UNDERUTILIZED PLANT SPECIES IN THE MID HILL REGION OF NEPAL

Rajib Khanal, Arbindra Timilsina, Chandra P. Pokhrel¹ and Ram Kailash P. Yadav*¹

School of Natural Resources and Bio Environment P. (Ltd.), P.O. Box 23383, Kathmandu

¹Central Department of Botany, Tribhuvan University, Kirtipur, Kathmandu

Email: rkp.yadav@cdbtu.edu.np

ABSTRACT

Around the world, many communities depend on plant species that are outside the mainstream of agricultural research and development. These species are also known by various names, such as 'underutilized crops' 'neglected crops, poor people's crops' or 'third order crops'. More recently, they have been designated as crop for the future agriculture. Changing human perception and custodian, changing food habits, influence of globalization are the major factors leading to low priority to the local crop products. The study of underutilized plant species of the mid hill region is an attempt to highlight the food, fruits, vegetables, pulses and medicinal plants; and their mode of use by the local people. The study was conducted in two VDCs; Siddeshwor of Palpa and Hastichaur of Gulmi districts. A total of 52 plant species belonging to 27 families were recorded to be used frequently by the people of Siddeshwor and Hastichaur VDCs. Declining consumption of these local crop varieties at local level and low demand in the local market due to eroding traditional knowledge are main reasons for the farmers being unwilling to grow these crops.

Key words: Underutilized crops, neglected crops, genetic resources, agrobiodiversity, traditional knowledge, mid hill region.

INTRODUCTION

Agricultural biodiversity is a strategic asset for poor communities living in harsh environments and represents a source of livelihood options to improve their quality of life in terms of income, food security and health (Sthapit and Padulosi 2012). It is well established that biodiversity conservation and maintenance of associated ecosystem services are vital for human well being (Beaumont *et al.* 2011). Approximately 75,000 species of plants worldwide are believed to be edible (Walters and Hamilton 1993). Among them,

about 30 crop species provide 95% of the worlds' food energy whereas over 7,000 species have been known to be used for food and are both partly or fully domesticated (Williams and Haq 2000). Overdependence on a few plant species exacerbates many acute difficulties faced by communities with regard to food security, nutrition, health, ecosystem sustainability and cultural integrity (Jaenicke and Hoschle-Zeledon 2006). Most of these plants are important locally or regionally only, and are known as 'minor', 'neglected', 'underexploited' and 'orphan' species,

or 'underutilized crops' or 'undervalued crops', 'poor people's crops' or 'third order crops'. More recently, they have been designated as crop for the future agriculture (Pratap 1990).

The underutilized crops were once more widely grown but are now falling into disuse for various agronomic, genetic, economic, or cultural factors. In general, they are characterized by much less genetic improvement than the major crops but they are being lost because they are less competitive. In addition, these crops remain inadequately characterized and, until recently, have been largely ignored by researchers despite being valuable genetic resources. However, they are important for the subsistence of local communities, are maintained by socio-cultural preferences and traditional uses. Recently, there is an increasing realization among researchers, development practitioners and the general public regarding the positive role played by these neglected and underutilized species, not only in food security and improving people's livelihoods but also due to greater range of nutritional options (Padulosi *et al.* 2009). In addition, they are locally well adapted to marginal land and constitute an important part of the local diet, providing valuable nutritional elements (e.g. protein, vitamins and minerals) and spices, often lacking in staple crops (IAEA 2004). Yet they may represent our most valuable potential resource for the future. Moreover, underutilized crops in particular have received little investment from research institutions and development agencies (World Bank 2007).

Agriculture is the mainstay of hill's and mountain's economies in Nepal. Hills and mountains represent unique habitats or niches and great opportunities for promoting specific niche-based farming system or agrobiodiversity. Some local cultivars considered as underutilized or neglected crops can ensure sustainable production and contribute to improve livelihood of poor farmers. Many neglected and underutilized species

are nutritionally rich. The erosion of these species can have immediate consequences for the nutritional status and food security of the poors (CGIAR 2010). Besides, they are less susceptible to climate change effects and diseases compared to improved varieties (Jarvis *et al.* 2008). Many of these groups and their breeds are nutritionally rich and adapted to low input agriculture (Thies 2000). These species hold great genetic diversity, and vast heritage of indigenous knowledge is linked to these species (Frison *et al.* 2000). Furthermore, these crops are now underutilized and becoming neglected which can be cultivated with less agricultural inputs on marginal lands in hills and mountain areas. Since the cultures and rituals are handed down from generation to generation, traditional knowledge is also transmitted in the same way. Such knowledge needs to be studied and documented. The documentation of underutilized plants and traditional knowledge on their utilization can be useful in devising strategies to check the loss and erosion of these valuable genetic resources. The aim of the present paper is to explore the underutilized plants of the mid hill region of Nepal through their documentation along with their use values in the local community based on their traditional knowledge.

MATERIALS AND METHODS

Study site

The study was conducted in two Village Development Committees (VDCs), viz. Siddheshwor VDC (83° 22' 14.17'' E to 27° 56' 33.9'' N) of Palpa and Hastichaur VDC (83° 14' 6.31'' E to 28° 7' 52.93'' N) of Gulmi district of mid hill region of Nepal. Map of the study areas is given in Fig. 1. Siddheshwor and Hastichaur VDCs, resembling in geographical locations, are characterized by three bio-geographical zones staggered from the temperate zone to tropical zone. As a typical feature of the hills, narrow river valleys are interspersed between mountain ranges

and spurs. The average minimum and maximum temperature varies from 23°C to 4.1°C, respectively, and mean annual rainfall is over 1900 mm. Varied altitude, topography, status of soil and climatic conditions favor high species richness and support different types of forests.

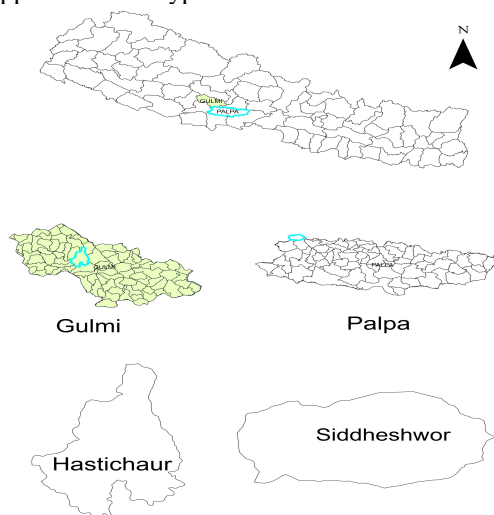


Fig. 1. Map of the study area showing studies VDCs.

Data collection

Both primary and secondary sources of information were used. Field surveys were carried out in both VDCs during the month of June-September 2013 to document information on different aspects of underutilized plant species such as traditional use, current practice, the method of preparation of food items and local names of such species harvested from private land and the nearby forest. Structured and semi-structured questionnaires were applied for community survey. Both male and female participants were involved during the field survey. In some cases, the edibility of plant parts was ascertained by personally eating cooked vegetables and prepared food items as bread and pickles, etc. Key informant interview was also conducted with the local key persons such as VDC secretaries, school teachers and lead farmers. Consumers and retailers of local market were also interviewed regarding underutilized plants and their prospect for commercial purpose.

RESULTS AND DISCUSSION

Both study areas are rich in underutilized and neglected plant species. Majority of the households depend largely upon their marginal land to grow and collect the fruits, grains, vegetables, and nuts as well ingredients for preparing pickles and spices. This is possible because most of the respondents of study areas are well aware and rich in indigenous knowledge about beneficial use of the plants.

Many domesticated or semi-domesticated underutilized plants cultivated by indigenous people not only determine their agricultural system, but also influence their food habit and way of life.

Such plants have received limited agronomic attention, hence their full potential has not been realized. Underutilized plant species in the study areas with their scientific name, local name (Nepali name), parts used and their uses (mode of use) are presented in Table 1. During the present study, information was collected on 52 species belonging to 27 families. Leguminosae was found to be the most common family with 7 species. Other important families were Gramineae, Cucurbitaceae (6 species each), Rutaceae (5 species), Chenopodiaceae, Cruciferae, Myrtaceae, Umbelliferae (2 species each). Parts of these plant species; seed, fruit, tuber, leaf, stem, twigs, pod and root are mainly used for consumption. Seeds of *Fagopyrum esculentum*, *Paspalum scrobiculatum*, *Setaria italic*, *Sorghum vulgare*. *Echinocloa crus-galli* are used for pan cake and are also consumed as fruits. The fruits of species *Myrica esculenta*, *Aegle marmelos*, *Aesandra butyraceae*, *Phyllanthus emblica* are highly demanded in the market at a large scale. The spicy seed and plant part of *Perilla frutescens*, *Sesamum oriental*, *Cannabis sativa*, *Cuminum cyminum* and *Coriandrum sativum* are also demanded in the market at large scale and with higher price. Highly nutritive vegetables such as *Moringa oleifera*,

Dryopteris cocheleata, *Asparagus racemosus* and *Momordica balsamina* have also soaring demand in the urban area and market center. The study revealed that most of the underutilized plants recorded in the study area are used for multipurpose such as food, fruit, medicine, religious purpose, vegetables, oil extraction and pickle. Seeds of those species are mostly consumed

as food, pulse, pickle; and leafy vegetables are cooked as boiled or fried. Some of the pulses are also found in the study area as underutilized species viz. *Vigna umbellate*, *Macrotyloma uniflorum*, *Vigna mungo*, *Glycine max* which are used for various purposes such as medicine and oil extraction. *Macrotyloma uniflorum* is consumed to cure stone in kidney.

Table 1. Neglected and underutilized plant species found in the Siddeshwor and Hastichaur VDCs and their local use.

SN	Botanical Name	Nepali Name	Family	Plant parts use	Local uses (Mode of use)
1.	<i>Fagopyrum esculentum</i> Moench	Phapar	Polygonaceae	Seeds	Used as a pan cake, fodder
2.	<i>Eleusine coracana</i> (L.) Gaertn.	Kodo	Gramineae	Seeds	Pan cake, Beverages, fodder, porridge
3.	<i>Panicum miliaceum</i> L.	Cino	Gramineae	Seeds	Pan cake, Beverages, fodder, porridge
4.	<i>Setaria italica</i> (L.) Beauvois	Kaguno	Gramineae	Seeds	Pan cake, Beverages, fodder, porridge
5.	<i>Perilla frutescens</i> (L.) Britton	Silam	Lamiaceae	Seeds	Used as a pickle
6.	<i>Amaranthus viridis</i> L.	Latte dana	Amaranthaceae	Leaves, seeds	Used as vegetable, sweets
7.	<i>Chenopodium album</i> L.	Bethe	Chenopodiaceae	Leaves, seeds	As vegetables and pickles
8.	<i>Ipomoea batatas</i> (L.) Lam	Sakhara khand	Convolvulaceae	Tuber	Eaten raw or roasted used in religious occasions
9.	<i>Sesamum orientale</i> L.	Til	Pedaliaceae	Seeds	Used to make pickles and religious occasions to worship
10.	<i>Vigna umbellata</i> (Thunb.) Ohwi & Ohashi	Masyan	Leguminosae	Seeds	As a pulse
11.	<i>Dioscorea alata</i> L.	Ghar tarul	Dioscoreaceae	Stem, twigs fruit	As vegetable and sometime by boiling
12.	<i>Colocasia esculenta</i> (L.) Schott	Gaba	Araceae	Leaves and tuber	As vegetable
13.	<i>Macrotyloma uniflorum</i> (Lam.) Verdc.	Gahat	Leguminosae	Seeds	Used as pulses, fodder and medicine for curing stone
14.	<i>Benincasa hispida</i> (Thunb.) Cogn	Kubindo	Curcubitaceae	Fruit	As vegetable, used to prepare pickle and sweets
15.	<i>Phaseolus vulgaris</i> L.	Asare simi	Leguminosae	Pod and seeds	Vegetable and pulses

16. <i>Lathyrus sativus</i> L.	Khesari	Leguminosae	Seeds	Pulses and as fodder
17. <i>Brassica nigra</i> (L.) Koch	Rayo	Cruciferae	Leaves	Used as a vegetables
18. <i>Sechium edule</i> (Jacq.) Sw.	Skush	Curcurbitaceae	Twigs, fruit and root	Vegetables
19. <i>Moringa oleifera</i> Lam.	Sahinjan	Moringaceae	Leaves, pods	Used as vegetable and sometimes as medicine and biofuel
20. <i>Myrica esculenta</i> Buch-Ham.ex D. Don	Kaphal	Myricaceae	Fruit	Fruit
21. <i>Aegle marmelos</i> (L.) Correa	Bel	Rutaceae	Leaves and fruit	Medicinal and religious value
22. <i>Aesandra butyraceae</i> (Roxb.) Baehni	Chyuri	Sapotaceae	Fruit	As fruit and seeds used to prepare ghee
23. <i>Phyllanthus emblica</i> L.	Aamala	Euphorbiaceae	Fruit	Fruits, Source of vitamin c and as medicine
24. <i>Citrus maxima</i> (Burm. ex Rumph.) Merr	Bhogate	Rutaceae	Fruit	Fruit
25. <i>Syzygium cumini</i> (L.) Skeels	Jamun	Myrtaceae	Fruit	Fruit and medicinal purpose
26. <i>Dryopteris cocheleata</i> (D. Don) C. Chr.	Niuro	Aspidiaceae	Stem	As vegetable
27. <i>Trichosanthes dioica</i> Roxb.	Parvar	Cucurbitaceae	Fruit	Used as a vegetable
28. <i>Curcuma angustifolia</i> Roxb.	Besar	Zingiberaceae	Root	Used in vegetable and as medicine
29. <i>Vigna mungo</i> (L.) Hepper	Mas	Leguminosae	Seeds	Used as a pulses
30. <i>Cucurbita pepo</i> L.	Pharsi	Cucurbitaceae	Twigs and fruit	As vegetable
31. <i>Annona squamata</i> L.	Sitaphal	Annonaceae	Fruit	Used as a fruit
32. <i>Cannabis sativa</i> L.	Bhang	Cannabaceae	Seed	To make pickle
33. <i>Ricinus communis</i> L.	Ander	Euphorbiaceae	Fruit	Fruit
34. <i>Asparagus racemosus</i> Willd.	Kurilo	Liliaceae	Twigs and stem	As medicine, vegetable and used as religious value
35. <i>Spinacia oleracea</i> L.	Palungo	Chenopodiaceae	Leaves	Used as vegetable
36. <i>Citrus aurantifolia</i> (Christ.) Swingle	Kagati	Rutaceae	fruit	As medicine and source of vitamin c
37. <i>Citrus limon</i> (L.) Burn f.	Nibuva	Rutaceae	Fruit	As medicine and source of vitamin c
38. <i>Cuminum cyminum</i> L.	Jira	Umbelliferae	Seeds	Used as condiments
39. <i>Citrus junos</i> Tanka	Kali jyamir	Rutaceae	Fruit	Used as fruit
40. <i>Raphanus sativus</i> L.	Mula	Crucifereae	Stem and leaves	As vegetable

41. <i>Vicia faba</i> L.	Bakula	Leguminosae	Pods and seeds	Used as vegetable and pulses
42. <i>Glycine max</i> (L.) Merr.	Bhatmas	Leguminosae	Seeds	As vegetable pulses and for oil extraction
43. <i>Psidium guajava</i> L.	Amba	Myrtaceae	Fruit	Used as fruit and to make juice
44. <i>Litchi chinensis</i> (Gaertn.) Sonner	Lichi	Sapindaceae	Fruit	As a fruit
45. <i>Coriandrum sativum</i> L.	Dhaniya	Umbelliferae	Leaves and seeds	As condiments
46. <i>Capsicum annuum</i> L.	Khursani	Solanaceae	Fruit	As spicy condiments
47. <i>Juglans regia</i> L.	Okhar	Juglandaceae	Fruit	As fruit and oil extraction
48. <i>Hordeum vulgare</i> L.	Jau	Gramineae	Seeds	Beverage, used in baking industries and religious purpose
49. <i>Luffa cylindrica</i> (L.) Roem	Ghiu toria	Cucurbitaceae	Fruit	Used as vegetable
50. <i>Momordica balsamina</i> L.	Barela	Curcubitaceae	Fruit	Used as vegetable
51. <i>Sorghum vulgare</i> Pers.	Junelo	Gramineae	Seeds	Used as food after frying
52. <i>Echinochloa crus-galli</i> (L.) Beauvois	Sama	Gramineae	Seeds	Used as rice

Neglected plant species can be cultivated in marginal land or the fallow land (Williams and Haq 2000). They can be easily grown in the rain fed land or non-irrigated land so they are also called drought resistant species. Underutilized plant species provide more option for dietary diversity that can help smallholder farmers to collect food and earn more diet and nutrition. Majority of respondent expressed that they don't give much priorities to these neglected crops although these crops can be grown in marginalized or upland area. In addition, it is found that there is no use of any chemical fertilizer and pesticides to these crops. Therefore, underutilized crops are more safe and hygienic than that of commercially cultivated crops with high agricultural inputs.

Percentage of underutilized herb species is markedly more (50%), followed by trees (23%), climbers and creepers (19%) and shrubs (8%) (Fig. 2).

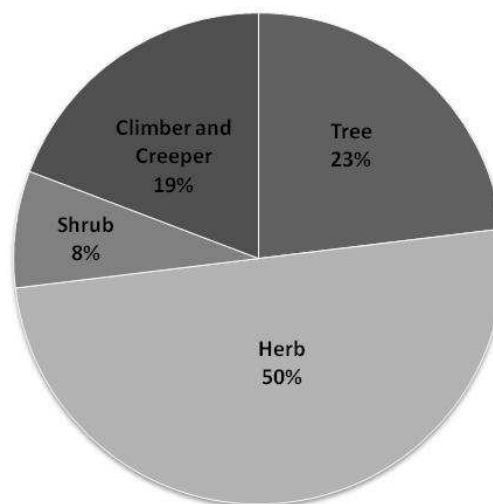


Fig. 2. Proportion of underutilized crops by habit type in the study area.

The results demonstrated that a total of 52 species were found as underutilized species in the study area; among those are 32% fruit, 31% seeds, 27% all part, 6% tubers and roots and only 4% leaves according to parts consumed by the local

communities (Fig. 3). Uses of different parts of these plants by the local people in the study area are mostly similar to those used by other communities of Nepal (Srish *et al.* 2011, Khanal *et al.* 2013, Pant and Yadav 2013).

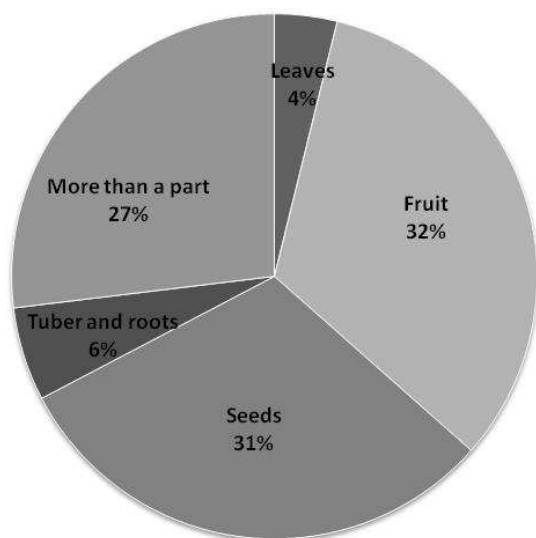


Fig. 3. Proportion of underutilized crops by parts used in the study area.

The present study also documented the use pattern of these plant species as follows: vegetable (40.38%), and then followed by fruits (21.15%), food (19.23%), medicinal (11.54%) and pulse (7.69%) (Fig. 4). However, some plants have multipurpose utility too.

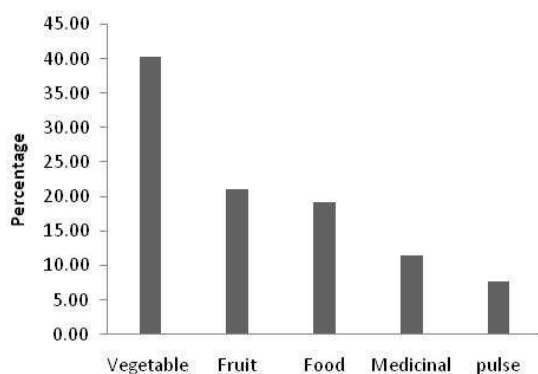


Fig. 4. Use pattern of underutilized plant species in the study area.

Out migration appeared to be a serious issue in the region rendering large number of farm area left abandoned. That has posed a threat on loss of many local useful species. Abandonment of traditional crops/cultivars means a loss of agrobiodiversity that remains ‘lesser known’ or ‘unknown’ to outside community and isolated distinct pocket areas (Sing *et al.* 1997). Agriculture practice of finger millet was mixed cropping system with other crops including maize, beans and soya beans. Villagers were found to cultivate these species on upland fields that were more important for the subsistence of the people. Most of the arable land of the study area were non-irrigated, which is very common farming system of mid hill, Nepal. These fields produced millet, sorghum, barley, buckwheat, soya beans, vegetables, and root crops as well as upland rice. Peasants eat these foods at least amount, and often these products are usually mixed with barley and sometimes buckwheat and millet. Production of these crops has decreased sharply with increasing imported food and seed items.

The local people have their own definition of underutilized crop species as “crops that are not regularly used at home, cannot be treated as food for guests due to their social inferiority and have poor marketing opportunities”. These crops are considered as inferior [poor man's] foods.

Some people recalled that, traditionally, these species contributed significantly to the well-being and livelihood of their households. Despite the general notion that underutilized crops are neglected for specific socio-economic reasons, the role of these species used by indigenous farming communities becomes extremely important when reducing risks and adapting to adversity caused by climate changes. Many of these species are well adapted to stress conditions of extreme environments and form part of subsistence farming systems (Jarvis *et al.* 2008).

Underutilized species hold great genetic diversity and enormous indigenous knowledge is linked to these species (Frison *et al.* 2000). Despite the fact that the importance of these plants to rural peoples' subsistence, economy and culture has long been reported (Kunwar and Adhikari 2005), these species are often found growing in marginal habitats (Pastor *et al.* 2006). Lack of awareness of these crops among the locals, changing human perception, food habits, high status on imported food items are also the leading factors of low priority to the local crop products. Declining consumption of these local crop varieties at local level and low demand in the local market are main reasons for the farmers' unwillingness to grow these crops.

CONCLUSIONS

Underutilized or neglected crops are 'underexploited' and 'orphan' species, and they are also under-researched crops. Promoting local underutilized plant species is one alternative for conservation of agrobiodiversity and it will prove successful in improving the food sufficiency and economic well being of poor farmers in mid hill of Nepal such as Gulmi and Palpa districts. Farmers are reluctant to grow these crops because of low return, poor market value, unaware about their nutritional and environmental value. Therefore, there should be intensified promotion and development of these neglected crops and channelize the surplus products to the market through the value addition process. These underutilized and neglected species can play a crucial role in the food security, income generation and diversify food culture of the rural poor. Also conservation of these crops is one of the best options for genetic resources conservation, which is the main asset of marginality and poor community living in the hill and mountain regions. Therefore, indigenous knowledge regarding farming systems and underutilized plant species

also need to be protected and promoted through research and development programmes.

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