COFFEE AS A NICHE CROP FOR MID-HILLS OF NEPAL

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ABSTRACT

Coffee, the second largest commodity next to petroleum traded in the world market, is produced in more than 100 countries. Brazil is the world leader in production and America in consumption. Coffee, entered Nepal from Burma in 1938 has been extended to about 41 districts in the mid-hills of Nepal with significant potential as export commodity. It is a high value cash crop with environmental importance and is being popular among Nepalese people since last few decades. More than 30,000 small growers have been involved in coffee cultivation in about 1911 ha with 429 tons of green beans production in the year 2014. In line with the focus of periodic plans and policies, the Ministry of Agricultural Development has taken ample initiatives for the promotion of coffee cultivation. Thirteenth plan has also given attention for development of coffee sector as high value crops in the mid-hill regions of Nepal. Respecting the interest of the people on coffee and favorable climatic conditions for its cultivation, development organisations like HELVETAS Nepal are complementing to government organizations in coffee sub-sector development. In Nepal majority of coffee is wet processed and considered better quality coffee. Nepali coffee possesses specialty quality potential; have revealed 82-86 percent specialty quality, thus demand outstrips supplies. Lack of manpower, research on technologies and varieties to increase production and productivity, national policy and plans for promotion of organic and fair trade practices are the areas to review for coffee sub-sector development in Nepal.

INTRODUCTION

Coffee is one of the prestigious soft drink. It is the second largest commodity traded in the world market next to the petroleum product, and producing in more than 100 countries. Being such high profile statistics it is well-known by "Brown Gold" in the world community. Brazil is the number one leading country in terms of production whereas USA is higher coffee consuming country and per capita coffee consumption is highest (12 kg/person/year) in Finland.

In 9th century, an Ethiopian shepherd discovered coffee when he noticed his goats excited after eating the coffee beans. Thus, the origin country of domesticated coffee plant is known as East Africa "Ethiopia".

All coffee plants are classified in the botanical family Rubiaceae. They are evergreen shrubs. Several species of shrub of the genus Coffea produce the berries from which coffee can be extracted. There are four species: arabica, robusta, excelsa and liberica. However, two main species are commercially cultivated i.e., Coffea arabica and Coffea robusta. In these two species of Coffea, the finest quality being arabica, which today represents 70% of the world's coffee production (www.coffea arabica Wikipedia). All introduced and cultivated coffee cultivars in Nepal are Coffea arabica which is regarded as Highland Himalayan special coffee. Chemically, the caffeine content of C. arabica varies from 0.9 to 1.7% of each bean's volume (www. Coffea arabica Wikipedia).

Hira Giri, who is known as the pioneer of coffee introduction in Nepal in 1938 AD (www.teacoffee.gov.np), brought few seeds of coffee from Sindhu Province of Burma (Now Myanmar) through India and planted in Aanpchaur, Gulmi. Thus, Gulmi stands for the first coffee growing district in Nepal. Thereafter coffee extended as a curiosity plant for about four decades.

In late Seventies, coffee commercialization got momentum to some extent when Tinau watershed Programme planted coffee as soil conservation crop in Palpa and Government of Nepal imported coffee seeds from India for distribution to the farmers. In 1983/84, Nepal Coffee Company (NeCCo) was established in Manigram, Rupandehi district. This was the milestone to the coffee commercialization in Nepal. Then, the coffee producers were able to sell their produce to the company. Until early 2000, coffee producers were not sure of coffee being a source of income or income generating crop due to the market problem. However, after the year 2002, substantial increase in the export and also increase in domestic market consumption to some extent motivated coffee producers to consider coffee as a major income generating crop (www.teacoffee.gov.np). At present Nepal's coffee has its own brand, due to organic produce and persist special taste, aroma and flavor, it has own dignity in the world coffee consuming society. In

Nepal, coffee is grown commercially in 24 districts amongst 41 potential mid-hill districts.

IMPORTANCE

Coffee is playing very important role in Nepalese economy, agriculture and environment. It is high value crops in terms of economy and export status. Being imperishable commodity by nature, coffee can be grown in remote areas by rural people in groups or cooperative model. These activities definitely help to reduce rural poverty and increase income of rural people and generate employment opportunities. The importance of this crop is briefly discussed as follows:

Nutritional value

The primary chemical available in coffee beans is caffeine "C8H10N4O2", which is a special safe chemical that stimulate the central nervous system (CNS). The coffee beverages are very popular; in USA, 90% of adults consume coffee daily. A cup of coffee contains 80-175 mg of caffeine, depending on what "bean" (seed) is used and how it is prepared (www.caffeine Wikipedia). It is reported that regular consumption of black coffee reduces cholesterol level of blood and persist antioxidant properties in coffee drink which has multiple positive impact in human health. However, it depends on the physiology of an individual.

Economic value

Coffee is planted on marginal uplands where single crop of maize and in few cases second crop of millet planted. The study reported that in comparison to maize and millet, net return from coffee cultivation is 4.33 times higher than maize, 3.30 times higher than millet and 1.87 times higher than maize followed by millet cultivation (CoPP, 2009). In Nepalese context, coffee plantation is under the shade of multipurpose trees, which provides shade as well as their own produce. It can aid 10-15% additional income (NTCDB, 2013).

Employment opportunity

Coffee, as a perennial shrub, need series of work on production, processing and marketing and requires a lot of technical and skilled human resources. Coffee value chain starts form cherry picking to final cup, which involves different steps such as picking/harvesting - pulping - hulling - roasting - grinding - packaging - brewing etc. Every step adds value. This contributes to employment opportunity and income generation for rural youth and reduces labor migration.

Environmental benefit

Nepal is hilly region and topography of land in Nepal is too steep. Nepalese hills are prone to land slide during monsoon (Paudel, 2009). In steep slope, ever green vegetation like coffee plantation is very much helpful for soil and environment conservation and ecological balance. Coffee farming is done in the shade of trees, which provided natural habitat for many animals and insects, roughly approximating the biodiversity of a natural forest. Coffee plant is also bird friendly and during flowering period it attracts the honey bees; good source of nectar. It is a good source of oxygen (O2), which produces 37 kg of O2 per ha per day (www.ico.org).

Import substitution and export promotion

It is rectified that Nepalese organic coffee can compete world coffee market due to its premium quality. The demand for Nepalese coffee is increasing at national and international market. Major portion of Nepalese coffee is exported to more than 20 countries where Korea, Japan, Europe and USA are the major ones (www.tepc.gov.np).

SCOPE OF COFFEE CULTIVATION IN NEPAL

Owing to the prevalence of unique microclimate and organic produce, Nepalese coffee has classic quality: taste, aroma, and flavor, which shows the high potential of coffee cultivation in Nepal. In the context of comparative advantage and growing international demand of specialty Nepali coffee, it is high time to consider commercialization of this high value commodity from all sectors including government, donors,

investors and coffee stakeholders. The scope of this crop examines in this paper as follows.

Potential area and production

There are 41 potential districts in the mid-hill region of Nepal where 1.1 m.ha of land is potential for coffee (MoAD, NTCDB, 2014). Hills have unique micro environment in very short vertical distance (Paudel, 2009). Such micro climate variation favors comparative advantage of growing different niche base crops. Land may not be the limited resource for coffee production in Nepal. Sloppy and marginal land somehow degraded land; community forest also can be used for coffee plantation by using soil amendment. Among total area of Nepal, mid-hill occupies about 42 percent of land (MoAD, 2014) with altitude ranges from 800 to 1500 meter above mean sea level majority of which can be brought under coffee cultivation. Present production is at 429 ton Green Bean which can be increased by 1000 times.

Sustainable farming

Climate change is another new challenge to the sustainable farming system in the mid-hills. Ever green shrub like coffee plantation could be the best option for mitigation and adaptation activity. Coffee growing and processing needs water, which can be managed properly in mid-hills of Nepal. Being imperishable commodity, people from remote area can also grow coffee in groups or cooperative model and coffee cooperatives are taking lead throughout the value chain of coffee with fair trade principle.

Specialty quality

Coffee in Nepal is grown in altitude ranges from 800-1500m msl for specialty highland coffee. Being grown in hilly region, away from the Mediterranean region; it possesses specialty quality different to other major coffee growing countries. Nepali coffee offers specialty taste to the consumers because it is Arabica only, grown with organic practice under shade above 800 m from mean sea level.

Organic and fair trade

Organic and fair trade coffee has high demand at both national and international markets, for which Nepal has high scope/ potential because 100 % of Nepali coffee is considered as by default organic and many of the cooperatives have practices fair trade principle.

Youth employment

Coffee involves several activities from seed to cup. Farmers' involvement in planting to cherry harvest, pulping and preparation of Parchment is followed by, traders' involvement in trading of parchment or green beans, coffee roasting, grinding and brewing imply scores of business. These series of value chain process definitely requires different human and financial resources, which in due course create employment opportunities to Nepalese youth.

Agro-tourism

Different distinctive features of mid-hills of Nepal like famous Annapurna trekking route, habitat of diverse ethnic and tribal communities, availability of different flora and fauna make them a very potential domain for agro-tourism. Like tea garden in Eastern Nepal, coffee plantation in Central and Western hills can promote tourism industry by catching the attention of domestic as well as foreign tourists from different countries visiting to Nepal.

Organized institutions

Good and well setup organizational structures also help in coffee promotion in Nepal. Ministry of Agricultural Development (MoAD), NARC, National Coffee Producer Association (NCPA) and different private sectors/INGOs like Coffee Promotion Programme, HELVETAS Swiss Inter cooperation Nepal (CoPP), IDE, Winrock International, Good Neighbor International, JICA are involved in production and trading, which eventually continue their support in coffee sub-sector development.

DEVELOPMENT OF COFFEE SUB-SECTOR IN NEPAL

To coordinate the coffee development in the country, Government of Nepal (GoN) established Tea and Coffee Development Section under Fruit Development Directorate of the Department of Agriculture in 1993. Likewise, National Tea and Coffee Development Board was also established under the National Tea and Coffee Development Board Act (1993). Some INGOs like Coffee Promotion Programme, HELVETAS Swiss Intercooperation Nepal (CoPP) is supporting the coffee farmers since 2003 in 12 districts. Similarly, JICA, IDE, Winrock International, Good Neighbor International are also supporting in coffee sub-sector development. As a genuine process of promoting Nepalese coffee, the GoN has approved Nepali Coffee Logo (Figure 1). Brief historical events of the development in the coffee sub-sector are listed in Table 1. Considering the prominence of high value crops, GoN has promulgated/ formulated some agricultural policies, and plans for the promotion of production, processing and marketing of high value crops including coffee.

Figure 1: Nepal Coffee Logo

Policies, Plans and Programs for promoting Coffee

Some of the policies that have emphasized promotion of coffee are as follows.

Agriculture Perspective Plan(APP) (1994/95-2014/15) recognised coffee as potential high value and exportable commodity. It was further emphasised in the Ninth Five Year Plan (1997-2002). Tenth Five Year Plan (2002-2007) targeted to increase the production of coffee and focused on production support on coffee and started to give 50% subsidy on the samplings (NPC, 2002). The Coffee Policy, 2004 paved the way of coffee sub-sector involving the private sectors, NGOs, cooperatives and other members based organizations for promoting the production, processing and marketing of coffee in a sustainable and organized way. The policy has emphasised import substitution and export (MoAD, 2004).National Agricultural Policy (NAP), 2006highlighted significantly for fostering

coffee as high value crops in the mid-hill regions.Agricultural Biodiversity Policy, 2007organic production like coffee (MoAD, 2006).Agri-Business Promotion Policy (ABPP), 2007 stated need for developing the organic certification of the products, including coffee.

National Technical Standard for Organic Agriculture System (NTSOAS), 2008further cleared the way for promoting the organic production and processing of high value agricultural products like coffee.

Three Years Interim Plan (2007-2010)included the coffee, among other 22 valuable commodities, as a priority commodity for income generation. Three Years Plan (2010-2013)emphasized mid-hill areas for the promotion of coffee production and gave importance for the conversion of Nepalese coffee into Highland Organic Coffee. This plan included support for the value chain development, technology transfer, agri-market information system development and agriculture entrepreneurships expansion for coffee and coffee export facilitation as well. Thirteenth Plan (2013-2016) gave attention for development of coffee sub-sector as high value crops in the mid-hill regions.

Table 1: Chronological history of coffee research and development in Nepal

Year	Event
1938	First time introduction of coffee in Aanpchaur, Gulmi, Nepal.
1968	HMG/Nepal introduced some varieties from India and distributed to the farmers of Gulmi, Palpa and Arghakhanchi.
1981	First commercial coffee nursery established in Aanpchaur, Gulmi.
1982	Tinau Watershed Project (TWP) and Palpa Development Project (PDP) planted coffee as soil conservation crop in Palpa.
1983	Nepal Coffee Company (NeCCO), first coffee mill in Nepal, established in Manigram, Rupandehi.
1984	Establishment of Coffee Development Centre in Aanpchaur, Gulmi.
1989	Initiation of organic coffee production in Madanpokhara, Palpla.
1990	Formation of Coffee Producers Group in Madanpokhara, Palpa.
1991	Registration of Nepal Coffee Producers Association in Palpa.

Year	Event
1993	Establishment of Tea and Coffee Development Section under Fruit Development Directorate of the Department of Agriculture.
	Establishment of National Tea and Coffee Development Board under the National Tea and Coffee Development Board Act, 1993.
1994	First recorded export of green beans (dry processed) to Japan.
1995	Establishment of Regional office of NTCDB in Palpa.
	Coffee Varietal Evaluation in ARS (Hort.) Malepatan by Lumle Agriculture Research Center, Kaski.
1996	Local Initiatives Support Programme (LISP) extended coffee through Nepal Coffee Producers Association (NCPA) in Palpa.
	Organic Certification of coffee under District Cooperative Federation, Gulmi.
1998	First training on organic coffee production organized by LISP, HELVETAS and FtF Program, Winrock International at Madanpokhara, Palpa.
	Formation of Central Committee of Nepal Coffee Producers Association (NCPA).
	HELVETAS Swiss Inter cooperation Nepal/ Winrock International introduced and distributed coffee varieties (Pacas, Pacamara, Tekisic, Ketisic) in different farms and stations.
1999	Registration of Nepal Coffee Producers Association at National Level.
	SSMP in collaboration with NCPA initiated coffee related activities in Syangja, Parbat, Kavre and Sindhupalchowk.
	Introduction of wet processing technology (11 pulpers from India) by AEC to introduce wet processing in Nepal.
2000	Establishment of Highland Coffee Promotion Company in Kathmandu.
2002	Initiation of coffee FFS in Palpa, Parbat, Syangja, Kavre and Sindhupalchowk (LISP/NCPA)
	Coffee Promotion Program initiated by CoPP, HELVETAS.
2003	First time NTCDB fixed dry cherry price based on the quality (three grades) of dry cherries.
	Introduction of wooden Hand Pulper from Indonesia by Holland Coffee Inc.

Year	Event
2004	National Coffee Policy implemented.
	NARC, DOA, Nepal Tree Crop Global Development Alliance initiated coffee study in Panchkhal farm, Kavre.
	Tea and Coffee Development Section was reorganized into Coffee and Tea Development Section with increased program thrust on coffee and additional manpower.
2005	Central Coffee Cooperative Union established.
	Agriculture Research Station (Hort.) and National Tea and Coffee Development Board started organic manure experiment.
	First training on Internal Control System (ICS) and Internal Inspection conducted at Gulmi by CoPP, HELVETAS
2010	Nepal Coffee Logo approved by the Government of Nepal.
	Establishment of Field Gene Bank of coffee in ARS (Hort.), Malepatan, Kaski.
2014	Establishment of Coffee Research Program in Baletaxar, Gulmi.

PRESENT STATUS OF COFFEE IN NEPAL

Coffee Varieties and Nursery

There are two main varieties of coffee being cultivated i.e., Arabica (C. arabica) and Robusta (C. canephora). Of the two main species, Arabica coffee is grown at higher elevations, produces better beans and has good quality. So, at present only this variety is cultivated in Nepal and is being preferred because of its quality. A number of varieties of Arabica coffee has been collected and planted in the Horticultural Research Station, Malepatan, Pokhara. But locally collected materials have not been analyzed at molecular level. Different varieties and their characteristic features are presented in the Table 2.

Figure 2: Coffee Nursery

Arabica coffee is most commonly grown from selected seed to raise seedlings in nurseries. A number of steps are being followed

for production of good seedlings i.e., selection the seed, starting the nursery, build nursery shelter and seedbeds, and finally planting the seed. Depending on temperature, coffee seedlings are ready to be transplanted from the nursery bed into poly-bags about two to three months after sowing following some steps in the process i.e., preparing the potting mixture, selecting the seedlings, planting seedlings in bags and caring for the seedlings (Figure 2).

Table 2: Coffee varieties and their major phenotypic characteristics

SN	Varieties	Major qualitative and quantitative characteristics
1.	Arghakhanchi Local	Collected from Arghakhanchi district in 2010, trees are tall, new shoots are green whereas ripe cherries are red in color, very good performance in mid hill condition, 100 fresh ripe cherries weight is 150 gram.
2.	Bourbon Amarillo	Trees are medium tall, new shoots are green whereas ripe cherries are yellow in color. 100 fresh ripe cherries weight is 136 gram.
3.	Bourbon Vermello	Trees are tall, new shoots are copper color whereas ripe cherries are red. 100 fresh ripe cherries weight is 148 gram.
4.	Cattuai Amarillo	Trees are medium tall, new shoots are green whereas ripe cherries are yellow in color. 100 fresh ripe cherries weight is 150 gram.
5.	Cattuai Vermelo	Trees are medium tall, new shoots are green whereas ripe cherries are red in color. 100 fresh ripe cherries weight is 128 gram.
6.	CatturaAmarillo	Trees are medium tall, new shoots are green whereas ripe cherries are yellow in color. 100 fresh ripe cherries weight is 150 gram.
7.	Cattura Vermello	Trees are medium tall, new shoots are green whereas ripe cherries are red in color. 100 fresh ripe cherries weight is 146 gram.

SN	Varieties	Major qualitative and quantitative characteristics
8.	Catimore	Hybrid cultivar (Catimore X Timor) developed in Brazil. Robusta gene also incorporates in this cultivar (NTCDB, 2013). Trees are medium tall, new shoots are green whereas ripe cherries are red in color. 100 fresh ripe cherries weight is 148 gram.
9.	Chhetradeep	Collected from Deep, Kaski district. Trees are medium tall, new shoots are green whereas ripe cherries are red in color. 100 fresh ripe cherries weight is 148 gram. Very good perform in mid hill condition.
10.	Hawai Kona	Trees are tall, open type tree, new shoots are copper color and ripe cherries are red in color. 100 fresh ripe cherries weight is 150 gram.
11.	Indonesia	Trees are tall, open type tree; new shoots are copper color whereas ripe cherries are red. 100 fresh ripe cherries weight is 146 gram.
12.	Indo Timtim	Collected from Puranchaur, Kaski district. Trees are medium tall, new shoots are green whereas ripe cherries are red in color.
13.	Kaski Local	Trees are tall, open type tree; new shoots are green whereas ripe cherries are red in color. 100 fresh ripe cherries weight is 152 gram.
14.	Ketisic	Selected from Catimore cultivar in El-Salvador. Trees are tall and open type tree, new shoots are copper in color and ripe cherries red. 100 fresh ripe cherries weight is 120 gram.
15.	Mundo Novo	Trees are tall, open type tree; new shoots are green whereas ripe cherries are red in color. 100 fresh ripe cherries weight is 112 gram.
16.	Pacas	This cultivar was developed through natural mutation from cultivar Bourbon. Trees are medium tall, dense tree and leaves are long, wide and shiny. New shoots are copper color whereas ripe cherries are red and large in size. Very late maturing (March/ April) in Pokhara condition. 100 fresh ripe cherries weight is recorded 176 gram.

SN	Varieties	Major qualitative and quantitative characteristics
17.	Pacamara	This cultivar was developed through crossing up to four progeny between Pacas and Redmaragojipka in El-salvador. Trees are medium tall dense tree and leaves are long, wide and shiny and new shoots are copper color whereas ripe cherries are red and large in size. Very late maturing (March/April) in Pokhara condition. 100 fresh ripe cherries weights is 247 gram.
18.	Puranchaur Local	Collected from Puranchaur, Kaski district. Trees are tall, new shoots are green whereas ripe cherries are red in color.
19.	Sanroman	Collected from Coffee Development Center Aanpchaur, Gulmi in 2012. Trees are dwarf and open type cultivar. Young shoots are copper color whereas ripe cherries are red. Useful for high density planting system. Ripe cherries are red in color.
20.	Selection-10	Cultivar developed by crossed among Cattura X other arabica varieties in India (NTCDB, 2013). Trees are tall and open type tree with long branches with long internodes. New shoots are copper color whereas ripe cherries are red in color. 100 fresh ripe cherries weight is 148 gram. Very good perform in western mid- hill condition.
21.	Syangja Special	Collected from Karendanda, Syangja district in 2004. Trees are medium tall, new shoots are green whereas ripe cherries are red in color. 100 fresh ripe cherries weight is 151 gram.
22.	Tekisic	This cultivar was developed from mass selection procedure in El Salvador during 1949-1957. Trees are tall, new shoots are green whereas ripe cherries are red in color. Very good perform in western mid-hill condition. 100 fresh ripe cherries weight 146 gram.
23.	Yellow Cattura	Trees are medium tall, new shoots are green whereas ripe cherries are yellow in color. 100 fresh ripe cherries weight 118 gram. Very good perform in western mid-hill condition.

Source: KC, R.B. 2014.

Coffee Farming

Figure 3: Coffee orchard

Nepal produces coffee in one of the highest elevation in the world. Coffee farming in Nepal is proven as promising due to the availability of soil with appropriate climate in the mid-hills at an altitude of 1000 meter and above where these areas get fresh and cool wind from Himalayas that is suitable for high grown specialty coffee. There are procedures which are followed in farm management i.e., preparing the land, planting windbreaks, marking out the rows, establishing shade trees. To achieve high yields of quality coffee, trees are protected from frost, weeds are controlled, plants are mulched and watered. Pruning is done to supply good healthy wood for the next season's crop, maintain the correct balance between leaf area and crop, prevent overbearing and dieback, reduce biennial bearing and maintain good tree shape. The plant can tolerate low temperatures, but not frost, and does best with an average temperature between 15 and 24 °C (Figure 3).

Coffee Production

Coffee is commercially produced in many parts of the country. At present, there are altogether 24 districts growing coffee commercially. The major coffee growing districts, where considerable amount of coffee is being traded, lie in Central and Western Development Regions namely Gulmi, Palpa, Arghakhanchi, Baglung, Syangja, Parbat, Kaski, Lamjung, Gorkha and Tanahu in the Western Region and Lalitpur, Sindhupalchowk, Kavre, Dhading, Nuwakot and Ramechhap in Central Development Region.

Most of the coffee producers grow coffee in small scale with 100-150 plants.Insome districts farmers have grown coffee in maximum of 0.4 hectare areas. Besides area coverage and production, the productivity of Nepalese coffee is also comparatively lower than the productivity of other countries.

In the fiscal year 2013/14, total area under coffee cultivation was 1911 hectares with total production of 429 MT Green Beans and 30,543 local farmers (Table 3) were engaged in this sector (MoAD, 2014).

Table 3: District-wise plantation area, production and yield of coffee, 2013/14

S. No.	Districts	Area (ha)	Green beans production (MT)	Yield (kg/ha)	Farmers (No.)
1.	Syangja	262	45.3	173	3,110
2.	Kavre	155	36.0	232	3,200
3.	Gulmi	143	36.4	255	1,760
4.	Nuwakot	136	31.5	232	1,173
5.	Kaski	122	28.0	230	4,000
6.	Lalitpur	120	31.5	263	975
7.	Arghakhanchi	110	25.0	227	1,600
8.	Lamjung	110	16.0	145	1,300
9.	Palpa	100	24.2	242	2,250
10.	Sindhupalchowk	96	28.5	297	1,535
11.	Parbat	75	11.5	153	1,875
12.	Dhading	60	15.0	250	700
13.	Baglung	55	13.0	236	1,330
14.	Ilam	52	16	308	600
15.	Panchthar	40	10	250	415
16.	Rasuwa	38	5.5	145	350
17.	Gorkha	35	7.0	200	700
18.	Tanahu	27	16	145	1,300
19.	Makwanpur	26	9.5	365	800
20.	Myagdi	25	6	240	470
21.	Sankhuwasabha	25	5.0	200	355
22.	Pyuthan	22	7	318	400
23.	Khotang	15	4	267	250
24.	Bhojpur	9	2	222	145
25.	Other 15 districts	53	11.5	217	650
	Total	1,911	429.4	225	30,543

Source: MoAD, 2014

As per official statistics, the area under coffee was 136 ha in 1994/95 which increased to 1911 ha in 2013/14 (Table 4). Similarly, the production of coffee increased several times since then (NTCDB/ MoAD, 2014).

Table 4: Coffee plantation area, production and yield in Nepal on different years

S. No.	Fiscal Year	Coffee Plantation Area (ha)	Coffee Production (kg)			Yield (kg/ ha)
			Dry Cherry	Dry Parchment	Green Beans	
1.	1994/95	136	12950			95
2.	1995/96	220	29200			133
3.	1996/97	259	37350			144
4.	1997/98	272	55900			205
5.	1998/99	277	44500			161
6.	1999/00	314	72400			230
7.	2000/01	424	88700			209
8.	2001/02	596	139200			234
9.	2002/03	764	187500			245
10.	2003/04	952	217500			228
11.	2004/05	1078	250000			232
12.	2005/06	1285	391000			304
13.	2006/07	1296		270000		208
14.	2007/08	1450		265000		183
15.	2008/09	1531		334000		218
16.	2009/10	1630		429000		263
17.	2010/11	1752			401500	229
18.	2011/12	1760			410000	233
19.	2012/13	1750			366000	209
20.	2013/14	1911			429400	225

Source: NTCDB, Nepal. MOAD, 2014

Coffee Harvesting

Harvesting of coffee is usually done once in a year. The time varies according to geographic zone but in Nepal harvesting starts in November and completes in March. Harvesting is done selective picking by hand (Figure 4) when about 5% of the cherry ripe and is termed as fly picking. And main picking starts after 50 % of the cherry gets ripe. Selective picking is done in Nepal which helps in maintaining high quality

of coffee.

Figure 4: Picking of ripe cherry

Coffee Processing

Coffee cherries are processed immediately after harvest. There are mainly two types of processing in practice: (a) Dry-Process, (b) Wet-Process.

(a) Dry-Process: It consists of drying selected cherries in the sun until the moisture comes down to 11 percent. The dry-process (also known as the natural method) produces coffee that is heavy in body, sweet, smooth, and complex.

(b) Wet-Process: This is a relatively new method of removing the four layers surrounding the coffee bean. This process results in a coffee that is cleaner, brighter, and fruitier. This method consists of following steps:

(b1) Pulping Coffee: In this step, coffee cherries are dipped in the water which is kept in a bucket. Undeveloped coffee cherries, sticks and leaves, float in water, are removed. The matured and good cherries sink in the water. Pulping should be done within 12 hours of harvest. It prepares parchment (Figure 5).

Figure 5: Pulping ripe cherry

(b2) Fermentation and Washing: The Parchment is covered with the slippery mucilage. Fermentation is done for 12-48 hours depending on the water temperature and humidity to remove the mucilage. Fermentation should be done in nonmetallic container like plastic, wooden bucket. Then the parchment is washed in clean water until the mucilage is completely removed.

(b3) Coffee Drying: Washed coffee parchment of about 60% moisture is moved to pre-drying net. It can be made up of bamboo mat

or steel wire mesh. Until the water is drained, the parchments are moved to drying yard /patios and dried in the sun to 11-12% moisture content.

Hulling

Dry parchment is hulled in a hulling machine which removes silver-skin and prepares Green bean.

Sorting Coffee Beans

Color sorting is frequently used to remove the defective coffee beans that were not removed during coffee processing or hulling (Figure 6).

Figure 6: Sorting coffee beans

Storing Green Coffee Beans

Coffee must be stored in dry and cool conditions. Exposure to the sun or moisture will rapidly deteriorate the coffee. Burlap or jute bags are often used for coffee bean storage because they allow air flow. They also preserve the coffee longer than plastic or paper bags. Burlap bags should be aired on the patios before storing coffee to prevent a baggy flavor or burlap scent from being imparted to the coffee.

Coffee Roasting

Coffee roasting is a process which creates or balances the aroma, acidity, aftertaste, bodyand other flavour components. Roasting at local level can be done in a ceramic pot or fry pan in a mild and constant heat. Roasting is generally done at three levels depending upon the personal taste and of choice: light, medium and dark. It should be done until the beans take on an oily sheen (Figure 7).

Figure 7:Roaster

Grinding Coffee Beans

For proper extraction, it is essential to grind coffee properly. Freshly

grinding the beans before brewing coffee is one of the most important steps for achieving a quality cup of coffee. Coffee grind just before brewing gives better taste. Grinding coffee depends on coffee brewing method:

Drip coffee requires a medium size grind, espresso requires a fine size grind, and a French press requires the largest grind size while the vacuum pot also requires the largest grind size.

Figure 8: Grinder

At household level, a small hand operated grinder can be useful to meet the need at the household level (Figure 8).

Coffee Brewing

Brewing coffee is as much of an art and methods of brewing are culturally dependent. Some of the common brewing methods are:

Espresso: It is a strong decoction of coffee with a full-flavored, concentrated form of coffee. It is made by forcing pressurized, hot water through very finely grind coffee beans (Figure 9). This process is called "pulling a shot."

Café Americano: Café Americano is a type of coffee created by adding hot water to espresso (Figure 10).

Coffee Latte: Latte is a coffee based drink made primarily from espresso and steamed milk. It consists of one-third espresso, two-third heated milk and about 1 cm of foam (Figure 11).

Figure 9: Espresso

Figure 10: Café Americano

Figure 11: Latte

Coffee Marketing

Nepalese Highland and organic coffee is known in the international markets owing to its high quality cupping and sound aroma (Poudel et al., 2009). Around 25 percent of the production is exported. Sales in

the domestic market are also increasing and the present sale is about 75% of the total production. There are about six to eight companies including cooperatives exporting coffee to different destinations. Nepal is exporting coffee beans mostly to Korea, Japan, America and European countries. This has been extended to other parts of the world, too. The data shows (Table 5) that in recent years export volume is decreasing, which indicates that the national consumption is increasing. Likewise import, in terms of value, is also in decreasing trend which helps in balancing trade deficit (NTCDB, 2014).

Table 5: Coffee export and import on different years

S. No.	Fiscal Year	Exports (Green Beans)		Imports (Rs. '000)
		Quantity (kg)	Value (Rs. '000)	
1.	1994/95	14660	1643	18232
2.	1995/96	5040	638	23832
3.	1996/97	4245	6023	15316
4.	1997/98	2000	318	16264
5.	1998/99	3160	634	32471
6.	1999/00	4254	1415	36437
7.	2000/01	3677	673	43200
8.	2001/02	9075	2455	4621
9.	2002/03	16861	5205	142
10.	2003/04	24295	5947	410
11.	2004/05	35677	10792	168
12.	2005/06	91500	27678	2265
13.	2006/07	100180	40117	56000
14.	2007/08	54621	22046	64481
15.	2008/09	508592	125108	11651
16.	2009/10	69044	24363	54400
17.	2010/11	279762	93089	12513
18.	2011/12	109442	43095	20894
19.	2012/13	99303	53009	32771
20.	2013/14	66461	52395	34816

Source: NTCDB, Nepal, MoAD, 2014.

Major Stakeholders

Nepal Coffee Producers' Association (NCPA) record shows that more than 30,000 farmers are cultivating coffee in Nepal. Apart from coffee growers there are several individual and organizations involved in coffee processing, trading and export. Of the eleven institutions involved in coffee processing and trade, two are cooperatives and remaining 9 are registered as companies. Four of them supply to domestic market and to exporters while six of them export coffee in addition to supply to domestic markets. A list of registered coffee processor and traders can be found in Annex 1.

OPPORTUNITIES

- High quality coffee can be produced in Nepal;
- There is increasing trend in consumption both at national and international market;
- It generates significant income for farm household (upland);
- Organic production methods are compatible with existing farming practices (No yield reduction in conversion);
- There is easy integration of coffee into existing farming systems;
- Coffee producers are organized at village, district and central level;
- Trade relationships are established with international buyers, long term trading relationships with Fair Trade buyers in Europe / Korea;
- Several certifying agencies are active in Nepal;
- There is strong organizational setup;
- Many stakeholders like producer groups/associations, processor/ traders, INGOs/NGOs, GOs, World Bank are involved in organic coffee promotion;
- National Organic Standard have been developed and approved by GoN;
- Government funds are available for external inspection and organic certification.
- Nepal coffee logo is approved and awarded to three processors/ traders.

ISSUES AND CHALLENGES

- Identification of location specific high yielding varieties: There is Lack of varietal option for different elevation. Although some research has initiated, high yielding domain specific coffee cultivars still not been recommended and released.
- Biotic/aboitic stresses: Even if several insect species have been recorded, Xylotrechus quadripes (Coleoptera: Cerambycidae), the coffee white stem borer is the most serious pest of arabica coffee in Nepal (Bajracharya, A.S.R., 2015). Low soil fertility and moisture stress during summer are the major yield limiting abiotic factors.
- Poor technical know-how: There is lack of trained human resources. Both production and post-production technical know-how is extremely lacking among the coffee producers.
- Demand surpass production: Present production of 429 ton has not been meeting the demand of about 6000 ton of coffee beans in the domestic and international arena.
- Quality inconsistency: At processing levels due to poor infrastructure like water, pulping centers, and storage facilities, the quality of coffee is inconsistent.
- Change in consumption pattern: The instant coffee has occupied the taste of coffee among the people. There is the challenges to ascertain the taste of Nepalese filter coffee as a substitute of instant coffee.

WAY FORWARD

- Promotion of coffee shops and consumption of Nepali filter coffee.
- Develop and establish systems to ensure the reputation of Nepali coffee in international speciality markets (Nepal coffee logo).
- Enhance the processing practices with quality consistency.
- Strengthen research throughout the value chain (seed to cup).
- Enhance area, production and productivity to meet the increasing demand.
- Increase collaborative approach/efforts of all the stakeholders involved in coffee sub-sector.
- Promotion of organic and fair trade practices all levels of value

chain.

- Clarity of roles and responsibilities of the stakeholders.
- Deployment of right man to right position.
- Develop human resource on coffee sub-sector.

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Annex1: Major Coffee Processors and Traders of Nepal

S. No.	Processor/Traders	Brand Name	Market
1.	Plantec Nepal Incorporated (P) Ltd., Kathmandu, Nepal. URL: www.plantecnepal.com	Jalpa Gold (for regional sales) and Mount Everest Supreme (for export)	Export and Domestic (Roaster)
2.	District Cooperative Federation Ltd., Coffee Purification Centre, Johang, Gulmi	Gulmi Organic Coffee	Export and Domestic (Roaster)
3.	Royal Everest Coffee Mills, Keshar Mahal, Kathmandu, Nepal	Everest Filter Coffee	Export and Domestic (Roaster and Brewer)
4.	Highland Coffee Promotion Co. Ltd., Narephant, Koteshwor, GPO Box: 21037, Kathmandu, Nepal	Him Café	Export and Domestic (Roaster)
5.	Buddha Organic Coffee Industries P. Ltd., Kirtipur-2, Kathmandu, Nepal	Buddha Organic Coffee	Export and Domestic (Roaster)
6.	Kathmandu International Coffee House, Himalayan Java, Kathmandu, Nepal	Himalayan Java	Domestic (Brewer)
7.	Nepal Organic Coffee Products, Madanpokhara, Palpa, Nepal	Morning Fresh	Domestic (Roaster and Brewer)
8.	High Mountain Organic Coffee (P) Ltd., Bhaisepati, Saibu-3, Lalitpur, Nepal	Organic Coffee	Domestic (Roaster)
9.	Shiva Agro Tourism Private Ltd., Pokhara, Nepal	Himal Coffee	Domestic (Roaster)
10.	Gaurishankar Organic Coffee Industry, Panchkhal, Kavre	Gaurishankar Coffee	Roaster and Brewer
11.	Coffee Cooperative Union, Lalitpur	Lalitpur coffee, Jureli coffee	Export and Domestic (Roaster)

Source: Office record of Coffee Promotion Program, Helvetas, Nepal