

Status of Area and Production of Horticultural Crops in Nepal

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Abstract

There has been continuous increase in the area covered by horticultural crops and its production over the years. The area covered and the production of fruits have increased by 123% and 142% respectively in the FY 2018/19 in comparison to the FY 2000/01, while the productivity is still hovering around 9-10MT/ha. The increase in the area and production is higher for summer fruits, followed by citrus and then by winter fruits. The increase in area, production and productivity during the same period i.e. from the FY 2000/01 to the FY 2018/19 for vegetables is 89%, 158% and 37% respectively; for the potato, it is 50%, 137% and 58% respectively and for spices it is 151%, 337% and 74% respectively. When we look into the increase in area and production of plantation crops in the same period, for tea they are 139% and 280% and for coffee 551% and 498% respectively. Floriculture is also an emerging potential enterprise in Nepal with an increase in its area and production as well as its transaction volume, which increased from 230 million in the FY 2005/06 to 2.42 billion in the FY 2018/19. Although there is an increasing trend in the area and production of horticulture crops over the years, the rate of increase is very low in comparison to its potential. Research, education and development partners must work together at all levels (federal, provincial and local) for the development of horticultural crops in the country.

Keywords: Fruits, vegetables, plantation crops, spices, floriculture

Introduction

Agriculture has been a major sector of the economy in terms of income, employment generation and food security with 60.4% of the nation's total population engaged in agriculture sector in 2018 (MoF, 2020). The contribution of agriculture on National Gross Domestic Product (GDP) in the FY 2018/19 is 26.5% (MoALD, 2020). The horticulture sector, which includes vegetables, fruits, plantation crops, floriculture

and spices, contributes 38.59% of Agriculture GDP (Thapa et al., 2019). Though horticultural crops like some indigenous fruits and vegetables were grown in homestead garden from time immemorial, and some exotic and fancy fruits and vegetables are grown in Rana manorial gardens even well before the start of government agriculture offices, commercial cultivation of horticultural crops started only after the start of agriculture/horticulture farms under

the department of Agriculture. Horticulture crops are important in terms of income generation, livelihood improvement of farmers, food and nutritional security of people, as well as the economy of the nation. Horticultural plants such as fruits and plantation crops contribute on soil conservation and carbon sequestration. Though Nepal constitutes just 0.15% of the world land mass, it accommodates almost all the important fruits and vegetables of the world due to its diverse physiography and geographic location. There are more than 55 types of fruits grown in Nepal, out of which 25 are grown in commercial scale (Shrestha et al., 2016). Similarly, 200 types of vegetables are grown in the country out of which more than 50 are grown in commercial scale (Shrestha et al., 2016). There is an increasing trend in area coverage and production of horticulture crops over the years however, the rate of increase in production is minimal and not able to meet the increasing demand especially in case of fruits in the country.

Area and production of fruits in the country

Total area, productive area and production of fruits are increasing over the years (Table 1).

Table 1. Total area, productive area, production and yield of fruits over the years

Year	Total Area (ha)	Productive Area (ha)	Production (MT)	Yield (MT/ha)
2000/01	73775	48166	487326	10.1
2005/06	91923	56549	535449	9.5
2010/11	117932	79184	794164	10.0
2015/16	157199	110586	976461	8.8
2018/19	164623	120023	1177640	9.81
% increase	123	149	142	-3

Nepal Increase in area under total fruits in the last 18 years is 123% i.e. from 73,775 ha in 2000/01 to 164623 ha in the year 2018/19, while production increase is 142%, i.e. 487326 MT in 2000/01 to 11,77640 MT in the FY 2018/19 (Table 1). Despite more than six decades of effort with the given strength and opportunities in the fruit development in

Status of Fruits in Nepal

Fruits are generally grouped into three categories; summer, citrus and winter fruits. The major summer fruits include mango, banana, litchi, guava, arecanut, papaya and pineapple; they are grown mostly in the southern belt of Nepal. The major citrus fruits are mandarin (Suntala), lime (Kagati) and sweet orange (Junar), mainly grown in the mid hills of Nepal. The major winter fruit crops are apple, pear, walnut, apricot, peach and plums, grown in mid to high hill regions. In recent years, avocado, strawberry, kiwifruit and pomegranate fruit are emerging as the potential crops in warm temperate areas of Province 1 and Bagmati Province, dragon fruit in sub-tropical areas of Bagmati Province and Lumbini Province and olive in hilly regions of Karnali and Sudurpashchim Province of the country.

Nepal, the productivity of fruit has remained low, hovering around 9-10 MT/ha, which is very low in comparison to other neighboring countries (Kaini et al., 2016). This can be raised up to 15 metric ton per hectare with increased access to information, modern production technology and inputs (high quality saplings, fertilizers, credit and irrigation). Because of the scattered areas

of cultivation, low productivity, high prices of production inputs, poor rural infrastructures, high transportation costs, high marketing costs and poor cultivation and postharvest technologies, Nepalese produce are less competitive even in the domestic markets.

Area wise, summer (or tropical) fruits cover 54% followed by citrus (28%) and winter (or temperate/warm temperate) fruits at 18% in

the FY 2018/19. Production wise summer fruits constitute 67% followed by citrus (23%) and winter fruits (10%) in the total fruit production. Increase in area, productive area and production are much higher in case of summer fruits (186% increase in production) followed by citrus fruits (123% increase in production), while winter fruits have slower increase (just 23% increase in production) (Table 2).

Table 2. Percentage change in area, productive area, production and productivity of three types of fruit crops from the FY 2000/01 to FY 2018/19.

Year	Summer				Citrus				Winter			
	Area (ha)	Productive Area (ha)	Production (mt)	Yield (mt/ha)	Area (ha)	Productive Area (ha)	Production (mt)	Yield (mt/ha)	Area (ha)	Productive Area (ha)	Production (mt)	Yield (mt/ha)
2000/01	37406	25846	276159	10.68	20673	11892	121665	10.23	15696	10429	89502	8.58
2018/19	88802	75740	790289	10.4	46412	28406	271908	9.6	29410	15,877	115,443	7.27
% increase	137	193	186	-2	125	139	123	-6	87	52	29	-15

Source: MoALD, 2020

Figure 1 shows the area and production of different fruit crops in Nepal in the fiscal year 2018/19. Mango is the number one crop on the basis of area and production, followed by mandarin, banana, apple, litchi, lime and sweet orange in terms of area, while there is some differences in the order in terms of production, i.e. mango followed by banana, mandarin, litchi, sweet orange, lime, pear and apple.

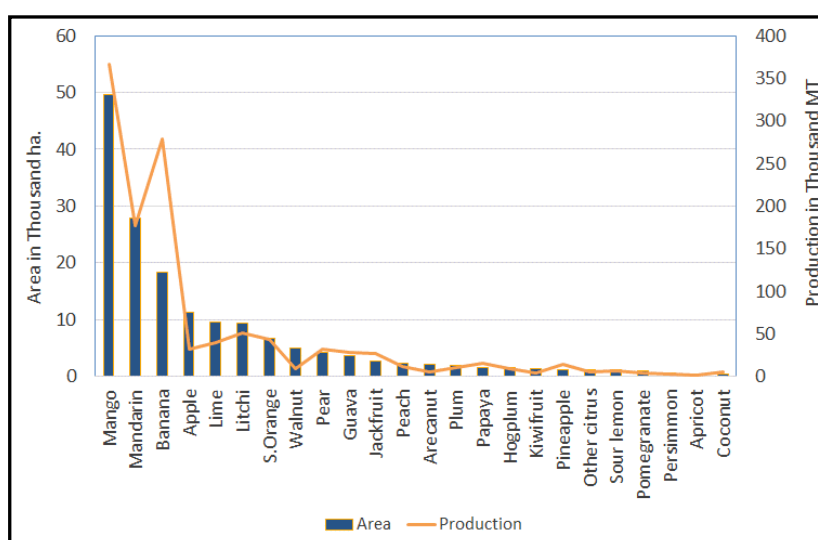


Figure 1. Area and production of different types of fruits in Nepal in FY 2018/19

Source: MOALD, 2020

Area and production of fruits in seven provinces

Of the total area and production of fruits, province 2 leads the other provinces constituting 25% of the area (41155 ha) and 31% of the production (369922 MT) of the nation, followed by the province 1, constituting 20% of the area and 20% of the production of the nation (Figure 2). Karnali Province has

the lowest productivity and lowest production of fruits among the 7 provinces, while the Sudurpashchim has the lowest area of total fruits.

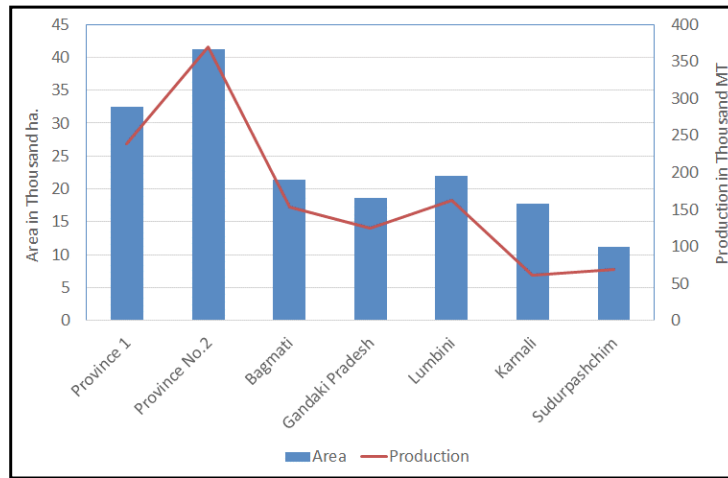


Figure 2. Area and Production of fruits in Provinces in FY 2018/19

When we look into the area and production of different types of fruits in the provinces, in case of summer fruits, Province 2 dominates accounting more than 46% in area and production, followed by Province 1 and 5 (Table 3). In case of Citrus, province 1 has more than 1/4th of nation's citrus area and production followed by Gandaki and Bagmati provinces. In case of winter fruits, in terms of area, Karnali province comes the first followed by province 1 and Bagmati, while in terms of production, Bagmati province comes first followed by province 1 and Karnali province as the productivity in Karnali province is low.

Table 3. Area and production of three different types of fruits in provinces

Province	Summer Fruits				Citrus Fruits				Winter Fruits			
	Area	Productive Area	Production	Yield	Area	Productive Area	Production	Yield	Area	Productive Area	Production	Yield
Province No. 1	15725	12677	143684	11.3	11916	8361	70719	8.5	4758	3306	23738	7.2
Province No. 2	41115	37269	369765	9.9	41	25	156	6.2	0	0	0	0.0
Bagmati	7596	5789	67699	11.7	9534	5232	59317	11.3	4275	3065	26195	8.5
Gandaki Pradesh	5383	4072	41822	10.3	9923	6540	65059	9.9	3371	1862	17537	9.4
Lumbini	13009	11008	114442	10.4	6591	3700	36449	9.9	2435	1516	10858	7.2
Karnali Pradesh	2081	1696	14854	8.8	4909	2584	22653	8.8	10754	3978	23430	5.9
Sudurpashchim Pradesh	3893	3229	38024	11.8	3498	1964	17555	8.9	3817	2151	13685	6.4
Nepal	88802	75740	790289	10.4	46412	28406	271908	9.6	29410	15877	115443	7.3

Source: MoALD, 2020

Nepal Status of Vegetable Crops in Nepal

Indigenous vegetables like broad leaf mustard (Rayo), Pyuthane red radish, pumpkin, gourds, colocasia, yam, cowpeas, beans, were cultivated in homestead gardens for family use from the time immemorial, while some exotic vegetables were introduced to the manorial gardens of Rana palaces from the mid-19th century, slowly these vegetable seeds leached out to the local farmers of Kathmandu valley through the gardeners of Rana Palaces and the cultivation of temperate vegetables such as cauliflower, cabbage, turnip etc. became popular in Kathmandu valley. Before the start of modern agriculture development in Nepal, Kathmandu valley had sustainable organic

vegetable production practices (Pandey and Shakya, 2016). Vegetable sector geared up nationwide only after 1972 when agro-eco-zonal strategies were adopted in vegetable research and its fresh and seed production.

Area and production of Vegetables in the country

Area, production and productivity of vegetables have been increasing steadily over the last 18 years (Table 4). Total area under vegetable cultivation is 2,97,195 ha and the production of 42,71,270 metric tons in the FY 2018/19 with an average productivity is 14.4 MT/ha., which is very low as compared to 30 MT in other countries. It clearly indicates that there is tremendous scope to improve vegetable productivity through effective research and developmental activities.

Table 4. Area and production of vegetables over the years

Year	Total Area (ha)	Production (MT)	Yield (MT/ha)
2000/01	157162	1652979	10.5
2005/06	189864	2190122	11.5
2010/11	244102	3203563	13.1
2015/16	280807	3819809.1	13.6
2018/19	297195	4271270	14.4
% increase in 2018/19 as compared to 2000/01	89	158	37

Source: MoALD, 2020

Increase in area is 89% during the last 18 years, while the increase in production is much higher i.e. 158%, this is due to increase in the productivity by 37% during the period (Table 4). Major vegetables in terms of area and production are Cauliflower, cabbage, tomato, onion and radish (Figure 3).

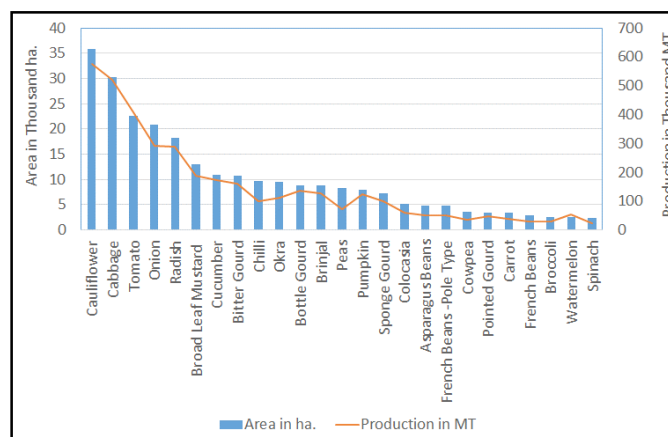


Figure 3. Area and production of vegetables in FY 2018/19

Area and production of vegetables in seven provinces

While we look into the province-wise area and production of total vegetables, province 2 has the highest share of total nation's area and production (29% of area and 30% of production) followed by province 1, Bagmati and Lumbini province (Figure 4).

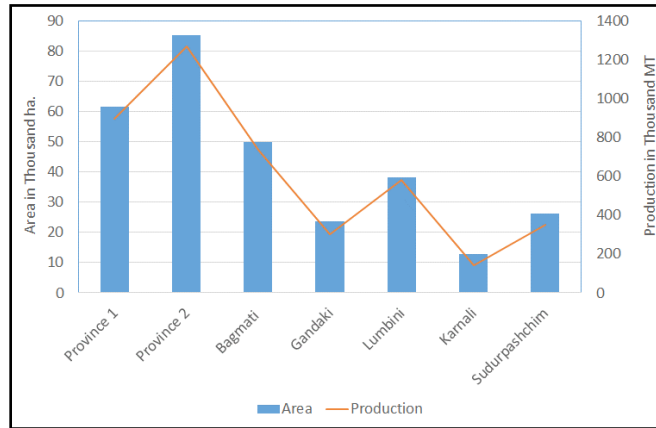


Figure 4. Area and production of vegetables in provinces

Status of Potato in Nepal

Potato is one of the most important crops in Nepal used as a major vegetable crop in mid-hills and terai whereas it is used as a staple food crop in high hills and grown in all the districts of the country.

Area and production of Potato in the country

Area, production and productivity of potato have been increasing steadily over the last 18 years. Total area under potato cultivation is 1,93,997 ha and the production of 31,12,947 metric tons with an average productivity 16.0 MT/ha in the FY 2018/19. Area has been increased by 50% while the production is more than doubled, i.e. increased by 137% due to increase in yield by 58% (Table 5).

Table 5. Area and production of potato over the years

Year	Total Area (ha)	Production (MT)	Yield (MT/ha)
2000/01	129019	1313717	10.2
2005/06	150864	1974755	13.1
2010/11	182600	2508044	13.7
2015/16	190896	2551740	13.4
2018/19	193997	3112947	16.04
% increase in 2018/19 as compared to 2000/01	50	137	58

Source: MoALD, 2020

Area and production of potato in the provinces

While we look into the province-wise area and production of potato, province 1 has the highest share of total nation's area and production (more than 30% of area and production) of potato followed by Bagmati, province 2, and Lumbini province (Figure 5).

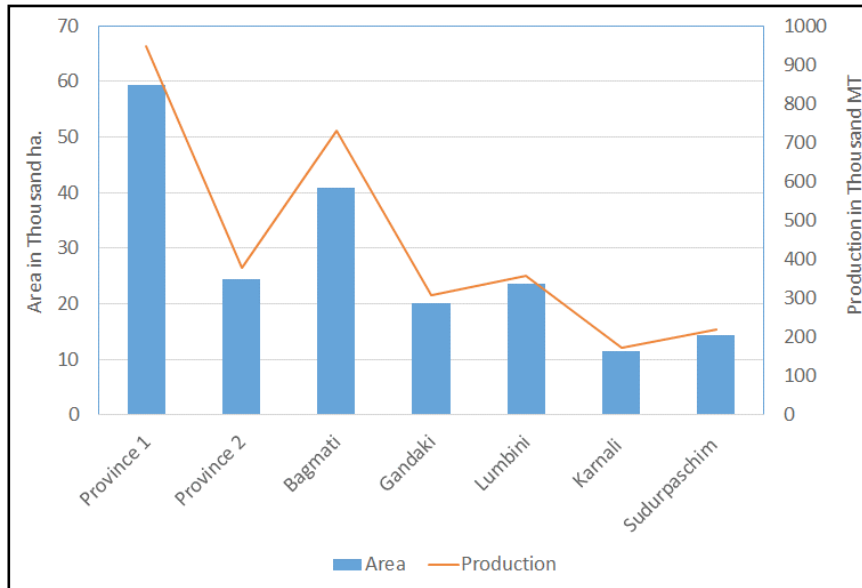


Figure 5. Area and production of potato in seven provinces

Status of Spices Crops in Nepal

Major spices commercially grown in Nepal are large cardamom, ginger, garlic, turmeric and dry chilli.

Area and production of spices in the country

Area, production and productivity of spices have been increasing steadily over the last 18 years. Total area under spices is 68,603 ha and the production of 5,44,260 MT with an average productivity is 7.9MT/ha in the FY 2018/19 (Table 5).

Table 5. Area and production of potato over the years

Year	Total Area (ha)	Production (MT)	Yield (MT/ha)
2000/01	27363	124512	4.6
2005/06	35956	226914	6.3
2010/11	47867	325487	6.8
2015/16	60894	419155	6.9
2018/19	68603	544260	7.9
% increase in 2018/19 as compared to 2000/01	151	337	74

Source: MoALD, 2020

Area and production of spices in the provinces

While we look into the province wise area and production of total spices, province 1 has the highest share of total nation's area and production (39% of area and 30% of production) of spices followed by province 2 and Bagmati province (Figure 6).

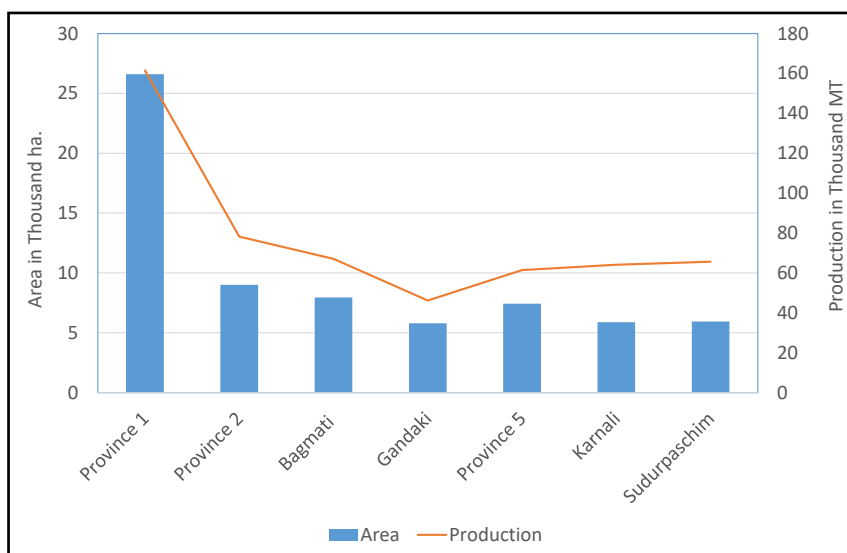


Figure 6. Area and production of spices in provinces

When we look into the area and production of specific spices in the provinces, in case of cardamom, Province 1 highly dominates accounting 84% of nation's cardamom area and 90% of nation's production followed by Gandaki and Bagmati provinces (Figure 7). In case of ginger also, province 1 dominates with 36% of total ginger area and 38% of total ginger production followed by Bagmati, Karnali and Gandaki provinces in terms of area while in terms of production, Karnali province surpass the Bagmati province, might be due to impact of ginger research station located in Salyan district of Karnali province.

In case of garlic, in terms of area province 2 is leading, followed by Lumbini and Sudurpashchim province, while in terms of production, Sudurpashchim is followed by province 2 and Bagmati. In case of turmeric province 2 dominates accounting 34% of area and 38% of total turmeric production in the nation. In case of dry chilli, in terms of area, province 2 is leading followed by province 1 and Lumbini province, while in terms of production, province 1 is followed by province 2 and Lumbini province.

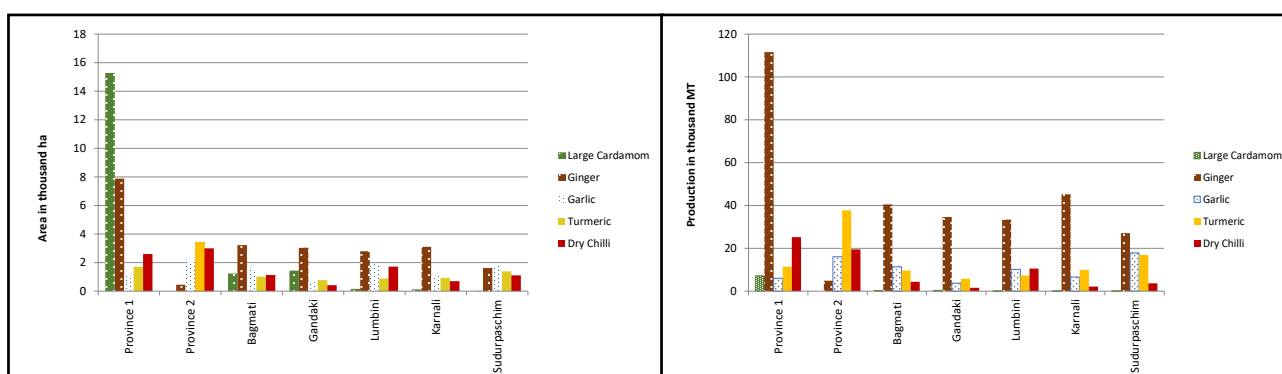


Figure 7. Area and production of three different types of spices in provinces

Status of Tea and Coffee in Nepal

Tea and coffee are recognized as export items of Nepal and listed in Nepal Trade Integration Strategy (NTIS) in 2010. Tea is the viable labor-intensive agribusiness that provide year-round employment opportunities. More than 70,000 workers seem to be employed in this business, while around 15000 small holder farmers are directly been involved in tea cultivation in Nepal (NTCDB, 2020). Orthodox tea of Nepal is recognized for its aroma, appearance, bright

liquor, and flavor. Similarly, though production and trading of Nepalese coffee stands pretty insignificant in the world coffee market, it has very different nature and importance. It is sold in niche and specialty international markets in about 10 times higher price than the ordinary coffee. Tea and coffee are contributing the national economy through farmers' income generation, fostering industrial development, soil conservation, eco-friendly, aesthetic and eco-tourism values.

Area and production of Tea

Area and production of tea have been increasing steadily over the last 18 years (Table 6). Total area under tea is 28732ha, which is 139% more than that of FY 2000/01 and the production of 25,206 MT., which is 280% more than that of FY 2000/01.

Table 6. Area and production of tea and coffee over the years

Year	Tea		Coffee	
	Total Area (ha)	Production (MT)	Total Area (ha)	Production (MT)
2000/01	11997	6638	424	88.7
2005/06	16012	13688	1285	391
2010/11	17451	17438	1752	502
2015/16	27688	24264	2618	434
2018/19	28732	25,206	2761	530
% increase in 2018/19 compared to 2000/01	139	280	551	498

Source: NTCDB, 2020

On the basis of processing methods and location of cultivation, mainly two types of tea are produced in Nepal, i.e. CTC (Crush, Tear and Curl) and Orthodox tea. Orthodox tea is recognized worldwide for its aroma, appearance, bright liquor, and flavor. CTC tea is produced in Jhapa district while orthodox tea is produced in hills of Ilam, Panchthar, Dhankuta, Terhathum, and new areas of Bhojpur, Sindhupalchok, Nuwakot and Kaski. 90% of CTC tea produced is used in domestic consumption, while because of the premium price paid to orthodox tea, 96% of it is exported while only a little is sold domestically mostly in souvenir packages suited for tourists.

Province 1 highly dominates in tea cultivation, contributing more than 80% of area and 99% of production of the country (Figure 8).

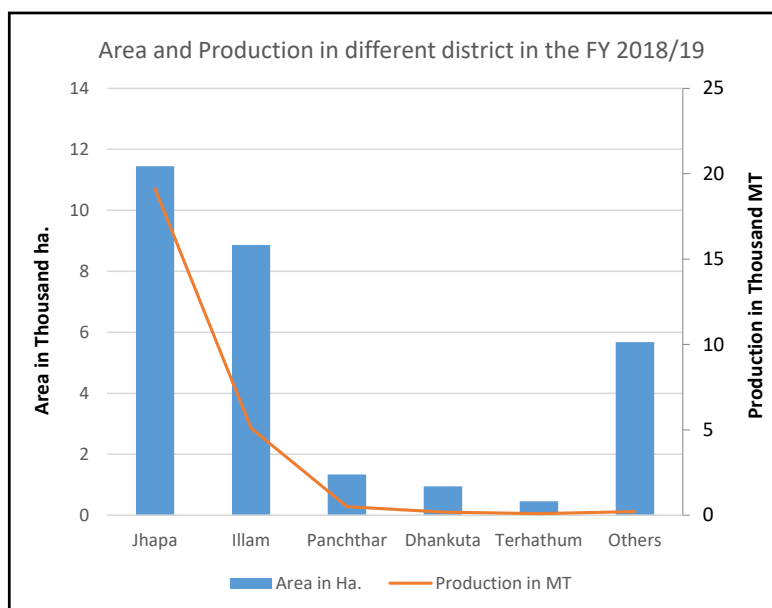


Figure 8. Major tea producing districts

Area and production of Coffee

Area and production of coffee have increased over the last 18 years (Table 6). Total area under coffee is 2761 ha in the FY 2018/19, which is 551% more than that of FY 2000/01 and the production is 530 MT., which is 498% more than that of FY 2000/01.

More than 80% of area and production is constituted by 3 provinces, Gandaki, Bagmati and Lumbini province. Major coffee producing districts are Syangja, Gulmi, Arghakhanchi, Kaski, Kabhrepalanchok, Lalitpur, Lamjung, Nuwakot, Palpa, Sindhupalchok. Districwise area and production is given in the Figure 9.

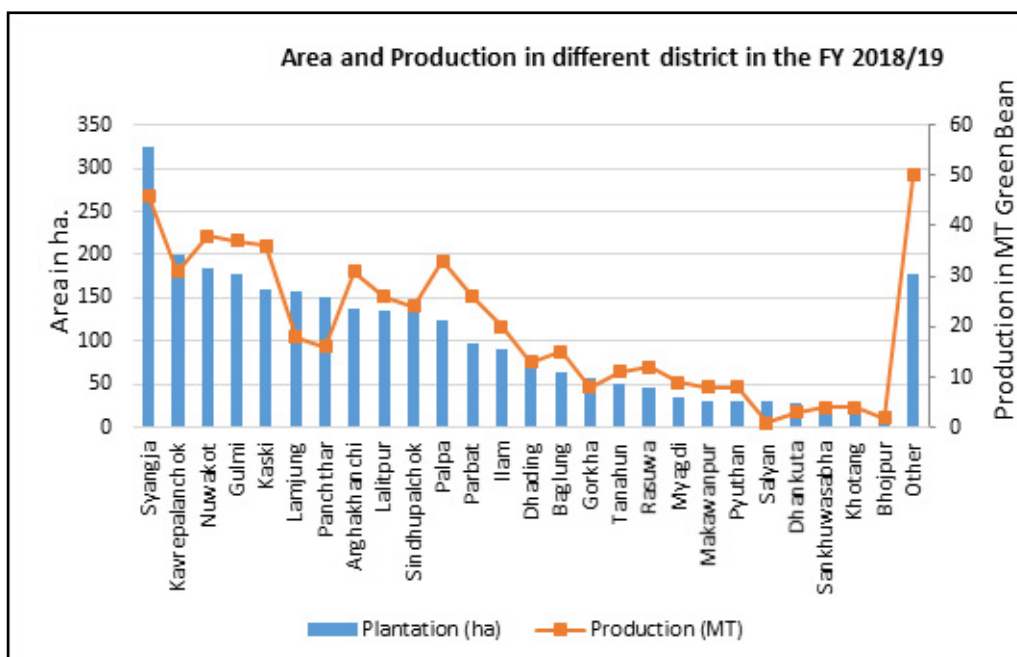


Figure 9. Area and production of coffee in different districts in the year 2018/19.

Status of Floriculture in Nepal

Floriculture is an emerging business in Nepal. In the last 3 decades, business volume has grown by more than 100 folds. Development of flora-business is the asset for the nation to minimize the unemployment problem and is vital enterprise for economic growth to assist in alleviating the poverty. Most important cut flowers in Nepal are carnation, gladiolus, gerbera and rose.

Kathmandu Valley remained the main centre of its business for many years. Currently the business is steadily expanding in other urban areas

like, Biratnagar, Dharan, Janakpur, Hetauda, Narayangadh, Pokhara, Butawal, Bhairahawa, Nepalganj, Surkhet, and Dhangadi. Altogether more than 700 floriculture entrepreneurs and farmers/firms are working with 157 hectares of land across 43 districts in Nepal. In the fiscal year 2018/19, total transaction in this sub-sector has reached to Rs. 2.42 billion (Table 7). More than 43,500 persons are directly and indirectly dependent on the floriculture sub-sector (FAN, 2020).

Table 7. Total transaction amount on floriculture business in Nepal

Year	1993/94	2005/6	2008/9	2011/12	2013/14	2015/16	2017/18	2018/19
Total value in million rupees	18	230	560	974.5	1338	1510	2250	2420

Source: FAN, 2020

When we look onto the production and consumption of floral products over the provinces, Bagmati province leads constituting 60% share while all other 6 provinces altogether constitute the rest 40% share. Bagmati province is found to have the highest number (70%) of floriculture plant nurseries followed by Province 1, Province 2, Lumbini Province and Gandaki Province while Karnali Province is found to have the least number (CBS, 2016; Pun 2019). Five leading districts on floriculture businesses are Kathmandu, Lalitpur, Morang, Kaski and Bhaktapur, and major products transacted are seasonal/perennial/ornamental plants, cutflowers and loose flowers.

Demand and Supply Gap in Horticulture Crops

Though the area and production of horticultural crops have been increasing in past years, they are not able to meet increasing demand due to increase in population and increase in per capita consumption. Demand of vegetables and fruits

is increasing in recent years due to more health consciousness, more awareness, easy access and higher per capita income. Imports of fruits and vegetables are increasing while the export in the same period has decreased sharply in quantity and in value especially in case of fruits. Apple, grapes, mandarins, banana, guava are the major fruits imported to Nepal. Apple alone was imported 73 thousand MT in quantity and 4.93 billion rupees in value in the fiscal year 2018/19 (DoC, 2019). Banana is supposed to be nearing to self-sufficient in our country, however in this fiscal year, 1.78 billion worth of banana were imported i.e. 2nd most imported fruits in value, this seems to be due to over production in India and sent to Nepal at very cheaper price with what Nepalese banana growers were not able to compete due to higher production cost. Similarly, 1.58 billion worth mandarin/oranges and 1.54 billion worth grapes were imported in the same fiscal year.

We are almost self-sufficient in most of the fresh vegetables while our domestic production

is insufficient in potato, dry onions, garlic and tomato. In the FY 2018/19, 5.81 billion rupees of potato, 5.27 billion rupees of onion, 527 million rupees of tomatoes and 370 million rupees of garlic were imported (MoALD, 2020).

According to the Floriculture Association of Nepal (FAN), 30 percent of the country's flower requirement is imported. About 20% of cut flowers, 60 % of ornamental plants and 90% of seeds demands are met through imports. In an average domestic market is growing between 10 to 15 per cent annually while growth in domestic production is between 7-9% only. When we compare import and export of floriculture products, trade deficit in floriculture products is increasing in recent years. In the fiscal year 2018/19, import of floriculture products accounted to Rs 209 million (FAN, 2020).

Cardamom, ginger, tea and coffee are recognized as export items of Nepal and listed in Nepal Trade Integration Strategy (NTIS) and they are the major agricultural commodities for reducing trade deficit in agriculture. In the FY 2018/19, 4.3 billion rupees of large cardamom and 512 million rupees of ginger were found to be exported from Nepal (DoC, 2019). In the FY 2018/19, 3.2 billion rupees of tea and nearly 100 million rupees of coffee were exported while 118 million rupees of CTC tea and 98 million rupees of coffee were imported (NTCDB, 2020).

Programs on Horticultural Crops

Many efforts have been made in developing favorable plans to harness the potential of horticulture in Nepal since the fifth five-year plan (1975-80) (Kaini et al. 2016) and many programs have been implemented. In the 20-years long Agricultural Perspective Plan (APP) (1995-2015), of the four priority outputs, high value commodity was one, including horticulture. In present time, the government has implemented Agriculture Development Strategy (ADS, 2015) which is expected to guide agricultural sector for the 20 years and horticulture has larger

role to play. In fruit developmental sector, Fruit Development Directorate (FDD)/National Centre for Fruit Development (NCFD) has run in recent past various developmental programs on fruits in order to reduce importation and promote exportation and address trade deficit in fruit crops, they are Lime mission program (2007/08 - 2013/14), Citrus orchard rejuvenation program (2013/14-2016/17), Apple self-reliant program (2011/12 to 2016/17), Olive promotional program (2015/16-2017/18), Fruit Decade program starting from 2016/17 which included Fruit Plantation Area Expansion Program (2018/19) (Manandhar et al., 2020; NCFD, 2020). In the vegetable sector, Vegetable Development Directorate (VDD)/National Centre for Potato, Vegetable and Spices (NCPVS) has run in recent past various programs on vegetables, potato and spices in order to reduce importation and promote exportation and address trade deficit in vegetable, potatoes and spice crops, they are onion mission program(2007/08-2011/12), Youth Focused Vegetable Production Program (2013/14-2015/16), Homestead Garden Program (2014/15-2017/18), Seed Potato Self Reliant Program (2011/12-2015/16), Large cardamom Disease Management and Nursery Establishment Program (2010/11-2016/17), Precision and Protected Horticultural Technological Dissemination program (2017/18) (VDD, 2018; NCPVSCD, 2020). Most of these programs were run for a shorter period than they were planned for.

Apart from the programs run by the then FDD and VDD, projects like High Value Agriculture Project (HVAP) (2010-2018), The High Mountain Agribusiness and Livelihood Improvement Project (HIMALI) project (2011-2017), One Village One Product (OVOP) program (Through FNCCI) (2006-2017) also had a larger component on horticultural crops and contributed in area expansion, production and value chain development of some horticultural commodities.

The Ministry of Agricultural Development (MoAD) has executed the Prime Minister Agriculture Modernization Project (PMAMP) from the fiscal year 2016/17. The super zones and zones are administered by separate offices while the pocket and block were under the DADOs for the first year, but now they are under the provincial government through Agriculture Knowledge Centres (AKCs) as the country has moved to the federal system. This on-going project also has a large component in horticultural crops such as mango, banana, mandarin, junar, apple, walnut, kiwifruit, olive in fruit sector, fresh vegetables, potato, large cardamom and ginger/turmeric in vegetable, potato and spice sector and coffee, rubber in plantation crop sector in many of the potential districts. They are also contributing in expansion of area and enhancing production as well as contributing on post production activities.

Challenges and Way Forward

Though production of most of the horticultural crops have increased significantly over the last 18 years, the increase is attributed mostly by increase in area, while increase in productivity is almost nil in case of fruit crops, while very minimal in case of vegetable crops and plantation crops. Despite the potentiality of horticultural crops, horticultural productivity remains low mainly due to the lack of access to information, technology, inputs (seeds, fertilizers, credit) and market. There is still a lot to be done to increase the productivity. Supply of quality seed/planting material, proper farm management including manuring, irrigation, training and plant protection, post-harvest technology and market infrastructure development have been found as major areas for intervention. The challenges and way forward are listed based on some review works and experience (Kaini et al. 2016, FDD, 2017, Manandhar et al. 2019, Thapa et al. 2019 and KC and Dhimal, 2019).

Challenges of Horticulture sector development

- Cordination
 - o Research, educational institutions and departmental organizations- linkage among them is very important for suitable technology development and utilization.
 - o Federal, provincial and local organization-horticultural programs have to be implemented in all three levels.
 - o Government and private sector- in past many years, Public Private Partnership (PPP) model has been spelled out, but the co-ordination is still weak.
- Strengthening of federal (departmental/research), provincial and local level governmental as well as private horticultural resource centres are required.
- Researches- Development of varieties highly demanded by farmers, is very low. Similarly production and distribution of quality saplings of many fruits as well as vegetable seeds is very poor. Therefore many varieties of fruits, vegetables and ornamental plants have been imported, but without any necessary research such as in case of wine variety grapes, blue berry, almond, pomegranate, and newly emerging dragon fruits. Recently many varieties of apples for high density planting and walnut varieties are imported in large scale from abroad without conducting necessary researches. Research works are insufficient as required to develop within country hybrids in case of vegetables.
- Weak value chain on horticultural commodities
- Low level of infrastructural facility
- Development of branding and tracking back of commodities are to be done.
- Marketing issues such as price information and development of marketing system is required.

Way forward of Horticulture sector development

- Clear roles and responsibilities should be provided at every level (local, provincial, federal) and Co-ordination committees should be formed and functionalized.
- Strengthen horticultural resource centres to carryout research, variety maintenance and all stages of seed and saplings production and develop as the centre of excellence. Develop horticultural resource centres as a practical training centre for field level technicians, seed producers, orchard owners, nurserymen to transfer modern production and post-harvest technology. Technicians should be capacitated.
- Researches should be demand driven, focused on issues of farmers' fields. Researches should address on following aspects:
 - o Varietal propagation techniques (tissue culture, nursery structures) and within country hybrid production of vegetables crops.
 - o Sapling production for high density planting of apples, walnut, citrus etc.
 - o Pest and diseases management (Fruit fly, citrus greening, crown gall in apple, mango malformation, club root of cole crops, chhirke and furke disease of large cardamom).
 - o Nutritional management
 - o Socioeconomic
 - o Protected cultivation of horticultural crops
 - o Postharvest technology for loss reduction and increase shelf life of perishable horticultural commodities.
- Value chain actors need to be capacitated with formulation of programs with budgets.
- Infrastructure development (access roads, rural electrification, irrigation facility. markets structures, collection centres, cold storage

structures, cold chain facility, processing facility)

- Capacity development is to be done for branding and tracking back.
- Strengthening pricing information and marketing system improvement

Conclusion

Though Nepal has a high potentiality of growing almost all the important horticultural crops of the world due to its varied topography and geographic location, we are still not able to tap their potentiality thus increases in the area, production and productivity of these crops are lower than the increases in their demands, thus we are highly trade deficit in fruits and some vegetables. Government of Nepal has implemented many programs, but the period they run were for a shorter period than they were planned for. Fruit crop research and development generally require long time devotion compared to annual crops, thus fewer scientists/technical staffs are attracted towards it. Large area of cultivated as well as cultivable land in the rural area is being abandoned due to migration of working force in search of job. Recent COVID-19 pandemic has resulted migrant workers to return home, their homecoming should be tapped as an opportunity and make them absorbed in horticultural sector. Large scale commercial cultivation of horticultural crops utilizing rural lands and linking them to the value chain including market is crucial. Quality seed/sapling production, pest and disease management, mechanization, value chain and market infrastructure development need to be focused for the overall development of horticultural crops. Research, education and development partners have to put their efforts together for the development of these crops in the country for self-reliance, import substitution and export promotion.

Reference

- ADS (2015). Agriculture Development Strategy, Ministry of Agricultural Development. Approved by the House committee on 12, June 2015.
- CBS (2016). Nepal Commercial Floriculture Survey 2072/73 (2015/16). Published by Central Bureau of Statistics, Nepal.
- DoC.(2019). Annual Foreign Statistics web-published by the Department of customs. Accessed on 1st Feb, 2020 at <https://www.customs.gov.np/en/>.
- FAN (2015). Nepal Floriculture Sub-Sector- A Concept Paper. Published by Floriculture Association of Nepal.
- FAN (2020). Status of Floriculture accessed at <http://www.fanepal.org.np> on Dec 2020.
- FDD (2017). Nepal: Fruit Development Project. Prepared by Nepal Horticulture Promotion Centre, Khumaltar, Lalitpur as a part of program of the Fruit Development Directorate, Kirtipur, Kathmandu.
- Kaini, B.R., Shrestha, G.P., and Manandhar, R. (2016). Six decades of Fruit Development in Nepal. *Six Decades of Horticulture Development in Nepal*. Pp 36-53.
- KC, H.B. and Dhimal, S. (2019). Value chain issues on fresh vegetables. *Proceeding of the 10th National Horticulture Seminar, Nepal* held at Warm Temperate Horticulture Centre, Kirtipur from 7-9 Feb, 2019. Pp 85-94.
- Manandhar, R., Shrestha, Y.K., Thapa, D.B., and Shrestha G.P. (2019). Present Status, Prospects and Challenges in Fruit Development in Nepal. *Proceedings of the tenth National Horticulture Seminar, Nepal* held at Warm Temperate Horticulture Centre, Kirtipur from 7-9 Feb, 2019. Pp 137-152.
- MoALD. (2020). *Statistical Information on Nepalese Agriculture 2075/76 (2018/19)*. Published by the Ministry of Agriculture and Livestock Development.
- MoF, (2020). *Economic Survey 2019/20*. Published by the Ministry of Finance, Government of Nepal, Singh Durbar. Pp 67.
- NCFD (2020). Annual Progress Report (2019/20). National Centre for Fruit Development, Kirtipur, Kathmandu, Nepal.
- NCPVSCD (2020). Annual Progress Report (2019/20). National Centre for Potato, Vegetable and Spice Crop Development, Kirtipur, Kathmandu, Nepal.
- NTCDB. (2020). Tea and coffee trade for Fiscal year 2018/19, web published by National Tea and Coffee Development Board. Accessed on 1st Feb, 2020 at <https://www.teacoffee.gov.np/statistics>.
- Pandey, I and Shakya, S.M. (2016). Vegetable Development in the last six decades in Nepal. *Six Decades of Horticulture Development in Nepal*. Pp 54-82.
- Pun, U. (2019). Floriculture in Federal Nepal: Present status and way forward. *Nepalese Floriculture*, published by Floriculture Association of Nepal. Pp 1-4.
- Shrestha, G.K., Thapa, P., Shahi, R.D., Gurung, H.P., Pokharel, D.M., Bhattarai, D., Bhattarai, B., Kafle, A. (Ed.). (2016). Six Decades of Horticulture Development in Nepal. Silver Jubilee Special published by Nepal Horticulture Society. Delta Offset Press, Thapathali, Kathmandu.
- Thapa, M.B., KC, H.B., Subedi, G.D., Dhimal, S. and Regmi, R.K. (2019). Contribution of Horticulture sector in National economy. *Proceeding of the 10th National Horticulture Seminar, Nepal* held at Warm Temperate Horticulture Centre, Kirtipur from 7-9 Feb, 2019. Pp 9-27.
- VDD (2018). Annual Progress Report of Vegetable Development Directorate (2017/18), Khumaltar, Lalitpur.