

Status of Horticulture in Nepal

Ram Bahadur KC*, Gopal Prasad Shrestha and Sanjay Dhimal

Nepal Horticulture Society

*Corresponding author's email: rbkc05@gmail.com

Country Background

Nepal, with area of 147,516 sq. km with 3091 thousand hectare of cultivated land, occupies the central part of the Hindu Kush Himalayas. Country is surrounded three sides by India and from north side Tibet, China. The country is located between latitudes 26°22' and 30°27' N and longitudes 80°40' and 88°12' E. Altitude varies from 60 meter above sea level at Kechana Kalan, Jhapa in the south-eastern Terai to 8848.86 meter at Mt. Everest the highest point in the world. Nepal's biodiversity is a reflection of its unique geographic position and variations in altitude and climate within a short horizontal span.

The Terai belt (60-300m) is a flat stretch of fertile agricultural land in southern part of the country, which forms part of the alluvial Indo-Gangetic plain. The Siwalik Hills Zone also called Churia range (700-1500m) rises abruptly from the Terai plain and is mainly composed of sedimentary rock and big boulders. The Mahabharat Lek (1500m to 2700m) lies between the Siwalik Hills to the south and the midlands to the north. The Mid-hills (average altitude 2000 m) occupy the central region, east to west of the country. The Himalayan zone (above 4000m) lies in the north and stretches from east to west of the country where summer grazing pastures are found in the lower elevations and high altitude plant species adapted to extremes of cold and desiccation grow in higher elevations. There are several inner Himalayan valleys with desert conditions such as the upper Kaligandaki and Bheri valleys located at altitudes above 3600m. A wide range of climatic conditions exists in Nepal, mainly as a result of variations in altitude. This is reflected in contrasting habitats, vegetation and fauna. Other important climatic factors influencing biodiversity and the composition of flora and fauna in Nepal include rainfall, winter snowfall, temperature and aspect (Bhujju 2007).

Nepal's climate varies considerably both seasonally and according to altitude ranges from subtropical to arctic. In southern part 60m from sea level to 700m temperature goes up to 43°C in May to August in summer and in winter December to February no frost is there but temperature drop down up to 5°C and severe cold wave with poor sun shine cause lethal.

The Siwalik hill zone 700m to 1500m above sea level. This region consists of the warm temperate and the sub-tropical climate zones. Considered the most suitable for habitat because of the mild climate. The midlands are pleasant throughout the year. However, the mornings and nights are quite chilly. With average summer and winter temperatures of 19°C to 35°C and 2°C to 12°C respectively, the Kathmandu Valley (1350 masl) has a richer spectrum of climate. The Pokhara Valley (850 masl) in this region has the highest amount of rainfall all over the country.

Warm temperate to cool temperate types of climate prevails in the altitude ranges from 1500m to 3000m and lies between the Siwalik Hills to the south and the highlands to the north. In 3000m to 4000m above sea level consists of sub alpine type of climate and above 4000m above sea level alpine to arctic climates is there and no importance to agriculture. Agro ecologically country is divided into major three zones; Terai and inner in the south, Mid-hills in the middle and high hills and mountain in the north.

Major perennial river systems are the Mahakali, Karnali, Narayani and Koshi Rivers, all are originated in the Himalayas. These rivers have potential for large-scale hydropower and irrigation project development. Medium-sized perennial rivers are the Babai, West Rapti, Bagmati, Kamla, Kankai and Mechi rivers that generally originate in the Mid-hills or in the Mahabharat range. The Terai region has many small and usually seasonal rivers most of them are originated in the Siwalik Hills (Bhujju, 2007).

History of Horticulture Development in Nepal

Milestone of horticulture research and development was initiated with First Rana Prime Minister Jung Bahadur Rana who visited European countries in 1850 to 1851. When he returned from Europe he brought some seeds of vegetables and ordered to plant them in Rana's aristocratic gardens. In fruit also, Rana ruler imported the exotic fruits saplings and planted them into their gardens. In 1951, immediate after the Rana regime, Department of Agriculture was established. From 1956 to 1984 several horticulture farms were established and different commodity programs were launched across the country in different agro-ecological zones. In 1966, as a separate entity, Fruit Improvement Department was recognized. Again in 1988 separate Horticulture Development Department was established. Now all developmental type of organizations are in single umbrella i.e. Department of Agriculture. National emphasis was given to produce cereal crops in terai area, mid-hills for fruit gardening and high hills and mountain for livestock development. Several technologies were generated in this period amongst them Vegetable Seed Production was one of the high esteemed activities. That period Nepal exported vegetable seeds to Bangladesh. In 1991, Nepal Agriculture Research Council (NARC) was formed as an autonomous apex body solely devoted for agriculture research. Under NARC, several horticulture stations and national commodity programs are being functionalized. USAID, Indian Cooperation Mission (ICM), Swiss Government, FAO, JICA, ADB, ODA, DFID played significant role for horticulture development in the country.

Guiding Policies. Strategies and Plans

To create enabling working environment and give the momentum to increase agriculture production and productivity for self-sufficiency and export promotion, there are number of policies and strategies are in implementation. Among them major policies are as follows:

- National Agriculture Policy, 2004
- National Tea Policy, 1993
- National Coffee Policy, 2003
- Floriculture Promotion Policy, 2012
- Agribusiness Promotion Policy, 2004
- Climate Change Policy, 2011
- Agro Biodiversity Policy, 2014
- Nepal Trade Policy, 2018
- National Agroforestry Policy, 2019

Likewise, major plans and strategies are mentioned hereunder:

- 15th Five Year Periodic Plan (2076/77-2080/81)
- Agriculture Development Strategy (2015-2035)
- National Seed Vision (2013-2025)
- Nepal Trade Integration Strategy, 2016
- Nepal National Sector Export Strategy-Tea, 2017
- Gender Mainstreaming Strategy, 2006

Similarly, current implementing projects are running as well:

- Prime Minister Agriculture Modernization Project (PMAMP)
- Food and Nutrition Security Enhancement Project (FANSEP)
- Agriculture Development Support Program (ASDP)
- Rural Enterprise and Economic Development Project (REED)
- Nuts and Fruits in Hilly Areas Project (NAFHA)

Present Scenario of Horticulture

Agriculture is the back bone of Nepalese economy because more than 50% population is engaged in agriculture and it has contributed around 23.95% (Table-1) in National GDP (agriculture, forestry and fishing). Horticulture is the major sub-sector of agriculture which comprises pomology, olericulture, floriculture, post-harvest and vegetable seeds. Horticulture sub-sector alone contribution was 7.26%. Similarly in AGDP this sector (vegetables, fruits, potato and spices) contributes 32.06%. The area, production and productivity of horticultural crops have been mentioned in the table 2 (MoALD, 2022).

Table 1. Overall Contribution of Agriculture Sector in GDP in last five years

S.N.	Sector	Overall contribution in GDP (%) at current price				
		2017/18	2018/19	2019/20	2020/21	2021/22 P
1.	Agriculture, forestry and fishing	25.63	24.92	25.16	24.9	23.95
2.	Agriculture	16.6	16.16	16.51	16.29	15.6
3.	Growing of vegetables, horticultural, specialties and nursery products	5.58	5.2	5.5	5.84	5.99
P: Preliminary						

Source: Central Bureau of Statistics, 2022.

Table 2. Area, Production and Productivity of Horticultural Crops/Commodity in F.Y. 2020/21

S.N.	Crops/Commodity	Area (ha)	Production (MT)	Yield (MT/ha)
1.	Vegetables	284181	3993167	14.05
2.	Fruit Productive	128733	1356218	10.52
3.	Potato	198788	3325231	16.72
4.	Ginger	21912	279206	12.74
5.	Tea	16917	23745	14.03
6.	Large Cardamom	15668	8289	0.52
7.	Dry Chili	12525	87731	7.00
8.	Turmeric	10340	105719	10.22
9.	Garlic	9784	72490	7.40
10.	Coffee	3052	315	0.10

Source: MoALD, 2022.

Table 2 clearly shows the productivity of almost all commodities is quite low. It means this sub-sector demands the advanced technological intervention. The area of top ten prioritized vegetables and fruit crops of Nepal is mentioned in the table 3 whereas number of horticultural plant species available in Nepal is tabulated in table 4.

Table 3. Top Ten Vegetable and Fruits Crops by Area in Nepal

S.N.	Vegetable Crops	Area (ha)	Fruit Crops	Area (ha)
1.	Cauliflower	35402	Mango	51681
2.	Cabbage	29638	Mandarin	27002
3.	Tomato	22600	Banana	21633
4.	Onion	20251	Apple	13678
5.	Radish	16641	Litchi	7406
6.	Brinjal	11292	Sweet Orange	6813
7.	Broad Leaf Mustard	10851	Walnut	5889
8.	Cucumber	9978	Lime	5715
9.	Bitter Gourd	9680	Pear	3978
10.	Okra	9584	Guava	3524

Source: MoALD, 2022

Table 4. Number of Horticultural Plant Species available in Nepal

S.N.	Horticultural plant group	Domesticated	Semi Domesticated	Wild Relatives	Wild Edible	Landrace	Exotic species
1.	Vegetable	73	6	35	334	7000	15
2.	Fruits	67	5	20	90	4500	20
3.	Spices and condiments	41	4	10	80	500	5
4.	Ornamental plants	300	-	-	-	-	100
5.	Medicinal aromatic and herbal plants	33	-	-	-	-	

S.N.	Horticultural plant group	Domesticated	Semi Domesticated	Wild Relatives	Wild Edible	Landrace	Exotic species
6.	Pesticidal plants	19	-	-	-	-	
7.	Green manure plants	24		-	-	-	
8.	Beverage plants	5	-			-	
	Total	562	15	65	504	12,000	140

Source: Adopted from Joshi et al 2023 and KC et al 2023 (on press)

(A) Vegetable Sub-Sector

Daily intake of vegetables is almost compulsory. So, it is widely grown because of its value in terms of economical and nutritional value. Nepal's vegetable industry has experienced significant growth from long back due to population expansion, health consciousness, economic progress and increased spending power. This sub-sector has seen significant achievement in policy formulation, institutional development and technology advancement and knowledge transfer. There has been a substantial increase in area, production and yield of vegetables. Furthermore, there has been also a slight decrease in vegetable imports in fiscal year 2020/21 in comparison to last few years. Despite various approaches adopted in the vegetable sub-sector development, a focused strategy on inclusive commercialization is necessary to optimize investment for the growth of the vegetable sub-sector in the country (Ghimire et al., 2023).

The vegetable seed production in Nepal has seen a significant increase from 10 MT in 1975 to 1,050 MT in fiscal year 2016/17, which is parallel to the domestic seed requirement. This growth in vegetable seed production has resulted in a significant reduction in the seed requirement gap, although the projected gap in seed availability remains close to 50% (fig. 1).

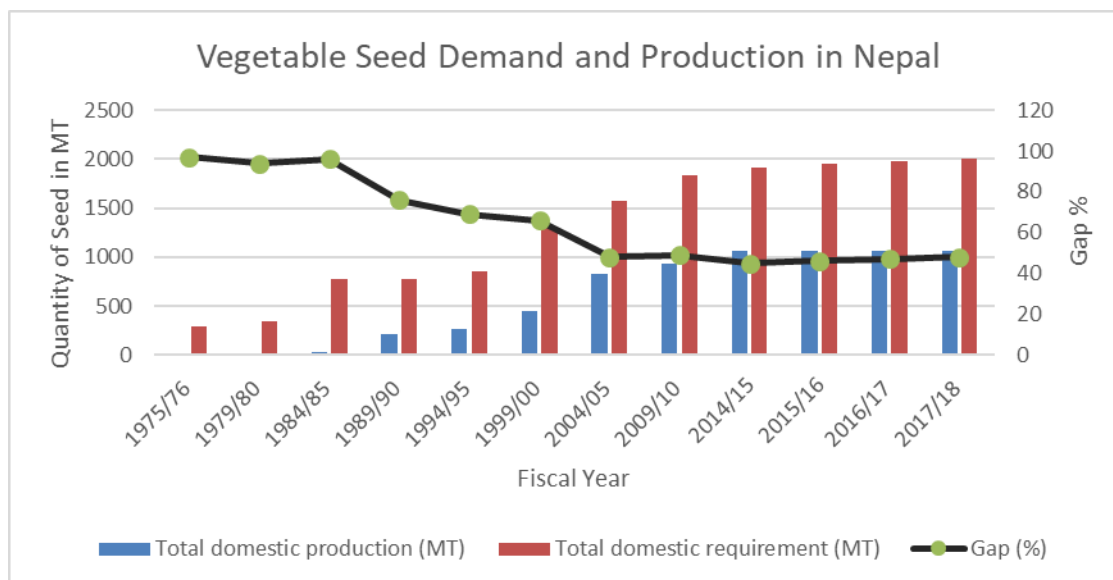


Figure 1. Vegetable seed demand and production in Nepal.

Source: I. R. Pandey / Comprehensive Insights in Vegetables of Nepal, 2021

(B) Fruits Sub-Sector

In the hilly area of Nepal, perennial fruits plantation play dynamic role like food and nutritional security, protects the soil against erosion, helps in environmental degradation etc. In the Fiscal Year 2020/21, total area covered by fruit crops was 177,568 ha, among which 128,733 ha (72.5%) area was productive area with total production of 1,356,218 MT and 10.52 MT/ha productivity. Total fruit production area was increased by 27.45%, whereas total production was increased by 31.7% and productivity was increased by 3.63% in past ten years. Total notified varieties of fruits till date are 20. Major problems in the fruit sector are of scientific orchard management, pest and disease and availability of quality fruit saplings in required amount. Citrus greening is one of the major devastating factor for the downfall of the citrus industry in Nepal. Lack of coordination with local level and provincial government has also caused the problem of irrelevant statistics of fruit sectors which directly influence in the policy formulation. Other major hindrance to develop fruit industry is lack of nursery regulations, inadequate post-harvest facilities and organized marketing. Use of healthy saplings from regulated nursery can be the major strategy for fruit development. In citrus, bud wood

certification may be one instrument. Similarly regular variety notification system for fruit crops should be implemented with focus on major fruits (Shrestha, 2023).

(C) Floriculture Sub-Sector

The pioneers of floriculture in Nepal are the *malis* or gardeners working in the royal palace and palace of the Ranas (Pun, 1997). Kathmandu is known as temple city of the world. Around the temple area flower were traded since long back. Modern floriculture in commercial scale began in 1955 after the establishment of Nepal Private Nursery and flowers and plants were available to general people (fanepal.org.np). Floriculture Association Nepal (FAN) was established on November 1992, a leading organization, with a view to organizing and promoting the floriculture business in Nepal (fanepal.org.np). At present floricultural activities are carried out in 48 districts out of 77 districts. There is 178 hectare of land under floriculture cultivation. All total 751 register nurseries are active in floricultural activity. About 44,000 human resources are directly or indirectly involved in floricultural activity with annual turnover of NRs. 2300 million (Gaire, 2023). In 2020/21, import of flower buds, bulbs, tuber, live plants, fresh cut flowers and fresh foliage was NRs. 38.61 crores, where export is negligible 1.95 million only (MoALD, 2022).

Table 5. Floriculture Scenario of Nepal

S.N.	Description	1992/93	2000/01	2005/06	2010/11	2015/016	2020/21	2021/22
1.	Number of nurseries	80	250	550	635	678	732	751
2.	Total land use (ha)			82	120	148	159	178
3.	Number of Districts	2	16	34	35	39	44	48
4.	Import of cut flowers (%)	95	20	20	20	30	28	50
5.	Number of cut flower show room in Nepal	0	33	58	86	87	97	137
6.	Floriculture business in Nepal (yearly transaction in NRs. crore)	1	7	23	90	151	163	230
7.	Yearly export (NRs. crore) TEPC Record		0.40	3.00	19.00	12.80	0.48	0.96
8.	Yearly import (NRs. crore) TEPC Record		0.18	0.15	1.11	6.00	38.00	36.00

Source: FAN, 2022

Import and Export Situation of Horticulture Commodity

Nowadays import of agriculture commodity is sky rocketing in the country. Increased and unplanned urbanization, small and multi land parcels, subsistence type of farming, youth reluctant to do agriculture business, unavailability of quality agriculture inputs, poor infrastructures and unstable government are the major issues for increase import of agricultural commodity. In the fiscal year 2019/20, vegetables of NRs.33.05 billion, fruits of NRs.20.74 billion, tea, coffee and spices of NRs.11.57 billion were imported. Similarly import of vegetables, fruits, tea, coffee and spices was NRs.38.50 billion, NRs.21.34 billion and NRs.9.49 billion rupees respectively in the fiscal year 2020/21. According to Department of Customs in last fiscal year 2021/22, vegetable and vegetable seeds of NRs.18.10 billion, fruits and nuts of NRs.24.99 billion, tea, coffee and spices of NRs.9.04 and fresh flowers and flowers propagating materials of NRs.0.33 billion were imported.

The export statistics of horticulture commodities observed are extremely in poor situation. In the last fiscal year 2021/22, large cardamom of NRs.4.81 billion, tea of NRs.3.43 billion, fresh and dry vegetables including yam and mushroom of NRs.0.77 billion, ginger of NRs.0.64 billion, coffee of NRs.0.11 billion and fresh flowers, flower propagating materials and turmeric in very limited amount was exported (www.customs.gov.np).

Organizational set up of Horticulture Research and Development (R & D)

Department of Agriculture (DoA), Nepal Agriculture Research Council (NARC) and Department of Food Technology and Quality Control (DFTQC) under the Ministry of Agriculture and Livestock Development (MoALD) are engaged in the research and development activities of horticulture sector in Nepal. After the federalism implemented in the country in 2015, provincial government and local level government are also responsible for the horticulture development. Under the Department of Agriculture the National Centre for Potato, Vegetables and Spices Crop Development (NCPVSCD) and the National Centre for Fruit Development (NCFD) are the apex body to look after horticultural activities i.e. vegetables sub-sector and fruits sub-sector respectively in the country and several horticultural farms are there across the country for production and distribution of quality seeds, saplings and technology transfer.

NARC is fully responsible for agriculture research. Crops, livestock and fisheries are the major component. For horticultural technology generation National Horticulture Research Center and National Commercial Agriculture Program is working. Similarly commodity programs like potato, citrus, ginger, coffee, six provincial level research directorate and three dedicated horticulture research stations are also involved for horticulture technology generation. Horticultural crosscutting issues are also taking consideration by crosscutting National centers.

Agro/Forestry Universities are the main actors taking responsibility to horticulture education. There are altogether seven universities involved in providing undergraduate and post graduate degree in Nepal. Around 31 colleges (17 constituent and 14 affiliated) offer B.Sc. Agriculture 4-year Program, most of them are the government colleges and some are private. One campus (Mahendra Ratna Multiple Campus, Ilam) providing B.Sc. Horticulture Program.

Challenges and Issues of Horticulture R and D

1. **Subsistent nature of farming:** Due to small land holding (<0.75 ha), fragmented land parcel small volume of produce, terrace land, unscientific land use system are the some reason of subsistent nature of farming.
2. **Youth are reluctant in agricultural business:** Out migration and interest to off farm business youth are not involved in agriculture. Cost of production is very high due to government policy and less investment, less use of farm machineries, unavailability of quality inputs, whole government system is not working well as expecting youth. So they are in foreign job.
3. **Weak Marketing System:** Weak marketing system of agriculture commodity is a major problem. A lot of activities were being implemented to agriculture research and development to increase the production but for systematic marketing is too much lacking. The marketing of perishable crops is so much sensitive issue of hilly country like Nepal where transportation facilities are not much favor to producers and traders.
4. **Poor Infrastructures:** For robust flourish of the horticultural business, infrastructures play vital role. For pre-production to post-production activities physical infrastructure like store, rustic store, cold storage, warehouse, working floor, road and transportation is minimal requirement.
5. **Weak Linkage and Coordination:** Research and developmental organizations and education providing agencies are in different chain of command. They are more interested to work solely. For commendable outcomes need togetherness in major issues among the concerned institutions. There is lack of strong commitment and leadership for the development of horticulture in the country. There is ineffective collaboration and coordination amongst the federal, provincial and local level government; among the public and private sectors; among the research, extension and education.
6. **Low Investment in Agriculture R and D:** Still 50 percent people are involved in agriculture and agriculture contributes about 24 percent in national GDP. But government is allocating only 2 to 3 percent of the national budget in this sector. For development of any nation private sectors role is very much crucial. Nepalese private sectors are more interested on trading of foreign goods and commodity rather than in country production. Investment of private sectors and financial institutions in agriculture sector is almost negligible.
7. **Climate Change and Biotic/Abiotic Factors:** Negative impacts of climate change have been seen in horticulture production. Emerging insect pests and diseases in horticultural crops have appeared. There is dominance of imported varieties in commercial horticulture.

Way forward

1. Hybrid variety development and increase the production of quality planting materials for commercialization.
2. Design, remodeling on protected and precision horticulture according to agro climatic zonation and need of the farmers.
3. Emphasis on organized marketing and post-harvest infrastructure development.
4. Innovation and adoption of hill farming mechanization for perennial and commercial horticultural crops.
5. Prioritize local biodiversity for commercial production program and explore niche based production potentialities.
6. All federal and provincial level horticulture farms and stations must develop as an excellent resource center where all types of propagating materials including technical knowhow available to the clients.
7. More research and development for climate resilience horticultural technologies.
8. Strengthen linkage and coordination among the Research Extension and education institutions in public private level.
9. Explore the areas of regional collaboration in common issues and challenges.

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