

# Emerging Fruits of Nepal: Pomegranate, Kiwifruit, Avocado, Dragon Fruit and Grape; Opportunities, Challenges and Ways Forward

Padma Nath Atreya<sup>1</sup>, Chandra Man Shrestha<sup>2</sup>, Basu Dev Suvedi<sup>3</sup> and Surya Prasad Pandey<sup>4</sup>

<sup>1</sup>Warm Temperate Horticulture Centre, Kirtipur, Kathmandu,

<sup>2</sup>Horticulture Centre, Faplu, Solukhumbu,

<sup>3</sup>Senior Horticulturists, Horticulture Entrepreneurs/Life member (NHS),

<sup>4</sup>Horticulture Soil Scientist, Horticulture Entrepreneurs

Corresponding author e-mail: atreyapadma@gmail.com

## Abstract

In this paper, a broad overview is provided for five emerging fruits namely pomegranate (*Punica granatum*), kiwifruit (*Actinidia deliciosa*), avocado (*Persea americana*), dragon fruit (*Hylocereus* spp) and grape (*Vitis venifera*) in the context of Nepal. These fruits are increasingly gaining interest among farmers for commercial fruit farming in recent years. Pomegranate although a long acquainted fruit among the Nepalese consumers and potential commercial fruit, has not been well successful in large plantation due to mainly plant protection obstacles. It can be cultivated from terai to mid hill of Nepal. Commercialization of Kiwi fruit started from Kabhre district 15 years ago. It is now rapidly spreading across the cooler mid hill region. Avocado has found hot hob in Dhankuta district and is spreading across the mid hills from east to west. Commercial plantation of dragon fruit also started from Kabhre and spreading to warmer regions of both eastward and westward. Grape can be cultivated from Terai to high hill of Nepal and it's both table and wine variety getting popularity among consumer. All of the above emerging high value fruits look very potential under our soil, geographical and climatic conditions However, the responsible agricultural research, education and development organizations are found still shy. Commercial farming of the above-mentioned emerging fruits could bring immense opportunities for the prosperity and happiness of the poor Nepalese farmers; however, there are several challenges that are to be solved to harness the opportunities.

**Keywords:** *Eerging fruits, High value fruits, Hilly region, Commercialization*

# 1. INTRODUCTION

## 1.1 Background Information

### I. Pomegranate:

Pomegranate (*Punica granatum* L.) is an emerging fruit crop in Nepal (Atreya, 2014b). It is originated in Iran. Its major producers are Afghanistan, Iran, Saudi Arabia, India, Palestine, China, Africa, Italy and America. It has more than 760 varieties in the world (Mahammad et. al., 2019). It has anti-oxidative and cholesterol dropping properties. It prevent from cardiovascular diseases and reduce blood pressure, diabetes, body stress, anaemia, diarrhoea (Stover and Mercure, 2007). It can be cultivated from 500 to 1500 masl (Atreya, 2013), plants are typically deciduous in subtropical region and evergreen in tropical region (Singh et. al., 2006).

It is well adapted to Mediterranean environments with cool winters and hot summers, but can be grown in the humid tropics or subtropics and well thrives on drought condition (Atreya, 2014a). Its versatile adaptability to a wide range of climatic conditions, hardy nature, low water requirement, good response to high tech-horticultural practices high yield, returns on investment higher than many crops of dry regions, magical therapeutic values and increasing demand for table and processed products as well as high export potential has made pomegranate a popular fruit of tropical and subtropical regions (ICAR, 2014).

### II. Kiwifruit:

Kiwifruit (*Actinidia deliciosa*) is an emerging fruit crop in Nepal. It is originated in China and commercialization from New Zealand. It is popular and fast growing fruit crop in mid hills and high hills of Nepal. Many organizations played important role for the introduction and development of Kiwifruit in Nepal. First

introduction of kiwifruit was by Mr. J F Messy, road engineer who worked in SDC Project 1986 AD Charikot Dolakha (Shrestha, 2013) and transplanted in Charikot and Jiri Technical School. Next JICA Nepal funded Hill fruit development project 1987 introduced kiwifruit and planted in Horticulture farm (Kirtipur), Horticulture farm (Daman) and Kakani farm (Nuwakot). ICIMOD knowledge park Godavari Lalitpur (1998) plays very important role for the extension of kiwifruit in the country. Commercialization started when they demonstrate kiwi farm and produce saplings and distributed to the farmers of Kavre, Ilam and Dolakha district. Government farms such as Dolakha, Kirtipur, Solukhumbu and Daman started to produce saplings and training for the extension of kiwifruit in the hill areas of the country. Commercial kiwifruit growing started since 2009 AD in Nepal. Its major producer countries are China, Italy, New Zealand, Australia etc. Production and consumption of kiwifruit has been increasing every year in the world as well as in Nepal. Area and production increases due to its high economic importance and consumption increases due to its high nutrition value and high health benefit. Kiwifruit grown well at an altitude of 1200 m. to 2400 m. in the hills of Nepal. The total area coverage by kiwifruit is 551 ha and production reached 719 mt. (MoAD, 2017). Market is the major concern for the kiwifruit growers. Due to its high fruiting habit and more economic importance, area and production increases every year and plays important role for the substitution of fruit import in Nepal. It seems best alternatives for fruit growers in the hilly region of Nepal. Province government as well as local government prioritize to cultivate and support for this fruit. There is high demand of kiwifruit sapling for commercial kiwifruit production.

### III. Avocado:

The avocado (*Persea americana*), probably originated in South Central Mexico, is belongs

to the family Lauraceae. It is also known as avocado pear or alligator pear. Avocado fruit is botanically a large berry with a single large seed. Avocados are commercially cultivated in tropical and Mediterranean climates throughout the world. It possess green-skinned and fleshy body and is climacteric in nature. It content 20 essential nutrients, including fiber, potassium, vitamin B, E, folic acid and possess 200 calories on 100 grams of fruits (OFN, 2019). Avocado trees are partially self-pollinating, and are often propagated through grafting to maintain predictable fruit quality and quantity. In Nepal government introduced avocado in 1979 AD (BS 2035) at Trisuli, Kirtipur and Sarlahi horticulture farm with five known varieties Hass, Fuerte, Ettinger, Reed and Topa topa. After that Pakhribas Agriculture Research Centre. Research officials and tourists from the UK had brought avocado to eat during their visit to Nepal. Introduction of avocado also continued by Nepalese visitors from abroad therefore we can get many varieties if we visit the private compound of Kathmandu valley and other cities. Dhankuta district is leading in Avocado farming but not yet commercialized. Due to its popularity, the local government has declared Dhankuta, as an avocado capital, In Dhankuta, avocado farming has become a key income generating sector. Currently Dhankuta possess around 3700 bearing trees and more than 26,000 saplings were planted in last few years. Annually Dhankuta produce around 80 tons of avocado fruit and a lot of saplings (Adhikari, 2018).

Till the date, very little farmers know the avocado and are further interested with this fruit and thinking to expanse its area with commercial farming approach. Commercial avocado farming is not very difficult it requires heavy organic manure, application of nitrogen and other necessary nutrients on soil.

#### IV. Dragon fruit:

Dragon fruit (*Hylocereus* spp.) is a tropical and subtropical semi-epiphytic climbing cactus native to Central America (Le Bellec et al., 2006). The genera *hylocereus* include mainly three cultivated species; *Hylocereus undatus* (red skinned & white fleshed), *Hylocereus polyrhizus* (red skinned & red fleshed); and *Hylocereus megalanthus* (yellow skinned & white fleshed). Dragon fruit is now widely cultivated in Southeast Asia, mainly in Thailand and Vietnam, as export fruit commodity and is increasingly gaining interest in Nepal. The white fleshed dragon fruit (*Hylocereus undatus*) found its way into Nepal from Vietnam through an American engineer working in Nepal in 2000 AD. Its commercial plantations started only after 2014 BS in Kabhre district (Rai, 1960). With the satisfactory results of these commercial farms, quite a number of farmers from various corners of the country have started plantations of white fleshed as well as red fleshed cultivars on trial basis in small scale or even on commercial scale (a total of about 8-10 ha) by a few enthusiastic persons including ex Minister Mr. Lokendra Bist in Dang district. This way, now dragon fruit is becoming an exciting new fruit crop for warmer region of the country. However, the government agricultural research and development organizations of the country are found still shy. Dragon fruit has very attractive look particularly on ripe. The pulp is juicy and contains small black seeds similar to that of kiwi fruit. It is also a potential source of micronutrients, and antioxidants (Ariffin et al., 2009). Morphologically, *Hylocereus* species are cactus species with greenish long stems having spines at margins. The stems are typically 3 sided/triangular shaped with multiple branches. It flowers at night and so called queen of the night. The size of the fruit is variable weighing in an average of 300-800 g (Mohd, 2010).

Dragon fruit is a semi-epiphytic plant which prefers a dry tropical and subtropical climatic

conditions with an average temperature 21-29°C, but can withstand temperature of 38-40°C and freezing temperature as low as 0°C for short period. It requires good sunshine and annual rainfall of 600-1300 mm with alternate wet and dry seasons (McMahon, 2003). It can propagate by seeds as well as cuttings. For commercial planting cuttings are preferred. The fruit is normally planted with vertical support of wood, iron or cement concrete poles. The fruit harvest can be achieved after 1-2 years of plantings (FAO, 2004). The fruit matures after 40-45 days of fruit set when colour changes from green to red/yellow. Dragon fruit can be stored for 25-30 days at 4°C but it can last 10 days at room temperature (Zee et al., 2004). The dragon fruit is a high yielder and fast return fruit crop with production in the second year of planting and full production start in five years. Its productive time lasts for 20-25 years. The average yield of dragon fruit is reported 44-65 tons/ha/year in Thailand; 50-80 ton/ha/year in Vietnam. However it is very low 16-27 tons/ha/year in Taiwan (Liaotrakoon, 2003). In Nepal, the yield data are not yet established; the initial second/third year yields were about 8-10 tons/ha/year from Durga Devi Farm in Temal, Kabhre (Pandey, 2020).

## V. Grape:

Grape (*Vitis vinifera*) is one of the very popular fruit crop in the world and it can be cultivated in tropical, subtropical and temperate region (Reddy, 2016). It belongs to the Vitaceae family, originated in Western Asia and Europe (Wium, 2008). Two popular species of grape i.e. *V. vinifera* and *Muscadinia* are cultivated out of which *V. vinifera* is commercially grown species and is originated from central part of Asia (Atreya et al., 2016/17). Commonly, vineyard suitability are based on topographic (elevation, slope, aspect) soil (soil texture, soil pH, and soil drainage) and climate variables (daily maximum and minimum temperatures,

precipitation, extreme minimum winter temperature, and growing degree days) (Boyer and Wolf, 1998; Brooker and Gray, 1990). There are some Japanese grape varieties (Himrod, Stuben, Kyoho, Buffalo, Delewar, Muscat Belly A, Rey Olympia, Black Olympia and etc) being cultivated at Warm Temperate Horticulture Center, Kirtipur (WTHC, 2019). Quantitative and qualitative growth in demand of wine shows a very promising scope for local farmers (Acharya and Yang, 2015). Grape was introduced by Janakpur Agriculture Development Project (JADP) during 1980 by cultivating Thomson Seedless, Perlette, Delaware, Campbell Early, Stuben, Olympia, Kyoho.

## 1.2 Production status in Nepal

The total area, productive area, production and productivity of pomegranate is 704 ha, 484 ha, 2881 mt, and 6 mt./ha. (NCFD, 2019). The highest total area coverage was found in Province no 1 (357 ha) followed by Bagmati Province (110 ha), Sudur Paschim (108 ha), Karnali (59 ha), Gandaki province (48 ha), and Province no 5 (23 ha). Similarly highest and lowest production was recorded in Province no. 1 (1581 mt) and Province no 5 (96 mt). (NCFD, 2019). Among the kiwifruit producing district Dolakha has more area (200 ha) covered by kiwifruit and Ilam district produced highest production (990 mt).

**Table 1:** Area, Production and Productivity of Pomegranate and Kiwifruit (2017/18)

Province/ Fruits	Total area (ha)		Productive area (ha)		Production (mt)		Productivity (mt/ha)	
	Pome	Kiwi	Pome	Kiwi	Pome	Kiwi	Pome	Kiwi
Province No 1	357	338	261	114	1581	1127	6.0	7.8
Province No 2	0	0	0	0	0	0	0.0	0
Bagmati	110	532	62	158	373	972	6.0	6.1
Gandaki	48	42	39	13	215	68	5.6	5.2
Province No 5	23	19	17	6	96	18	5.8	3.3
Karnali	59	7	26	1	152	2	5.9	1.5
Sudur Pashchim	108	11	79	1	464	1	5.8	0.8
<b>Total</b>	<b>704</b>	<b>949</b>	<b>484</b>	<b>322</b>	<b>2881</b>	<b>2188</b>	<b>6.0</b>	<b>6.8</b>

[Note: Pome: Pomegranate and Kiwi: Kiwifruit]

Source: NCFD, 2019

Production of both pomegranate and kiwifruit initiated in hilly districts of all provinces except terai districts of province no. 2. The real area under avocado and dragon fruits are still not known but Dhankuta district is leading in avocado farming but yet to be commercialized. Due to its popularity, the local government has declared Dhankuta, as an avocado capital. Dragon fruit cultivation started from Kabhre district and Bagmati is leading province among all seven in dragon fruit cultivation. The total area and productive area, production and productivity of grape is 20 ha, 8.5 ha, 76 mt, and 9.9 mt/ha respectively (Atreya et. al., 2016/17).

**Table 2:** Area, Production and Productivity of grapes (2016)

Development Region	Total Area (ha)	Productive area (ha)	Production (Mt)	Productivity (Mt/ha)
Eastern	10	3.5	28	8
Central	3	1.5	15	10
Western	5	3	27	9
Mid Western	0.5	0.1	1	10
Far Western	1.5	0.4	5	12.5
<b>Total</b>	<b>20</b>	<b>8.5</b>	<b>76</b>	<b>9.9</b>

### 1.3 Import and Export situation

These emerging fruits are very new for both producer and consumers of Nepal. Now a days there fruits getting popularity in our market. Major department store and super market of major cities have been found these fruits. Import data of these fruits have not found well recorded. Market survey shows that most of the avocado fruits imported from Thailand and South Africa, kiwifruit (Hayward) from Italy, Chile and New Zealand via India while most of pomegranate and grapes were imported from India. During the year of 2010/2011, the total import of pomegranate fruit was 1454 mt (NRs 14 crores) (Atreya, 2014b). According to Raising Nepal (2019), major portion of pomegranate import from India. Market price of kiwifruit during the year of 2014/15 AD, was expensive and beyond the access of local consumers as most of the produce goes to the big cities like Kathmandu, Pokhara,



Biratnagar and etc. with target and specific consumer After some years continuous fall down of kiwifruit price due to increase in production and supply. According to MoALD (2016) total import of kiwifruit is 1200 kg with the value of NRs. 57000. According to KFVMD (2020), the price of fresh kiwifruit up to NRs 500/kg was obtained by farmers this year 2076/77 BS (2019/20 AD) while it was NRs 1200/kg during 2072/73 BS (2015/16 AD). The price of avocado is NRs 450/kg in Chaitra, 2076 BS (March, 2020) while it was recorded only NRs 70/kg during 2076 BS (Feb, 2015). This condition may not last long and to find actual situation a market research is needed.

## 1.4. Major Varieties

Name of the fruit	Variety
1. Pomegranate	Bedana, Kandhari, Paper Shell, Muscat Red, Ganesh, Mridula, Safeda, Spanish Ruby, Red Dyana, Bagwa, Local variety (Darim)
2. Kiwifruit	Female line: Hayward, Abbott, Allison, Bruno, Monty, Soyou Male line: Tomori, Matua, Khohi
3. Avocado	Hass, Fuerte, Ettinger, Reed and Topa topa
4. Dragon fruit	Two types: white fleshed (Vietnamees) and pink fleshed (Malasian, Indian and others) but specific variety were not recorded officially.
5. Grape	Himrod, Stuben, Campbell Early, Muscat Belly A, Kyoho, Red Olympia, New Muscat, Thompson Seedless

**Source:** ICAR, 2014; Atreya, 2019; Liaotrakoon, 2003; Atreya et.al., 2016/17, Pandey, 2020

## 2. Opportunities, Challenges, and Ways forward

### 2.1 Opportunities

- Availability of diverse climatic condition suitable for cultivation of these emerging fruits (like pomegranate, kiwifruit, avocado, dragon fruit and grape).
- Pomegranate, avocado and dragon fruit can be cultivated from terai to mid hill, Kiwifruit can be cultivated throughout the mid hill region while grape can be cultivated from terai to high hill of Nepal.
- Pomegranate and dragon fruit could be cultivated in dryland areas under tropical/subtropical climatic conditions in Terai, Chure-bhabar zones, river basins and foothill slopes of Nepal
- High value fruit crop.
- Availability of market and fetch good price throughout the year.
- Its consumption is ever increasing due to high nutritional as well as medicinal value and health awareness among consumers.
- Due to its productivity potential and use in food industries/fresh fruit, kiwifruit and dragon fruit has a great potential with good economic return and thus can be a profitable commercial enterprise to venture.
- Very high possibility for import substitution and export promotion.
- Well thrives on adverse climatic condition (pomegranate and dragon fruit).
- High scope for entrepreneurship development and employment opportunities.
- Short payback period even 3-4 year we can produce quality fruit by using grafted plants.
- It can generate on farm as well as off farm employment and are popular among

commercial growers in Nepal.

- These crops could be used as raw materials for food processing and beverages industries.
- Could be a good crop candidate for poverty reduction of small farmers in rural areas of Nepal.

## 2.2 Challenges

- These all are new fruit crops in our context thus lack of commodity based technology in hand.
- Expansion of area is dominated by unknown seedling varieties and it would be a big problem for tomorrow.
- Lack of area specific high yielding variety, quality grafted saplings and awareness about flowering habits.
- High initial investment around Rs 100,000 per ropani (dragon fruit) and even more in kiwifruit and grape; small farmers need institutional and financial support for that.
- Uncertainty of market, internal and international competition is very high for all crops.
- Appropriate cultivars and management technologies not yet matured in the country and thus may lead low yield and return.
- Commencement of rainy season during harvesting time of grape is one of the major challenge for grape producer.
- High risk of fruit flies and diseases (dragon fruit and red kiwi fruit), though not yet serious.
- Attack of fungus in root and fruit is common in avocado fruit.
- Lack of awareness about its nutritional as well as medicinal values of above mention fruits.
- Poor research backstopping and lack of resource centre under DoA and NARC.
- Less priority in all research, education and extension (REE), government research

and development agencies not proactive.

- Fruit borer and pomegranate butterfly are great challenges among pomegranate growers.
- Challenge to develop and adopt pre-harvest and post-harvest technology in pomegranate at government level as farmer went far ahead.
- Lack of processing industries and postharvest technology in all above mention emerging fruit crops.
- Lack of storage and transportation facility along with poor marketing network establishment.
- Poor research backstopping and lack of resource centre under DoA and NARC.

## 2.3 WAYS FORWARD

- Keep these emerging fruits as priority crop by all government institution (REE).
- Selection and development of area specific variety for those crops.
- Develop resource centre at government farm both under research and extension wings.
- Specify and focus some potential districts for those fruits for commercial farming.
- Identify marketable variety mother plants and produce quality saplings.
- Practical training and interaction workshop, support/regulate quality planting materials and farmers trainings for the promotion emerging fruits.
- Use disease free and healthy grafted saplings instead of seeded plants.
- Manage technical manpower working environment, increase specialization.
- Promote postharvest technology and processing training for all.
- Strengthen storage facility, transportation facility and marketing network for its proper development.
- Increase processing industries such as

wine, brandy, jam, juice of these fruits.

- Increase institutional network for its marketing and overall value chain development.
- Integrated approach in orchard management including production, processing, marketing as well as research, education and development is urgent need.
- Immediate initiation of needful research.
- Ban/regulate import of fruit and saplings that may carry insects and disease threat related to those crops.

### 3. CONCLUSION

There is great scope of those emerging fruits (pomegranate, kiwifruit, avocado, dragon fruit and grape) production in Nepal due to availability of diverse agro ecological region as well as its high nutritional and medicinal importance. Having great export potentiality of these crop we need to develop crop specific technology to boost up its area, production and productivity. Thus we need to facilitate farmer to use of improved varieties/hybrids, quality planting material, high density planting, micro irrigation system, fertigation, integrated disease and insect pest management etc. have made pomegranate cultivation, a feasible commercial venture in future. These fruit has attracted attention of mankind since the arrival of mankind on this earth - earlier due to its magical therapeutic use and now due to alluring returns as well as consumer awareness towards its innumerable benefits. Local government and private sectors started to support for this fruit promotion. Thus we need to facilitate farmer to use of improved production technology and marketing facilities. There is a great potentiality for commercial cultivation of these emerging fruits which can contribute to achieve the national goal of prosperity and happiness of the Nepalese

people. The way forward should be to remove those constraints which are hindering to expand cultivation of these commodities by involving farmers, research, development and educational institutions appropriately.

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