

**Study Report on Status of Sweet-orange  
Cultivation and Processing Industries  
in Sindhuli District**

**Government of Nepal  
Ministry of Agriculture and Co-operatives  
Department of Agriculture  
Agribusiness Promotion and Marketing Development Directorate  
Agribusiness Promotion Program  
Chaitra, 2068**

## **Foreword**

Horticultural crops are of great importance for increasing the share of agriculture in Gross Domestic Product of the country. Commercialization of high value and low volume crops farming in the country is getting momentum at present. Agriculture Perspective Plan (APP) launched since 1995 with a view to develop overall economy and thus alleviate poverty have also emphasized citrus as high value crops throughout the midhills. Majority of the farmers are switching from the farming of agronomic crops to the horticultural crops. In this aspect, Sweet-orange farming is gaining popularity among the farmers of mid-hills of Nepal. Though farmers are trying to be commercial, there is lack of sufficient research and experiment in the Sweet-orange farming and processing.

This study, therefore, aims to collect the basic information on the Sweet-orange farming, its cultivation practices, marketing system and the scenario of processing industries.

I would like to thank Ms Sanju Rimal, Agriculture Economist for her overall efforts in bringing this report into this shape. I would also like to thank Mr. Ramraj Paudel, Agriculture Economist, Mr. Prakash Prasad Dhungel, Agriculture Economist and Mr. Birad Siku Shrestha, Technical Assistant for primary data collection.

I hope that this report will help in getting knowledge about the Sweet-orange cultivation practices and the situation of the processing industries of Sindhuli district. And, I really appreciate the valuable comments and suggestions from the readers toward this report.

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## **Acknowledgment**

Field survey is an important tool of research. With the field survey only, we can identify and develop appropriate and advanced processing system for any commodity. In this context, field study of cultivation practices and processing of **Sweet-orange** was carried out as per the program of Agribusiness Promotion Program (ABPP) for the fiscal year 2068/069. This study report is an attempt to provide information on the existing farming system and processing system of Sweet-orange in the Sindhuli district.

For this, we are very grateful to many individuals and organizations for extending their kind and valuable supports towards the successful completion of this study.

At first, we would like to express our deep gratitude to Mrs. Roseleen Maharjan, Chief, Agribusiness Promotion Program for offering us this opportunity and valuable suggestions during the study.

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Finally, the team would like to thank all Agribusiness Promotion Program staffs for creating conducive environment for the study. And, we really admire and appreciate the valuable feedbacks from the readers which will help in further improvement of the report in future.

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# **1. Introduction**

## **1.1 Background**

Agriculture sector has been considered the most important sector in Nepalese economy. Agriculture has become a way of life for about 65% of the people. This sector is contributing nearby 36% to the GDP (CBS,2012). Moreover, horticulture contributes 14 percent to the total agricultural gross domestic Product (AGDP). Agricultural diversification and commercialization have drawn attention of the planners and policy makers in terms of generating more income, employment opportunities and biodiversity conservation. The cultivation of high value and low volume crops and optimum utilization of the available resources for production, processing and marketing operations has been conceived for the sustainable development of the nation.

A twenty years Agriculture Perspective Plan (APP) was implemented since 1995 with a view to develop overall economy and thus alleviate poverty. High value Crops emphasized under APP were a) apple in the inner Himalayan zone, b) citrus throughout the midhills, c) off-season vegetables in the hill as well as terai, d) vegetable seeds in the hills and mountains. Nepal being rich in climatic diversity, we have wider scope for the production of various types of fruits and vegetables. Horticultural crops can contribute in food security, improve nutritional status, provide employment opportunities, increase income and thus increasing the overall GDP of the country.

The mid-hill region of Nepal ( 1000 meters to 1500 meters altitude) has a comparative advantage in the cultivation of citrus fruits. Compared to the traditional food grain crops like maize, wheat, rice, citrus farming has been found much more profitable.

The area under citrus fruits cultivation in Nepal is 30,790.3 hectare with total production of 2,27,070.62 metric tons. The productivity of Citrus is calculated to be 11.36 metric ton per hectare. Citrus alone contributes about 35.21 percent of the total fresh fruits production of the country (Horticulture Development Programe, 2064/65). During fiscal year 2065/066, 74.23 metric tons of citrus fruits was imported in Nepal, despite the fact that we have climate as well as land topography very much suitable for citrus cultivation. Mandarin orange as well as Sweet-orange produced in Nepal has been proven of best quality. Thus there is need to explore the potentiality of citrus cultivation in Nepal for export promotion as well as import substitution.

## **1.2 Rationale of the study**

There is growing demand for fresh fruits as a result of increased consciousness of the people towards their health. Also the demand of juice, jam, jelly, marmalade is increasing as a result of urbanization and tourism industries in Nepal. These increased demand of fresh as well as processed products are being fulfilled by importing these items in large quantities from India, China and other countries. Mid-hills of Nepal is very suitable for quality citrus production. On the other hand, citrus fruits like sweet-orange, mandarin orange are perishable in nature with higher post-harvest losses. Thus, it is necessary to establish and explore sweet-orange processing industries for import substitution as well as reducing post-harvest loss. In the viewpoint of import substitution, fetching of good price and reduction of the postharvest loss, establishment of Sweet-orange processing industry is must, and for this concerned matter, the Agribusiness Promotion Program has taken a self-effacing effort to vitalize the situation.

## **1.3 Objective of the study**

The objective of the study was to explore the feasibility of Sweet-orange processing industry in Nepal which will facilitate the entrepreneurs to establish Sweet-orange processing industry in Nepal. The specific objectives of the study were:

1. To identify the pocket areas of the Sweet-orange in Sindhuli district.
2. To observe the existing farming and processing practices adopted by the farmers.
3. To observe the status of processing industries.
4. To identify the problems and constraints faced by the farmers.
5. To observe the existing marketing system and market linkages.

## **1.4 Scope of the study**

The study was focused to reveal the existing production practices, marketing system and processing patterns on the production pockets of Sweet-orange in Sindhuli district. Following are the details of the scope of work:

- Collect, compile and review available primary and secondary data/information
- Develop data collection tools, primarily interview schedules, checklists and questionnaires
- Develop survey methodology

- Identify chain actors—from input suppliers to processor
- Availability of service providers and their linkage/relationship
- Key constraints and opportunities to the processor
- Possible solution to key constraints for the processing professional

## **1.5 Study Area**

The study was conducted in the potential Village Development Committees (VDC) of Sindhuli district. The VDCs were selected jointly by District Agriculture Development Office, Sindhuli and Agribusiness Promotion Program, Hariharbhawan, Lalitpur. Selected VDCs are as follows :-

- a) Ratanchura,
- b) Tinkanya,
- c) Jalkanya, and
- d) Baseswor .

## Map of Sindhuli District





## **2. Methodology**

Agribusiness Promotion Program adopted a holistic approach during this study period. Consultation with District Agriculture Development Office, Agriculture Service Centre, farmers, traders, processors, Market Management Committee, was done during the collection of primary as well as secondary data.

Potential pockets of Sindhuli were selected after consulting with DADO. Selected VDCs were Ratanchura, Tinkanya, Jalkanya, and Baseswor .

ABPP has developed two types of questionnaire for conducting survey; farmer's level questionnaire and processor level questionnaire. Sample farmers and processors from the selected VDCs were selected on the systematic random sampling basis. The questionnaire was then administered to 50 farmers and 4 processors. Survey team also collected information through Video recording.

Survey data analysis was done using MS Excel as well as Statistical Package for Social Science (SPSS). Adobe Photoshop CS5 was used in editing graphics and report writing was done using MS Word.

### **3. General description of the production area**

Sindhuli district lies in Janakpur zone of the Central Development Region of the Country. It is surrounded by Udaypur and Siraha in east, Rautahat and Makawanpur in west, Ramechhap, Kavrepalanchowk and Okhaldhunga in north and Dhanusha, Mahottari and Sarlahi in south. This district lies between the latitude 26°55"- 27°22" north and Longitude 85°25"-86°15" east. Altitude of the district varies from 168 meters to 2797 meters above sea level. The total area of the district is 249100 ha. Kamala, Marin, Gwang are the major rivers in the district. This district is divided into three topographical ranges– i) Mahabharat range, ii) Chure range and iii) Inner terai and plain. Politically, Sindhuli district is divided into 3 constituencies and 13 Ilakas. There are 53 VDCs and one municipality named Kamalamai . 64.66 % land is covered by forest in Sindhuli district. Climate of Sindhuli district is subtropical and there is ample climate for cereal farming in inner terai area while the hill area have suitable climate for Sweet-orange.

25.17 percent of total area,i.e. 62713 ha is the total cultivable land of the district. Out of this total cultivable land, 49789 ha (79.39 % of total cultivable land area) is being cultivated. 8832 ha(17.73 % of total cultivated land area have year round irrigation facility, 5872 ha (11.79 % of total cultivated land area)have seasonal irrigation facility, while 35085 ha (70.46 % of total cultivated land area) lacks irrigation facility ( DADO Sindhuli, 2010). The mean monthly temperature is about 6-7°C in January and about 31°C in June (DADO,2010). Average annual rainfall of Sindhuli was recorded to be 297 mm with maximum rainfall being 1116 mm in July and minimum rainfall being 0 mm in December in the FY 2066/067 (DADO,2010).

The population of this district is 294621 as per the census of 2068 B.S. (2012 A.D.). Main profession of the residents in this district is agriculture. Main residents of this district are Bramhin, Chhetri, Rajbanshi, Limbu and Rai etc.

District Agriculture Development Office was established in Sindhuli in 2023 B.S. and has six Agriculture Service Centre and two liaison centre.

## 4. Result and Discussion

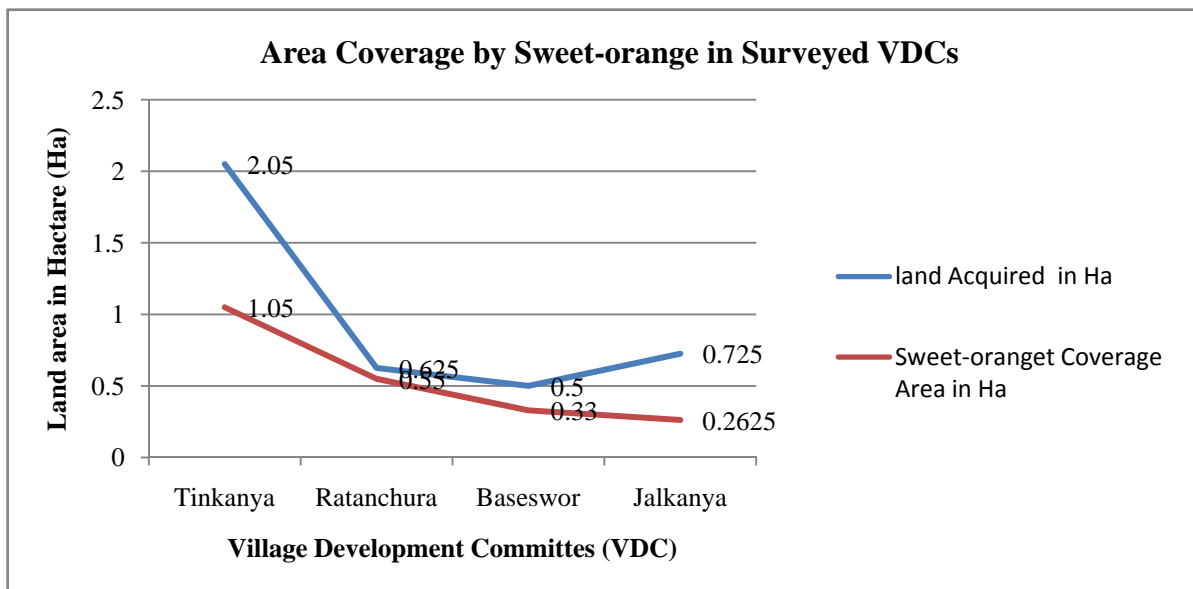
### 4.1 Socioeconomic status

The survey indicates that the area under Sweet-orange cultivation in each sampled household averaged 1.05 ha in Tinkanya, 0.55 ha in Ratanchura, 0.33 ha in Baseswor and 0.26 ha in Jalkanya VDC (See Table 1).

Table 1: Area, Fruiting and Non-fruiting Plants of Sweet-orange

S.N.	VDC	land Acquired in Ha	Sweet- oranget Coverage Area in Ha	No. of Fruiting plants	No. of Non Fruiting Plants	Total Plants	Total Prodn (Mt)
1	<b>Tinkanya</b>	2.05	1.05	212	103	315	25.44
2	<b>Ratanchura</b>	0.625	0.55	138	27	165	16.56
3	<b>Baseswor</b>	0.5	0.33	76	24	100	9.12
4	<b>Jalkanya</b>	0.725	0.2625	62	16	78	7.44
<b>Total of the Surveyed VDC</b>		3.9	2.1925	488	170	658	58.56

*Source: Field survey*



The survey reveals that a farm household cultivating Sweet-orange on an average harvested 25.44 metric tons in Tinkanya, 16.56 metric tons in Ratanchura, 9.12 metric tons in Baseswor and 7.44 metric tons in Jalkanya VDCs. Out of the surveyed VDCs, the lowest average production was found in Jalkanya VDC while the highest average production was observed in Tinkanya VDC.

In the whole Sindhuli district, there were all together 1077.5 ha. land covered by Sweet-orange cultivation. Among this area, 565.5 ha. land have productive Sweet-orange trees that yield 6868.25 mt. fruits. The Tinkanya VDC has highest area under Sweet-orange trees followed by Ratanchura, Baseswor and Jalkanya (A report by OVOP Programe, Sindhuli).

## 4.2 Existing Farming Practices

Sweet-orange is one of the major source of income in Sweet-orange growing area of Sindhuli. The Sweet-orange growers of Sindhuli district were found cultivating Sweet-orange since 40 years. Some were found to continue Sweet-orange cropping as they inherited Sweet-orange orchard from their parents. Whereas, some farmers were found to be newly involved in Sweet-orange cultivation. The Sweet-orange cultivation in Sindhuli district is an age old practice and generally used to sell for income generation instead of home consumption. Sweet-orange fruit is commonly used for fresh consumption.

In Sindhuli district, Sweet-orange fruit have found cultivated semi intensively. Cropping pattern include Sweet-orange and other cereal and legume crops. Inter cropping with finger millet, chilly, was found practiced by farmers.

**a) Climate:**

Citrus fruits grow best between a temperature range of 13°C to 37 °C. Temperatures below – 4 °C are harmful for the young plants. Soil temperature around 25 °C seems to be optimum for root growth. High humidity favours spread of many diseases. Frost is highly injurious. Hot wind during summer results in desiccation and drop of flowers and developing fruits. Barring these limitations citrus is grown in all subtropical and tropical areas of the world. The sub-tropical climate is best suited for citrus growth and development.

For good and excellent quality fruit production, Sweet-orange preferably require :

- arid and dry conditions,
- a distinctive summer and winter season,
- wide variation between day and night temperatures,
- low rainfall below 750mm.

Fruits produced under high humidity and heavy rainfall have thin and smooth skin, abundant juice but poor keeping quality.

In Nepal, sweet-orange is grown in a subtropical climate (submountaneous areas), ranging from 750to1400masl, with an annual rainfall of 750-2500mm.

**b) Soil**

Sweet-orange orchards flourish well in light soils with good drainage properties. Deep soils (2-3 m deep) with pH range of 5.5 to 7.5 are considered ideal. However, they can also be grown in a pH range of 4.0 to 9.0. High calcium carbonate concentration in feeder root zone may adversely affect the growth. So, extreme soils are to be avoided. Even heavy soils with much organic matter and provision of good drainage is suitable.

**c) Planting Material**

Availability of quality planting material is of utmost importance in citrus cultivation. Citrus plants are very sensitive to various biotic and abiotic stresses. Therefore selection of an ideal rootstock is a continuing challenge for the citrus industry.

Primary nursery beds are prepared on light fertile soils or in the trays under shade net structures. Selection of nucellar seedlings is done by eliminating weak seedlings, off types and non uniform seedlings in 2-3 stages in the nursery beds. Secondary nursery seedlings may be raised in polythene bags also as they become ready for plantation in the main field after attaining the height of about 30-40 cm after one year.

Majority of the farmers of sindhuli brought sapling from Local private nursery as well as DADO.

**d) Land preparation**

Land needs to be thoroughly ploughed and leveled. In hilly areas, planting is done on terraces against the slopes and on such lands, high density planting is possible as more aerial space is available than in flat lands. Since sweet-orange trees are highly sensitive to water logging and water stagnation during rainy season providing drainage channels of 3-4 feet depth along the slopes around the orchard is essential.

In Sindhuli, pit of 1.5m X 1.5m was dug one month prior to the sapling plantation. Pit was then filled with compost/FYM. The distance between two pits is generally 5m.

**e) Plant density**

For Sweet orange, normal spacing is 5 m x 5 m or 5.5 x 5.5 m with plant population being 400/330 per ha

In light soils, spacing can be 4.5 x 4.5 m or 5 x 5 m.

**f) Planting**

The best season of planting is June to August. Pits of the size of 75 cm x 75 cm x 75 cm may be dug for planting seedlings. 15-20 kg of FYM and 500 g of super phosphate is applied per pit while planting. With good irrigation system, planting can be done in other months also.

Planting is done during rainy season, ie Jestha-Ashad.

**g) Irrigation**

Sweet-orange requires critical stage watering in the initial year. It further reduces fruit drop and increases the fruit size. Diseases like root rot and collar rot occur in flooded conditions. Light irrigation with high frequency is beneficial. Irrigation water containing more than 1000 ppm salts is injurious. Quantity of water and frequency of irrigation depends on the soil texture and growth stage. Micro irrigation systems not only saves water and nutrients but also ensure good retention of fruits during crucial stages of crop growth in March – April even in situations where water is not a limitation.

**h) Manures & fertilizers**

Manuring is done in three equal doses three times in a year in February, June and September. The recommended manurial and fertilizers doses are given in Table 2.

Table 2 : Annual requirement of Fertilizers (Fruiting plant/year)

<b>FYM/Compost (Kg)</b>	<b>DAP (g)</b>	<b>Urea (g)</b>	<b>Potash (g)</b>
<b>50</b>	<b>543.48</b>	<b>874.29</b>	<b>833.33</b>

One or two sprays of micro nutrient mixtures if required may be given.

Most of the experienced farmers are applying manure as recommended while some of them are applying as per availability of the FYM in their farm.

#### **i) Interculture**

Ploughing, spading of basins, weed control, etc., are important inter-culture operations for soil aeration and health. Chemical control of weeds with pre-emergence weedicides like diuron (3 Kg/ha), simazine (4 Kg/ha), glyphosate 4 l/ha, paraquat (2 l/ha), etc. may also be adopted.

Weeding in Sindhuli was done during Jan-Feb. FYM is then applied in the periphery of the plant.

#### **j) Intercrops**

Leguminous crops like soybean, gram, groundnut, cow peas, french bean, peas etc., may be grown in sweet-orange orchards. Intercropping is advisable during the initial three-four years after planting. Bee farming can also be done as it provides double benefits of pollination as well as honey production.

Farmers were found to plant maize, millet and black-gram as intercrop.

#### **k) Training and Pruning**

In order to allow the growth of a strong trunk, initially shoots upto 40-50 cm from the ground level should be removed. The centre of the plant should remain open. Branches should be well distributed to all sides. Cross twigs and water suckers are to be removed early. The bearing trees require little or no pruning. All diseased, injured and drooping branches and dead wood are to be removed periodically.

Generally, farmers of Sindhuli were found to removed dried and diseased stems during Jan-Feb.

#### **l) Pests and Diseases Management**

##### **1. Pests**

Important insect-pests of citrus are citrus psylla, citrus thrips, leaf miner, scale insects, bark eating caterpillar/trunk borer, fruit fly, fruit sucking moth, mites, etc. Other pests attacking

citrus particularly mandarin orange, especially in humid climate are mealybug, nematode, etc. Control measures of major pests are indicated below:

**Leaf miner:** Foliar sprays either with quinalphos 1.25 ml or fenvalerate 0.5 ml or monocrotophos 1.0 ml/litre of water at weekly intervals on new flush as soon as infestation is noticed.

**Citrus psylla:** Foliar spray either with quinalphos 1.0 ml or acephate 1.0 g or monocrotophos 0.5 ml/litre of water at bud burst stage or as and when infestation is noticed during Feb, - Mar., Jun., - Jul. & Oct, - Nov.

**Citrus thrips :** Foliar spray either with dimethoate 1.5 ml or monocrotophos 1 ml/litre of water at bud burst stage and berry size fruits.

**Scale insects:** Spraying of parathion (0.03%) emulsion, dimethoate 150 ml and 250 ml kerosene oil in 100 litre of water or malathion @ 0.1 % or carbaryl @ 0.05% plus oil 1 %.

**Trunk borer:** Swabbing of tunnel either with dichlorvos (0.1%) or carbaryl (1%) or monocrotophos (0.02%) kills the grub effectively.

**Bark eating caterpillar:** Plugging of larval tunnels with cotton wad soaked either in dichlorvos (0.1%) or carbaryl (1%) or monocrotophos (0.01%) effectively checks the pest.

Farmers are found to use Roger for controlling bugs.

## **2. Diseases**

The important diseases of citrus are *Phytophthora* gummosis, citrus tristeza virus, citrus greening (HLB--*Huang Long Bing*), citrus canker, powdery mildew, anthracnose, etc. Control measures of these diseases are stated briefly below:

***Phytophthora* Gummosis :** Scraping of the affected area and application of Bordeaux paste or copper oxifluoride paste or ridomil + carbendazim.

**Citrus greening (HLB--*Huang Long Bing*):** Removal of infected branches/unproductive trees and their replacement by disease-free plants. Application of ledermycin 600 ppm with ZnSO<sub>4</sub> and FeSO<sub>4</sub>. Meticulous control of citrus psylla vector.

**Citrus tristeza virus:** Control of aphids and use of cross protected grafts and shoot tip grafted plants or disease free grafts are recommended.

**Citrus canker:** Cutting of infected twigs followed by spraying of 1 % Bordeaux mixture or copper fungicide. Foliar spray application of 100 ppm streptomycin sulphate is also effective.

**Powdery mildew:** Pruning of dead twigs followed by foliar spray of wettable sulphur @ 2 g/litre, copper oxychloride @ 3 g/litre of water in April and October.



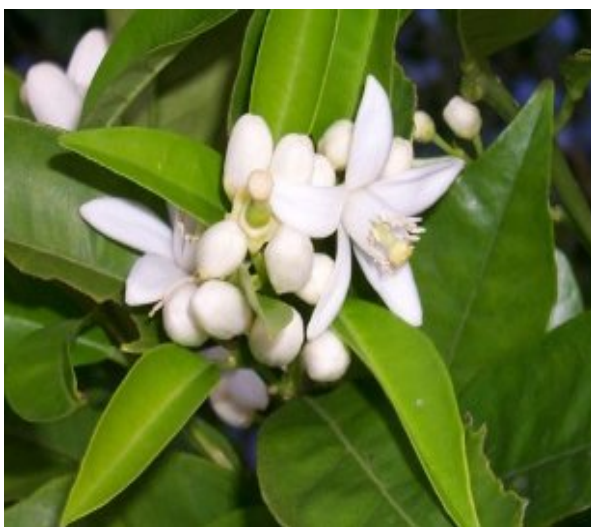
**Anthracnose:** Pruning of dead twigs followed by two foliar sprays of carbendazim @ 1 g/litre or copper oxychloride - 3 g/litre at fortnightly interval.

Majority of the farmers are using Bordeaux-paste and Bordeaux spray for such pathogen control.

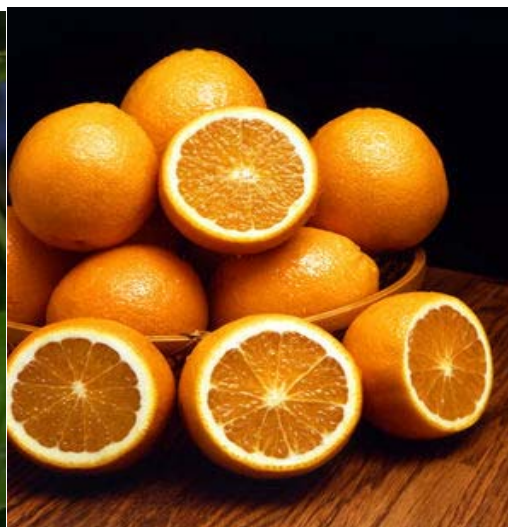
#### **m) Harvesting**

Sweet oranges normally take 240-280 days to arrive at maturity. Mature fruits at colour break stage are picked up in 2 - 3 intervals of 10-15 days.

Harvesting of Sweet-orange fruits in Sindhuli starts from Kartik (Oct) and lasts till Magh (Jan) months. Proper harvesting at proper level of maturity reduces the losses. Harvesting of Sweet-orange fruits was done manually ie. hand picking. Mostly fruits were harvested on maturity and after ripening but some immature fruits were observed in market. Harvesting and selling of immature Sweet-orange fruits was found due to economical as well as technological (fruit drop) problem.



**Sweet-orange Blossom**



**Sweet-orange Fruit**

#### **n) Yield**

Yield in Sweet Orange commences from 5th year with 40-50 fruits per tree and it stabilises around the 8th year. Average production is about 500-600 fruits per tree after stabilization . Economic life of plantation is 15 to 25 years.

#### **o) Post-harvest handling**

Post harvest handling of horticultural crops from harvest to the time they reach the consumers, must be understood by farmers in order to reduce losses which are caused by biological (respiration, ethylene production, compositional changes, transpiration of water, physiological break down and physical damages) and the environmental factors (temperature, relative humidity, atmospheric composition and light).

**Sorting:** Sorting of harvested Sweet-orange fruits were found practiced by farmer. Misshapen, insect pest infected, deformed fruits were found discarded.

**Grading:** In Sindhuli, so far proper grading is not practiced. The grading is categorized normally as Grade A, Grade B, Grade C according to size.

**Packing:** Containers for packaing were found Doko, plastic crates. Cushion materials such as straw, leaves were found used against impact and compression. Fruits were found generally packed into Doko with or without cushion. Wrapping of fruits with was also found before packing into crate and sent for market or kept in storage. Most of the fruits were found sent to market without storage in farm.



**Transportation:** Pick up van, tractors and bus were found commonly used vehicle for transportation. Porter's transportation in Doko also found practiced.

5-10% damage was found experienced by farmers during transportation. This damage can be minimized by the use of proper container. Tomiyasu/Verma (JICA Project) reported 29% storage losses of Sweet-orange in Nepal.

Table 3: Utilization of Sweet-orange fruits

Home consumption	Sell	
5-25 %	75-95 %	
	Fresh consumption	Processing
	75-90 %	10-25 %

*Source: Field survey*

The survey shows that out of total production of Sweet-orange, 5-25 percentages consumed at household level. Among 75-95 % sold Sweet-orange fruits only 10-25 % fruits were found used in processing. The households who have less numbers of Sweet-orange trees these households found consumed more fruits and viceversa.



### 4.3 Cost of production, marketing cost and marketing margin

Total cost of production is the summation of variable cost and fixed costs, including household labour incurred during production process.

**Variable cost:** Variable costs includes the cost of human labor, labor, planting materials, manures, fertilizer, plant protection aids and other cost like transportation charges etc.

**Fixed cost:** Fixed costs are those cost that do not differ with size of activity and have no bearing upon decisions to up-down of production. It include land tax (revenue), interest on investment, depreciation etc.

**Marketing cost:** Marketing costs are summation of the produce preparation cost, handling cost, transportation cost, product losses cost, storage cost, processing cost etc under the sells and distributions process of the product.

Table 4 : Cost of Production per Plant	
Land rent	160
Labor(Human And Bullock) cost	300
Planting material	50
Fertilizer and FYM/Compost	200
Plant Protection	150
Irrigation	60
Repair and maintenance of farm equipments	50
Annual taxes	10
Others	100
<b>Total Cost</b>	<b>1080</b>

*Source: Field survey*

As per our field survey, total cost per plant was found to be Rs. 1080.

Sweet-orange plant starts to yield fruit from the fifth year and it stabilises around the 8th year. On fifth year, it yields around 5 kg which starts increasing and reaches around 60-70 kg from the 8<sup>th</sup> year. The tree keeps on yielding till 15-20 years.

Table 5 : Cost and Return Analysis			
Year	Total Cost	Return	Net Profit
1	1080		-1080
2	680		-680
3	680		-680
4	750		-750
5	750	200	-550
6	750	250	-500
7	825	700	-125
8	825	1200	375
9	825	1850	1025
10	908	1950	1042
11	908	1950	1042
12	908	1950	1042

#### 4.4 Marketing Facilities

The farm product which reaches to the ultimate consumers through the hands of various marketing agents is called the marketing channels. Marketing channel also helps determining the prices. Higher the numbers of marketing agents, higher the price and vice versa. Market itself organized the intermediaries, so that market is functioning well.

The produced Sweet-orange fruits brought to Sindhuli mandi market through marketing agents or farmers themselves or group of farmers or cooperatives. Then from district market center, these fruits sales to retailer, and distant wholesaler and also to exporter. Produced Sweet-orange fruit was sent to Kathmandu, Biratnagar, Janakpur, Hetauda, Narayanganj, Sitamadi (India) market for sale directly from farm or from Sindhuli mandi market. Some amount of Sweet-orange fruits was found stored in cold storage or local cellar storage which fetch higher price during off season.

## 4.5 Market Price Analysis

Price of Sweet-orange was found to be determined by bargaining between farmers and traders by weighing or counting. Average farmgate price was Rs 3.5 per piece of Sweet-orange ranging from Rs 2 - 5. The farmers during earlier harvest fetch lower price Rs 2-5 as compared to late harvest (Rs 5-8).

Farmers try to fix the price on the basis of demand and supply in the market, previous day price and as per contract with the traders. Wholesalers fix the price based on demand and supply situation, quality of the produce and the speculative price based on situation and supply. Finally, retailers would charge the price to the consumers as per the quality of the produce, keeping their profit margin.

## 4.6 Processing Scenario and Potentialities:

There is growing demand for fresh Sweet-orange as well as juice, jam and jelly due to increased population, urbanization and increased health consciousness of the people. Increased demand is being fulfilled by importing such products from the neighboring countries. At the same time, Sweet-orange is also perishable in nature which cannot be kept for longer duration without proper storage facility, maintaining the freshness and quality. These days, farmers of sweet-orange growing area are found to transplant new saplings due to high demand of sweet-orange fruits in market, increased road access for transportation as well as technical assistance from the government and non-government organizations. Thus, the coverage area and production of Sweet-orange seems to be increasing. Addition to this, there is also problem of the transportation facilities. So processing of the Sweet-orange is needed to reduce postharvest loss, diversify the product, fetch the good price of the processed product as well as for import substitution. In Sindhuli district, a few Sweet-orange based processing plants micro enterprises were found operating.

Table 6: The Sweet-orange processing micro enterprises of Sindhuli

S N	Fruit processing enterprises	Address
1	Pragati Sweet-orange Processing Centre	Ratanchura
2	Langhali Sweet-orange Udhog	Tinkanya
3	Fikkal Fruits Processing Centre	Kamalamai Municipality, Majhitar

*Source: Survey, 2011*



Most of the farmers (90%) expressed the need of establishing processing industry. However, some of the respondents (10%) suggested for not to establish the processing industry.

Table 7: Product diversification and price rate of Sweet-orange in Sindhuli Market (Saugat Griha operated by DMEGA Sindhuli.

S N	Fruit product	Amount	Retail price (NRs.)
1	Sweet-orange Squash	500 ml.	75/-
		700 ml.	100/-
2	Sweet-orange Jam	0.5 kg.	160/-



Sweet-orange Squash



Sweet-orange Jam

#### 4.7 Major problems of the farmers

The technologies adopted by the farmers were mostly found to be conventional. Fertilizers and manures are not applied as per recommendation. Thus they are not able to achieve full production potential. Landscape of the orchard is also not satisfactory as well as there is poor varietal selection. Farmers also did not remove the dried, diseased branches. There is also poor technical assistance in insect-pest management and disease control. This is all due to the lack of sufficient research and extension. Just 50-60% of the yield potential (>30metric ton/ha) is being harvested by the farmers. They also face the problem of fetching lower prices. Lack of roads, vehicles and higher transportation cost , lack of storage facilities, lack of knowledge of packaging, grading. There is also insufficient processing facility. Strikes (Nepal banda) and other types of strikes damage their products. Moreover import from India is reducing the price to be fetched by our farmers.

## 6. Summary and Conclusion

### 5.1 Summary

Agricultural sector has been considered the most important sector in Nepalese economy. It employs about 65% of the economically active population and contributes about 36 percentage of the Gross Domestic Product (GDP). Twenty years Agriculture Perspective Plan (APP) has also prioritized citrus as a cash generating commodity for the middle hills of Nepal. Mid hills of 1000 meters to 1500 meters above sea level has a comparative advantage of cultivating citrus fruits, especially mandarin and Sweet-orange. Compared to agronomic crops, It is easy to cultivate as well as fetch higher prices.

Sweet-orange fruit have unique sweet taste and is rich in Vitamin C and minerals. It is a special fruit of Nepal because this type of citrus fruit is rarely found in other countries. Thus, Sweet-orange can be considered as National fruit of Nepal (Tomiyasu et. al., 1998). These days the farmers of Sindhuli are involved in cultivating Sweet-orange as commercial and cash crop. Sweet-orange produced in Sindhuli have special identity and is known as *Sindhuli ko Junar* all over the country. Sweet-orange is being cultivated in 45 VDCs of Sindhuli district. One Village One Product program is launched in four VDCs namely Ratanchura, Baseshwor, Tinkanya and Jalakanya of Sindhuli District for production promotion and marketing management.

The objective of the study was to explore the feasibility of Sweet-orange processing industry in Nepal which will facilitate the entrepreneurs to establish Sweet-orange processing industry in Nepal. Due to time as well as budget limitation, we carried our study on sindhuli district only. Potential pocket of Sweet-orange was selected after consulting with DADO. Selected VDCs were Ratanchura, Baseshwor, Tinkanya and Jalakanya. The study was thus focused on the pocket areas of Sweet-orange in the district. Consultation with District Agriculture Development Office, Agriculture Service Centre, Farmers, traders, processors and market management committee was done during the collection of primary as well as secondary data. Sample farmers and processors from the selected VDCs were selected on the systematic random sampling basis. The questionnaire was then administered to 50 farmers and 4 processors. Survey team also collected information through Video recording. Survey data analysis was done using MS Excel as well as Statistical Package for Social Science (SPSS). Adobe Photoshop CS5 was used in editing graphics and report writing was done using MS Word.

Existing farming and processing practices adopted by the farmers were also studied which was found to be traditional. Most of the farmers were found to use the sapling raised from the seed by the local private nursery. They are not applying Chemical fertilizers and FYM/Compost as per recommendation. Major problems faced by the farmers are diseases like fruit rot, premature fruit fall, dieback and insects/pests like citrus psylla, citrus thrips,

leaf miner, trunk borer, fruit fly, fruit sucking moth, mites, etc. There is wider scope for the research and development in Sweet-orange cultivation.

75-95 percentage of the total product is sold for processing while only 5-25 percentage is kept for household consumption. There were just 3 processing industries in Sindhuli district which is not sufficient for the processing of the Sweet-orange produced over the district. It is due to the processing technology being traditional, unscientific as well the lack of skilled manpower. Processed items of Sweet-orange are juice, jam, jelly and candy.

## **5.2 Conclusion**

The following conclusions are made based on the findings:

Sweet-orange cultivation is gaining popularity among the farmers of Sindhuli district.

Average land holding per household under the surveyed VDCs of Sindhuli district was found to be 0.97 ha. The survey indicates that the area under Sweet-orange cultivation in each sampled household averaged 2.05 ha in Tinkanya, 0.625 ha in Ratanchura, 0.5 ha in Baseswor and 0.725 ha in Jalkanya VDC.

Majority of the farmers are using the sapling raised from the seed by the local private nursery, while some of them are using the saplings from DADO.

Majority of the farmers use FYM only (12-15 kg per plant) during the plantation period.

Major problems faced by the farmers are diseases like fruit rot, premature fruit fall, dieback and insects/pests like citrus psylla, citrus thrips, leaf miner, trunk borer, fruit fly, fruit sucking moth, mites, etc.

Generally, 75-95 percent of the produce is sold, keeping only 25-5 percent for the consumption. Moreover, 75-90 percent of the sold fruits are consumed fresh while 25-10 percent is processed.

Most of the farmers sell their Sweet-orange on contract basis to the local as well as Indian traders.

Average farmgate price was Rs 3.5 per piece of Junar ranging from Rs 2 - 5. The farmers during earlier harvest fetch lower price Rs 2-5 as compared to late harvest (Rs 5-8).

There are 3 processing industries found in the Sindhuli district. These industries collect the raw Sweet-orange mostly from the local farmers on a contract basis and process to the juice and jam.

Average selling price of Juice/Squash was Rs 75 for 500ml bottle and Rs100 for 700ml bottle, while that of Jam was Rs.160 for half kg bottle.

Most of the farmers (90%) expressed the need of establishing processing industry. However, some of the respondents (10%) suggested for not to establish the processing industry.



## **7. Recommendation**

As the farmers are cultivating Sweet-orange conventionally, production potential of Nepal is very low (10-14mt/ha) compared to more than 30mt/ha of other developed countries. Also, there is lack of technically sound expertise on Sweet-orange cultivation. Research on Sweet-orange cultivation as well as postharvest technology is to be accorded a high priority. Appropriate post-harvest technologies should be developed and demonstrated. Moreover, there is urgent need of producing technically skilled manpower and providing such technology to the farmers.

Sweet-orange, which can be the promising horticultural crop for Nepal should be given high priority by the government. Special programs for increasing the production and productivity of Sweet-orange should be launched very soon. 'One Village One Product (OVOP) program of Sweet-orange should be extended on other potential VDCs also.

Packaging and transportation on sweet-orange is not done properly with proper containers which increases the post harvest losses. Thus an educational program /training is to be given to the farmers and traders relating to harvesting time, harvesting techniques, grading, packaging and storage.

Adequate and timely supply of inputs like fertilizer, irrigation, technology, credit, etc are to be made.

Establishment of small scale processing industries, development of collection centre, linkage with big wholeseller, construction of storage infrastructures are to be done for reducing post harvest losses as well as fetching good prices.

## Annexes

### Annex I : कृषक/कृषक समुह/प्रशोधन कर्तासंग सोधने प्रश्नावली

- जिल्ला : सिन्धुली कृषक समुहको नाम : ठेगाना :
१. कृषकको नाम : .....
  २. समुहको सदस्य संख्या : .....
  ३. खेती गरीएको क्षेत्रफल : ..... ४. सिंचित क्षेत्रफल : .....
  ५. जुनार खेती गरिएको क्षेत्रफल : .....
  ६. लगाईएका जातहरु .....
  ७. अन्य बालीलगाईएको भए .....
  ८. फल दिने बोट संख्या ..... ९. फल नदिने बोट संख्या: .....
  १०. कति वर्ष पछि फल दिन सुरु हुन्छ ? ..... ११. प्रति बोट उत्पादन .....
  १२. फल दिने अवधि: .....
  १३. कूल उत्पादन .....
  १४. घरायसी उपभोगको परिमाण .....
  १५. ताजा बिक्री परिमाण .....
  १६. प्रशोधनको लागि छुट्याईएको परिमाण .....
  १७. जुनारको प्रशोधनबाट उत्पादित वस्तुहरु .....
  १८. **विक्री प्रकृया**
    - क) आफै बगैचाबाट टिपेर नजीक बजारमा ..... ख) समूह .....
    - ग) सहकारी ..... घ) बोटबाटै बिक्री
    - ड) प्रशोधन उद्योग ..... च) भण्डारण गरी बजारको माग अनुसार
  १९. **बजार (विक्री वितरको लागि)**
    - क) स्थानीय बजार ..... ख) जिल्ला भित्र स्थान .....
    - ग) जिल्ला बाहिर स्थान ..... घ) भारत तथा अन्य मूलुक .....
    - ड) भण्डारण गरेर बजारको माग अनुसार
  २०. आफ्नो उत्पादनलाई प्रशोधन गर्नु भएको छ ? यदि छ भने,
    - क) प्रशोधनबाट कुन कुन वस्तुहरु उत्पादन गर्ने गर्नु हुन्छ ?
    - ख) कस्तो किसिमले प्रशोधन गर्ने गर्नु भएको छ ?
    - ग) जुनार प्रशोधनका लागि उपर्युक्त तरिका के के अपनाईएका छन् ?
    - घ) अनुमानित उत्पादन लागत कति छ ?
    - ड) जुनार खेतीबाट अन्य बालीका तुलनामा के कति फाईदा पाउनु भएको छ ?
  २१. उत्पादन स्थल देखि बजार सम्म पुर्याउदाको खर्च
    - क) टिपाई ..... ख) ग्रेडिंग ..... ग) भण्डारण ..... घ) ढुवानी ..... ड) अन्य
  २२. ताजा फलको बिक्री मूल्य.....
  २३. प्रशोधन लागत के कस्तो/कसरी छ ?
    - क) जुस ..... घ)मार्मलेड
    - ख) जाम ..... ड) क्यान्डी
    - ग) जेली
  २४. प्रशोधित वस्तुको बजारहरु
  २५. प्रशोधित वस्तुहरुको बिक्री मूल्य
  २६. अन्य उप उत्पादनहरु (By-product)
  २७. उप उत्पादनको उपयोग वा बिक्रीबाट हुने आम्दानी

- २९ जुनारको प्रशोधन सम्बन्धी अन्य सरकारी तथा गैरसरकारी निकायबाट प्राप्त सहयोगहरु  
 ३० जुनार उत्पादन सम्बन्धि समस्याहरु भए,  
 ३१ समस्या समाधानको लागि गरिएका प्रयासहरु :  
 ३२ अन्य केही आवश्यक सहयोग केही भए.....  
 ३३ अन्तमा तपाईंको केही सुझाव भए .....

\*\*\*\*\* सहयोगको लागि धन्यवाद \*\*\*\*\*

## **Annex II : जिल्ला कृषि विकास कार्यालय सँग सोधिने प्रश्नावली**

१. जिल्लाको क्षेत्रफल
२. जिल्लाको कुल खेती गरिएको भूभाग
३. जिल्लाको उचाई
४. जिल्लाको सरदर तापक्रम
५. जिल्लाको सरदर वर्षा
६. जिल्लामा जुनार खेती गरिएको क्षेत्रफल
७. जिल्लाको जुनारको पकेटक्षेत्रहरु ( गा.वि.स. को आधारमा)
८. जिल्लामा एक गाँउ एक उत्पादन कार्यक्रम लागू भएको भए,  
 क) लागू भएको मिति  
 ख) लागू भएका गा.वि.स.हरु
९. जिल्लाको कुल उत्पादन तथा उत्पादकत्व
१०. जुनारको खेती विस्तार, प्रशोधन तथा बजारीकरणका लागि संचालन भएका कार्यक्रमहरु
११. जुनारको उत्पादन लागत
१२. जिल्लामा अवस्थित जुनार प्रशोधन उद्योगहरु
१३. उत्पादित जुनारको बजार
१४. जिल्ला कृषि विकास कार्यालयबाट संचालित कार्यक्रमहरु र तिनबाट परेको प्रभाव :

## **Annex III: प्रशोधन उद्योगहरु सँग सोधिने प्रश्नावली**

१. नाम:
२. ठेगाना:
३. स्थापित मिति:
४. लगानी:
५. प्रशोधित वस्तुहरु:
६. प्रशोधनको परिमाण:
७. प्रशोधनमा समेटिएका गा.वि.स.हरु तथा अन्य छिमेकी जिल्लाहरु:
८. आवश्यक कच्चा जुनारको स्रोतहरु:

- ९. प्रशोधित जुनार बजार:
- १०. प्रशोधन लागत/खर्च:
- ११. जनशक्ति:
- १२. प्रशोधनको प्रकृया:
- १३. प्रशोधनको प्रविधि:
- १४. कच्चा जुनारको खरिद मुल्य:
- १५. ढुवानी खर्च:
- १६. प्रशोधन पश्चातका प्रशोधित बस्तुको विक्री मुल्य:
- १७. केही सुझाव, अपेक्षाहरु भए,
- १८. केही समस्याहरु भए,

**Appendix IV: List of local leader farmers of Junar in Sindhuli districts**

S N	Name	Address	Contact	Specialization
1	Bishnu Bahadur Shrestha	Ratanchura-2	9844024535	Junar orchard management & Nursery management
2	Hasta Bahadur Thapa	Ratanchura-3		Junar orchard management
3	Deepak Thapa	Ratanchura-6		Junar orchard management
4	Chuda Raj Shapkota	Ratanchura-5	9844092319	Nursery management
5	Randa Bahadur Lungeli	Baseswor-6		Junar orchard management
6	Jhalak Bahadur Asthani	Baseswor-6		Junar orchard management
7	Dhan Bahadur Bhujel	Baseswor-6		Junar orchard management
8	Padam Bahadur Thadamagar	Tinkanya-6	9844094871	Junar orchard management & Nursery management
9	Gunda Bahadur Thakuri	Tinkanya-6		Junar orchard management
10	Lok Bahadur Aalemagar	Tinkanya-7		Junar orchard management
11	Krishna Prashad Gautam	Jalkanya	9844022983	Junar orchard management
12	Nirmal Ramtel	Ratanchura	9844080250	Junar orchard management

**Appendix V: List of Junar nursery owners in Sindhuli district**

S N	Name	Address	Contact
1	Buddhi Bahadur Khadka	Ratanchura-8	
2	Balram Khadka	Ratanchura-9	9744055418
3	Damar Bahadur Thapa	Ratanchura-7	
4	Deepak Kumar Thapa	Ratanchura-7	9844042392
5	Bhoj Raj Shapkota	Ratanchura-5	9844092319
6	Randa Bahadur Magar	Baseswor-6	

7	Padam Bahadur Thada	Tinkanya-6	9844094871
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**Appendix VI: List of organizations involved in Junar promotion in Sindhuli district**

S N	Organizations	working areas and supported services
1	District Agriculture Development Office, Sindhuli	Whole district, technical and inputs and implements support
2	Sindhuli Chamber of Commerce & Industry	4 VDCs of OVOP, inputs and implements support
3	Junar Bikas Sangh, Sindhuli	Junar production and marketing
4	Junar Production District Cooperative Union Limited, Sindhuli	Junar production and marketing
5	DMEGA, Sindhuli	Junar based micro enterprises, training and skill development
6	MEDEP	Junar based micro enterprises, training and skill development

**Appendix VII: List of organizations involved in Sweet-orange promotion in Sindhuli district**

S N	Organizations	working areas and supported services
1	District Agriculture Development Office, Sindhuli	Whole district, technical and inputs and implements support
2	Sindhuli Chamber of Commerce & Industry	4 VDCs of OVOP, inputs and implements support
3	Sweet-orange Bikas Sangh, Sindhuli	Sweet-orange production and marketing
4	Sweet-orange Production District Cooperative Union Limited, Sindhuli	Sweet-orange production and marketing
5	DMEGA, Sindhuli	Sweet-orange based micro enterprises, training and skill development
6	MEDEP	Sweet-orange based micro enterprises, training and skill development

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