

**Contact Details:**

Tel office: +264 61 379 500

Fax office: +264 61 22 5371

E-mail: [nabdesk@nab.com.na](mailto:nabdesk@nab.com.na)

Website: [www.nab.com.na](http://www.nab.com.na)

**Physical address:**

Agricultural Boards' Building

30 David Hosea Merero Road

Windhoek

Namibia

**Postal address:**

PO Box 5096

Ausspannplatz

Windhoek

Namibia

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## **AGRONOMY AND HORTICULTURE MARKET DEVELOPMENT DIVISION**

### **RESEARCH REPORT**

#### **CITRUS VALUE CHAIN ANALYSIS: THE CASE OF NAMIBIA**



**AUGUST 2023**

## TABLE OF CONTENTS

ABSTRACT.....	3
ABBREVIATIONS AND ACRONYMS .....	4
1 INTRODUCTION AND BACKGROUND .....	5
2 PROBLEM STATEMENT .....	6
3 SPECIFIC OBJECTIVES OF THE RESEARCH .....	6
4 SIGNIFICANCE OF THE STUDY .....	6
5 METHODOLOGY .....	7
5.1 STUDY DESIGN AND LOCATION .....	7
5.2 POPULATION, SAMPLING STRATEGY, DATA COLLECTION AND ANALYSIS .....	7
6 RESULTS AND DISCUSSIONS .....	7
6.1 PRODUCTION INFORMATION .....	7
6.1.1 Soil and Climatic Conditions.....	8
6.1.2 The Status Quo of Citrus Seedlings Production and Supply.....	8
6.1.3 The Status Quo of Citrus Production.....	10
6.1.4 Average Cost of Producing Citrus Fruits .....	15
6.1.5 The Status Quo of Value Addition on Citrus Fruits.....	16
6.2 Regulatory CompliANce and Protection Information.....	16
6.2.2 Quarantine Pests .....	18
6.2.3 Food Safety Certification and Fruit Handling.....	19
6.2.4 Government Protection.....	21
6.3 FINANCING INFORMATION.....	21
6.4 CITRUS MARKETING AND PRICE INFORMATION.....	22
6.4.2 Citrus Seedlings Marketing, Price, and Value .....	22
6.4.3 Citrus Fruits Marketing, Price, and Value .....	23
6.5 TRAINING AND INDUSTRY AFFILIATION .....	24
6.5.1 Training Opportunities .....	24
6.5.2 Value Chain Member Organisational Affiliations.....	25
6.6 Main CONSTRAINTS AND OPPORTUNITIES Along The Citrus Value Chain .....	26
6.6.1 Seedling Suppliers.....	26
6.6.2 Citrus Growers.....	26
6.6.3 Traders .....	27
7. CONCLUSIONS.....	27
8. RECOMMENDATIONS .....	29
REFERENCES .....	30

## ABSTRACT

*This study describes the extent of citrus seedlings and fruit production, value addition and critical success aspects within Namibia's citrus value chain. Twenty-two (22) seedling suppliers, 52 citrus growers and 20 traders were interviewed using structured questionnaires to gather primary data for descriptive statistics analysis. Literature reviews were helpful to obtain secondary data. A total of 42, 239 seedlings were supplied during 2022, of which 47% were imported. About 300ha has been planted with 185,866 trees in total, including 121,288 mature trees that yield about 1,872.1 tons of citrus fruits. About 7,850 tons of citrus fruits were harvested in a year as of 2022. The study signifies a record of local undersupply of citrus fruits, whilst value addition is entirely vacant, regardless of the repackaging of unspecified imported citrus juice. To meet self-sufficiency and possibly supply citrus fruits for export markets, more than 520 ha of land needs to be planted with about 224,890 citrus trees if planted on open fields.*

*The study revealed multiple potential limitations, hence the critical success factors with room for improvement to unlock full potential in Namibia's citrus value chain, namely, lack and high local cost of improved variety seedlings, limited pest and diseases surveillance, absence of seedling supplier registrations and certifications, post-harvest losses due to absence of fruit treatment, packaging and storage facilities, limited bank financing, lack of skills on grafting and citrus production, absence of strong industry affiliations, and oversupply of un-grafted rough lemon seedlings vs market preferred lemon varieties. Given the citrus favourable climate, land, and water availability in some parts of Namibia, the main opportunities to unlock the potential regarding the citrus value chain were identified as importing improved varieties for local grafting, increasing citrus production in favourable areas, improving efficiency and productivity by training all citrus growers and seedling suppliers, domestic and export markets, and value addition on lemons (juice, flavour for cosmetics, etc).*

*The study recommends local citrus seedlings grafting by domestic nurseries and the expansion of citrus production by citrus growers. The government and its agencies should ensure capacity-building programmes for both seedling suppliers and citrus growers. The government should also ensure the provision of disease and pest surveillance services. It is also recommended that the newly created Citrus Producers Association develops a code of conduct for producers and seedling suppliers to ensure regulatory compliance and to meet market requirements.*

**Key Words:** *Citrus, value-chain, Namibia, citrus growers, seedling suppliers, traders, challenges, opportunities*

## ABBREVIATIONS AND ACRONYMS

<b>AGRIBANK</b>	Agricultural Bank of Namibia
<b>CGA</b>	Citrus Growers Association South Africa
<b>DOF</b>	Directorate of Forestry
<b>FAO</b>	Food and Agriculture Organisation
<b>GAP</b>	Good Agricultural Practice/s
<b>GRN</b>	Government of the Republic of Namibia
<b>HACCP</b>	Hazard Analysis Critical Control Point
<b>MAWLR</b>	Ministry of Agriculture, Water and Land Reform
<b>NAB</b>	Namibian Agronomic Board
<b>UNAM</b>	University of Namibia
<b>USA</b>	United States of America

## 1 INTRODUCTION AND BACKGROUND

Citrus fruits are a collective term for a genus of flowering trees and shrubs in the Rue family, also called the Rutaceae family (Brodie, 2022). It encompasses oranges, lemons and limes, grapefruits, kumquats and soft citrus (Brodie, 2022). Soft citrus is a subdivision of citrus that has relatively loose skin and is easy to peel such as mandarins, clementine, satsuma, Mineola and tangerines (Krisel, 2022). Despite interchangeable market names, citrus is normally grouped as orange, lemon, lime and grapefruit, and easy peelers such as tangerine/mandarin and pomelo (Haifa, 2021). According to the Citrus World Organisation (2023), the world produced 158.5 million metric tons, and 13.9 million metric tons were exported, whilst 14 million metric tons were imported during 2021/ 2022. China (28%), Brazil (12%) and India (9%) were the world's leading citrus-producing countries in 2021/2022.

Out of 6,672 tons of citrus fruits nearly valued at N\$61.5 million consumed by Namibia, all 6,162 tons were imported from South Africa, valued at approximately N\$57,64 million, whereas, only 510 tons are locally produced valued at N\$ 3.83 million (NAB, 2023). This means that 7.6% of citrus consumed by Namibia is locally produced, whereas, 92.4% was imported during 2022/2023. Citrus fruits consumed in Namibia include oranges, lemons, and nartjies, accounting for 76.9%, 11.3% and 3.3% respectively, and the rest are below 3%, namely, lime, pomelos, clementine, grapefruit, kumquat, satsumas, mineola (tangelo) and nectarine (NAB, 2023). Table 1 below indicates that most citrus fruits consumed in Namibia are imported. Oranges, lemons, nartjies, lime, and pomelos are the top 5 citrus fruits produced in Namibia, whereas, there are currently no exports of citrus fruits by Namibia as of March 2023.

**Table 1: Namibia's formal market citrus trade statistics during the 2022/2023 reporting period**

Citrus Fruit	Local Tonnage	Import Tonnage	Consumption Tonnage	Local Value	Local Value (N\$/ton)	Import Value	Import Value (N\$/ton)	Total Consumption Value	Export Tonnage
Oranges	362.4	4,771	5,133	2454320.04	6,773	32,532,863	6,819	34,987,183	0
Lemons	86.6	664.6	751	831660.09	9,603	5,403,950	8,131	6,235,610	0
Nartjies	51.5	169	221	333493.15	6,473	11,467,026	67,684	11,800,519	0
Lime	7.2	25.28	32	201501.19	27,947	510,139	20,180	711,641	0
Pomelos	1.5	1.53	3	12264.4	7,964	16,347	10,684	28,611	0
Clementine	0	152.64	153	0	0	1,424,628	9,333	1,424,628	0
Grape Fruit	0	96.9	97	0	0	1,068,189	11,024	1,068,189	0
Kumquat	0	7.26	7	0	0	109,032	15,018	109,032	0
Satsumas	0	73.89	74	0	0	609,298	8,246	609,298	0
Mineola/Tangelo	1.04	29.94	31	0	0	312,318	10,431	312,318	0
Nectarine	0	169.42	169	0	0	4,185,399	24,704	4,185,399	0
<b>Totals</b>	<b>510.30</b>	<b>6,161.60</b>	<b>6,671.90</b>	<b>3,833,238.87</b>		<b>57,639,188.58</b>		<b>61,472,427.45</b>	<b>-</b>

**Source:** NAB (2022)

This study focused on fundamental factors impacting the production and marketing of citrus fruits and products in Namibia to provide baseline information. It is in partial fulfilment of NAB's strategic objective

to provide comprehensive and efficient information services on agronomy and horticulture through applied research.

## **2 PROBLEM STATEMENT**

Citrus is a good source of nutrition. It contains an abundant amount of vitamin C and macronutrients such as sugars, dietary fibre, potassium, folate (vitamin B-9), calcium, thiamine (vitamin B1), niacin (vitamin B-3), pyridoxine (vitamin B-6), phosphorus, magnesium, copper, riboflavin (vitamin B-2), and pantothenic acid (vitamin B-5), (Lv et al., 2015 & FAO, 2021). More so, citrus contains vital bio-activities of vital importance to human health such as antioxidants, anti-inflammatory, anti-cancer and cardiovascular protective effects, neuroprotective effects and others (Lv et al., 2015). Citrus does not only provide nutritional benefits but also financial benefits to farmers across Africa, provided good agronomic practices are followed (Otieno, 2021).

Due to low citrus production, Namibia is a net importer of fresh citrus fruits, juice and other citrus value-added products. In 2021/2022, there was no citrus export from Namibia and the local production only contributed 6% to formal domestic demand and 94% was imported from South Africa to satisfy the domestic demand gap (NAB, 2022). These statistics indicate very low competitiveness for Namibia's citrus industry. The availability of baseline information on the citrus fruits industry is critical to stimulate investment (in production and value addition), policy formulation, and future research. This study provides recommendations on what should be done to stimulate the growth of the citrus fruits industry in Namibia.

## **3 SPECIFIC OBJECTIVES OF THE RESEARCH**

- To quantify the extent of domestic citrus tree seedlings and fruit production in Namibia.
- To assess the status of critical success aspects along Namibia's citrus value chain.
- To assess the extent of value addition along the citrus value chain in Namibia.
- To recommend what should be done to stimulate the growth of the citrus industry in Namibia.

## **4 SIGNIFICANCE OF THE STUDY**

It would be complex for the NAB to make policy decisions that are pertinent to the development of the citrus value chain without value chain analysis information. Data-driven decision-making will aid industry actors in making calculated decisions. This baseline information is useful for citrus growers, seedling suppliers, traders, processors, consumers and development agents for use in developing the citrus value chain within Namibia to bring about national competitiveness.

## **5 METHODOLOGY**

### **5.1 STUDY DESIGN AND LOCATION**

The study adopted a mixed-method research approach, in which secondary and primary data were gathered for analysis. Hence, literature reviews and a field survey were deployed in gathering the research data. The entire country was covered by the study, notwithstanding the disaggregation of data according to horticultural production zones, namely; South & Orange River, North Central, Kavango, Zambezi, Karst and Central.

### **5.2 POPULATION, SAMPLING STRATEGY, DATA COLLECTION AND ANALYSIS**

Due to the wide geographical locations of the citrus producers and seedling suppliers, the population for the study was not so certain. Nonetheless, a population of 152 actors in the citrus industry was established. This population encompass 52 discovered citrus growers, 20 discovered suppliers of seedlings, and 80 traders of fruits. A purposive sampling strategy was used to a list of respondents to the survey questionnaires at all seven (7) production zones.

The study was accomplished to gather data from 52 citrus growers (34 males and 18 females), 20 seedling suppliers (11 males and 9 females) and 22 traders of citrus fruits or related products (13 males and 9 females). A structured questionnaire was used to gather primary data. The questionnaire covered the following matters, and this is where this research analysis was constructed, namely, production, value addition, storage, industry affiliation, industry protection, regulatory compliance, and marketing of citrus and citrus products in Namibia. The constraints and opportunities are among the pertinent matters included in this analysis. Microsoft Excel was useful in analysing the survey data.

## **6 RESULTS AND DISCUSSIONS**

This section describes, visualises and discusses the results of the study, encompassing a range of information under headings such as production, regulation and protection, marketing, financing, training and industry affiliations, challenges and opportunities within the citrus value chain in Namibia's context.

### **6.1 PRODUCTION INFORMATION**

The section reports on the citrus production factors such as soil and climate, as well as the production information such as the supply of seedlings, citrus fruits production, and cost of production, and lastly, handling and value addition.



### 6.1.1 Soil and Climatic Conditions

A wide variety of soils (sand, loam and clay) are acceptable for growing citrus. However, citrus trees do well in deep and well-drained soils with a PH range of 6-7 (Haifa, 2021; Otiene, 2021). Soil clay content of 10% to 40% is best (Farmer's Weekly, 2012). Like any other plant, citrus trees require nutrients such as manure and fertilizers to grow well and provide good yields (Otiene, 2021). It is critical for citrus growers to sample their soils for nutritional content analysis to determine the correct soil amendment and avoid waste whilst increasing yields. Fertilisation is usually done soon after harvesting.

Citrus trees may grow in both arid and humid climates. However, extreme prevailing low temperature (winter) seasons are riskier to grow citrus trees (Haifa, 2021). The average temperature during the coldest month should not be below 2°C to 3°C if the trees are not protected (Farmers' Weekly, 2012). Sensitivity to low temperatures depends on the duration, variety, rootstock and dormancy of the trees (Haifa, 2021). The growing temperature for most citrus trees, especially oranges, ranges from 13 °C to 38 °C (average of 25.5 °C) with an annual average rainfall of up to 1500mm (Otiene, 2021). Hence, citrus trees production commonly takes place under irrigation as opposed to rainfed production. Citrus trees do not tolerate severe frost (Dikgale, 2021). Low temperatures affect flowering, slow down the growth of trees, and affect the fruits' internal quality. However, moderately low temperatures are required for peel and juice colour development for oranges and grapefruits (Davies, n.d).

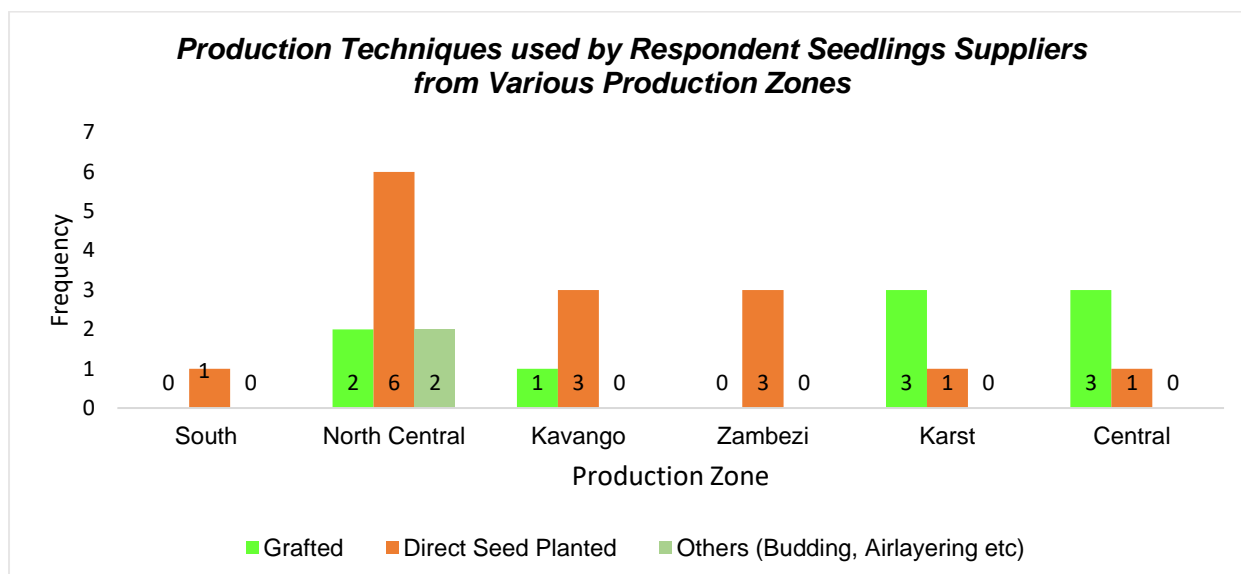
For elevation, citrus trees generally have poor growth and low productivity at altitudes higher than 2,286 metres above sea level (Davies, n.d.). Elevations of most areas in Namibia are below 1700 metres above sea level (Floodmap.net, n.d.), thus making elevation not to be a constraint as far as citrus production is concerned for Namibia. Hence, the main determinant of where to grow citrus trees in Namibia should be the intensity and duration of low temperatures, seconded by the availability of water for irrigation.

### 6.1.2 The Status Quo of Citrus Seedlings Production and Supply

A total of twenty (20) suppliers supplied about 43, 239 citrus seedlings during 2022, from both imports (47%) and local production (53%). It turned out that 83% of the interviewed citrus seedlings suppliers are irrigating their seedlings manually i.e. using either hose pipes, buckets or watering cans, 13% irrigate with micro sprinklers, whereas 4% are using a drip irrigation system.

As Figure 1 shows, most seedlings are propagated by direct seeding, as opposed to grafted and other techniques (budding, air layering, etc.). The majority of the grafted seedlings supplied are those imported.





**Figure 1: Techniques used to propagate citrus seedlings supplied**

As presented in Table 2, the local production of citrus seedlings is limited to orange (9%), lemon (74%), nartjies (16%), and pomelos (1%), as well as lime and kumquat, both at less than 0.05%. The majority of locally produced citrus seedlings are lemons, mainly by GRN institutions such as DOF nurseries country-wide and UNAM, as well as by small-scale private nurseries in Northern and North-eastern regions. Most of the lemon tree seedlings tallied by the study were not grafted and/or were rough lemons that are normally supposed to be used as rootstock (Haifa, 2021).

**Table 2: Domestic production of citrus seedlings based on the current survey data**

Citrus tree type	South	North Central	Kavango	Zambezi	Karst	Central	Total	% Share
Orange	200	1,550	10	300	-	15	2,075	9%
Lemon	200	7,700	5,001	4,000	-	210	17,111	74%
Nartjies	200	2,200	1,015	300	-	-	3,715	16%
Lime	-	-	-	-	-	10	10	0.04%
Pomelos	200	-	-	-	-	7	207	1%
Clementine	-	-	-	-	-	-	-	0%
Grape Fruit	-	-	-	-	-	-	-	0%
Kumquat	-	-	-	-	-	4	4	0.02%
Satsumas	-	-	-	-	-	-	-	0%
Mineolas	-	-	-	-	-	-	-	0%
Mandarine	-	-	-	-	-	-	-	0%
Totals	-	-	-	-	-	-	-	0%
<b>Total No. of Citrus Seedlings Produced per Production Zone</b>	<b>800</b>	<b>11,450</b>	<b>6,026</b>	<b>4,600</b>	<b>-</b>	<b>246</b>	<b>23,122</b>	<b>100%</b>

Table 3 shows the citrus tree seedlings supplied per year, from domestic raising and imports. As shown in Table 3, a total of 54% of annual seedlings supplied by the study respondents were locally produced, whereas 46% were imported. Oranges accounted for 68% of the annual citrus tree seedlings imported for resale, followed by soft citrus at 13% (naartjies/ mandarin/ clementine/ tangerines) and thirdly,

lemons at 12%. Lime and grapefruits each accounted for 3% of imported seedlings. There was no revelation of exported citrus seedlings during the study.

**Table 3: Citrus tree seedlings supplied per year locally and imports**

Citrus seedlings types	Number of citrus seedlings locally produced in a year	Number of citrus seedlings imported in a year	Total number of citrus seedlings supplied in a year	Percentage of total citrus imported
Orange	2,075	13,638	15,713	69%
Lemon	17,111	2,450	19,561	12%
Lime	10	662	672	3%
Pomelos	207	-	207	0%
Kumquat	4	54	58	0%
Grape Fruit	-	510	510	3%
Nartjies	3,715	721	4,436	
Mandarin	-	1,700	1,700	
Tangelos/ Tangerine	-	150	150	13%
<b>Total</b>	<b>23,122</b>	<b>19,885</b>	<b>43,007</b>	<b>100%</b>
	54%	46%		

### 6.1.3 The Status Quo of Citrus Production

This subsection displays and discusses the status of citrus production in Namibia. The area under citrus plantations, the population of mature and young trees, and the tonnage harvested per year at each production zone are presented and discussed.

#### 6.1.3.1 Production Hectares

**Table 4: Total hectares under citrus production in various production zones**

Type of citrus by market names	South	North Central	Kavango	Zambezi	Karst	Total national production area (Ha)	Percentage share of citrus types by area
Orange	7	11	1	0	78	98	33%
Lemon	0	13	1	1	11	26	9%
Nartjies	0	3	0	1	43	46	15%
Lime	0	0	0	0	4	4	1%
Clementine	3	0	0	0	8	11	4%
Grapefruit	12	0	0	0	25	37	12%
Mandarin	77	0	0	0	0	77	26%
<b>Total</b>	<b>100</b>	<b>27</b>	<b>1</b>	<b>2</b>	<b>169</b>	<b>300</b>	<b>100%</b>
<b>Percentage Share of production zones</b>	<b>33%</b>	<b>9%</b>	<b>0%</b>	<b>1%</b>	<b>57%</b>	<b>100%</b>	

The study enumerated about 300 hectares planted with citrus, including young (138) and mature (162) trees. The Karst production zone accounts for 57% (169 hectares) of this total area, followed by South & Orange River with 100 hectares, accounting for 33% of the total area. The North Central production zone has about 27 hectares planted with citrus trees, accounting for 9% of the nationwide citrus production area, and the rest of the production zones planted less than a hectare. Most of the citrus tree types planted are oranges, occupying about 98 hectares, followed by mandarins occupying 77 hectares, nartjies with 46 hectares, grapefruits with 37 hectares, lemons with 26 hectares, and

clementine with 11 hectares, whilst the rest of citrus types occupy less than 5 hectares as illustrated in Table 4.

### 6.1.3.2 The Population of Citrus Trees in Namibia

Table 5 depicts the total population of citrus trees enumerated during the study as of March 2023 which was 185,868 trees, including 129,028 mature trees and 55,980 young trees that are not yet bearing fruits. Most of the trees (58%) are found in the South and Orange River production zones (58%), followed by Karst (35%), and North Central (6%), whereas the rest of the production zones account for less than 1% of the total citrus population. Mandarin dominates the citrus population with 48%, followed by oranges at 25%, grapefruits at 10%, nartjies at 8%, lemon at 5% and the rest of the trees account for less than 4% of the citrus trees' population (Table 5).

**Table 5: Population of citrus trees enumerated per production zone by March 2023**

Citrus type by market names	South	North Central	Kavango	Zambezi	Karst	Total number of trees nationwide	Percentage share of total citrus trees
Orange	8,060	4,260	455	165	33,417	46,357	24.9%
Lemon	120	5,188	90	116	3,702	9,216	5.0%
Nartjies	4	1,073	30	152	17,949	19,208	10.3%
Lime	10	1	-	51	296	358	0.2%
Pomelo	50	-	4	-	100	154	0.1%
Clementine	3,644	-	-	-	3,440	7,084	3.8%
Grapefruit	6,870	-	-	1	11,229	18,100	9.7%
Mineola (Tangelo)	-	-	-	-	100	100	0.1%
Mandarin	85,291	-	-	-	-	85,291	45.9%
<b>Totals</b>	<b>104,049</b>	<b>10,522</b>	<b>579</b>	<b>485</b>	<b>70,233</b>	<b>185,868</b>	
<b>Percentage Share</b>	<b>56%</b>	<b>6%</b>	<b>0.3%</b>	<b>0.3%</b>	<b>38%</b>		

#### 6.1.3.2.1 Population of Mature Citrus Trees

Table 6 presents the proportion of citrus trees population that is bearing fruits. During the study, 121,288 mature trees were enumerated nationwide, whereby the South and Orange River areas have the biggest proportion of mature citrus trees (93,301 trees), followed by Karst with 17,188 mature citrus trees and then the North Central with 10,375 mature citrus trees. Mandarins (85,291 trees), oranges (22,082 trees), lemons (7,349), and nartjies (5,955) are the top four (4) citrus types that were found as mature trees (Table 6).

**Table 6: Number of mature citrus trees enumerated per production zone in Namibia by March 2023**

Type of citrus by market names	South	North Central	Kavango	Zambezi	Karst	Central	Total Number of Mature Trees Nationwide
Orange	8,010	4,248	53	144	9,627	-	22,082
Lemon	-	5,068	72	102	2,107	-	7,349
Nartjies	-	1,058	30	18	4,849	-	5,955
Lime	-	1	-	1	266	-	268
Pomelo	-	-	4	-	100	-	104
Grapefruit	-	-	-	-	239	-	239
Mandarin	85,291	-	-	-	-	-	85,291

<b>Total</b>	<b>93,301</b>	<b>10,375</b>	<b>159</b>	<b>265</b>	<b>17,188</b>	<b>0</b>	<b>121,288</b>
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### 6.1.3.2.2 Population of Young Citrus Trees in Namibia

As presented in Table 7, the Karst production zone leads in terms of newly planted trees, whereby the number of young trees exceeds double the number of mature trees. The South and Orange River areas are second in terms of new citrus plantations. Oranges (24,275 trees), grapefruit (17,861), nartjies (13,253 trees) and clementine (7,084) are the most recently planted citrus trees.

**Table 7: Number of young citrus trees enumerated per production zone in Namibia by March 2023**

Type of Citrus by market names	South	North Central	Kavango	Zambezi	Karst	Total Number of Young Trees Nationwide
Orange	50	12	402	21	23790	24,275
Lemon	120	120	18	14	1595	1,867
Nartjies	4	15	0	134	13100	13,253
Lime	10	0	0	50	30	90
Pomelo	50	0	0	0	0	50
Clementine	3644	0	0	0	3440	7,084
Grapefruit	6870	0	0	1	10990	17,861
Mineola (Tangelo)	0	0	0	0	100	100
<b>Total</b>	<b>10,748</b>	<b>147</b>	<b>420</b>	<b>220</b>	<b>53,045</b>	<b>64,580</b>

### 6.1.3.3 The Productivity of Citrus in Namibia

The study reveals that a total of 162 hectares with a population of 121,288 mature citrus trees (748 trees per hectare on average) provided a total yield of 1,872.1 tons in a year. This yield could be about 12 tons per hectare. The normal citrus yields range from 30 to 60 tons per hectare per year in the case of intensive citrus cultivation, whereas the peak of 15 to 25 tons per hectare per year is achieved with trees of between 8 and 15 years of age in the case of extensive citrus cultivation (Haifa, 2021).

**Table 8: Tonnage of citrus fruits produced per year**

Type of citrus by market names	South	North Central	Kavango	Zambezi	Karst	Central	Total national yield (tons)
Orange	50	12.1	4	7.5	544.8		618.4
Lemon	-	56.3	13.2	4	52		125.5
Nartjies	-	12.4	3.7	0.4	49.1		65.7
Lime	-	0.1	-	0.4	2.8		3.3
Pomelo	-	-	1.2	-	2		3.2
Clementine	50	-	-	-	-		50
Grapefruit	50	-	-	-	16.1		66.1
Kumquat	-	-	-	-	-		-
Satsumas	-	-	-	-	-		-
Mineola (Tangelo)	-	-	-	-	-		-
Nectarine	-	-	-	-	-		-
Mandarin	940	-	-	-	-		940
<b>Totals</b>	<b>1,090</b>	<b>81</b>	<b>22.2</b>	<b>12.2</b>	<b>666.7</b>	<b>0</b>	<b>1872.1</b>
<b>Percentage Share</b>	<b>58%</b>	<b>4%</b>	<b>1%</b>	<b>1%</b>	<b>36%</b>	<b>0%</b>	<b>100%</b>

As presented in Table 8, mandarin (940 tons) leads in terms of total production, followed by oranges (618.4 tons), whereas lemon (125.5 tons) and nartjies (65.7 tons) are the third and second most

produced, respectively. South and Orange River areas lead in the production of citrus, accounting for 59% of total production, followed by Karst accounting for 34% of total production.

### 6.1.3.4 The Seasonality, Citrus Varieties and Growing Practices

#### 6.1.3.4.1 Citrus Seasonality

The citrus season in South Africa (SA) runs from February until September (Food Lovers Market, 2023). According to respondent farmers, Namibia's citrus season is more or less the same as in SA. However, the peak season in Namibia is from June to July for most citrus fruits, whilst it is year-round for lemon fruits. Most of the grafted citrus trees like oranges, only start bearing fruits after the third year of transplanting (Otiene, 2021).

#### 6.1.3.4.2 Citrus Varieties

Despite the wide range of citrus varieties fruit market names, Haifa (2021) listed the principal citrus scions to be six (6) varieties only, whereas the other six citrus types are commonly used as rootstock. The six citrus types used as scions are: 1. Orange (*C. Sinensis Osbeck*), 2. Mandarin (*C. reticulata Blanco*), 3. Lemon (*C. limon [L.] Burn.*), 4. Lime (*C. aurantifolia [Christ.] Swing*), 5. Grapefruit (*C. paradise Macf.*) and 6. Pomelo (*C. grandis [L.] Osbeck*). Although they are listed as individual citrus in the markets, the following citrus types form a group of mandarins: Nartjie, tangerine/ mineola/ tangelo and satsuma (Dikgale, 2015). According to Haifa (2021), the six types of citrus fruits that are used as rootstock are Rangpur (*C. limonia Osbeck*), Rough lemon (*C. jambhiri Lush.*), Sour Orange (*C. aurantium L.*), Cleopatra mandarin (*C. reshni Hort.*) and Trifoliata (*P. trifolia [L.] Raf.*). Notably, it was observed during this study that rough lemons are the most planted lemons in the Northern and Northern production areas, whereas the formal market prefers the *C. Limon* such as the Eureka lemon variety.

Table 9 illustrates some of the common varieties found in the formal retail shops in Namibia, including those planted by commercial farmers.

**Table 9: Common citrus fruit types and varieties in the Namibian's formal markets**

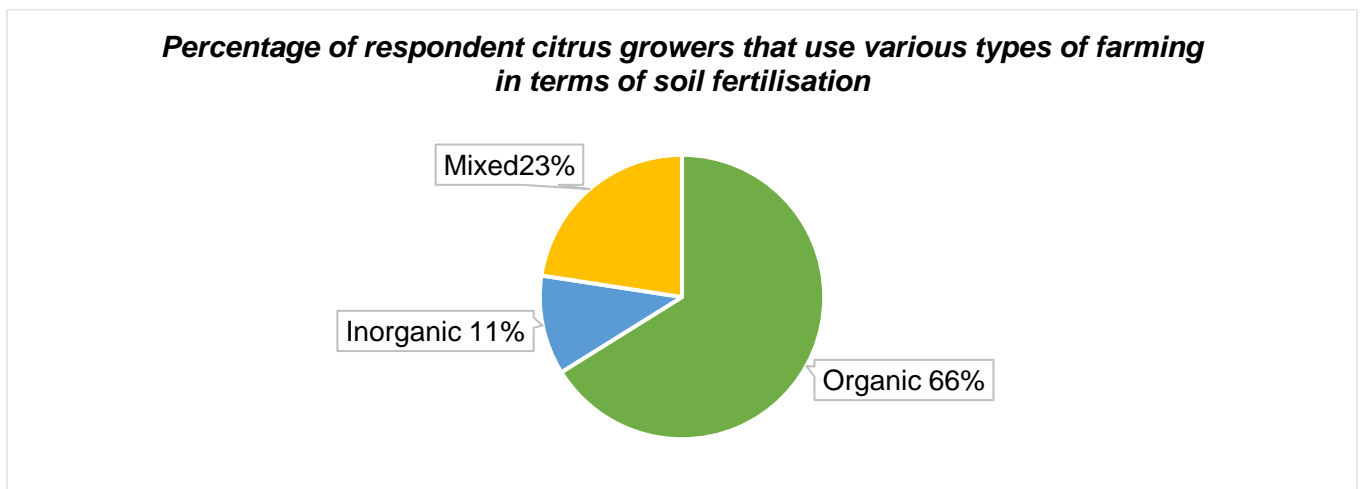
Orange	Mandarin	Lemon	Lime	Grapefruit	Pomelo
Valencia –Midnight	Nova	Eureka	Tahiti/ Bearss	Star ruby	African Shaddock
Valencia - Delta	Nardocott	Lisbon	West Indian	Marsh	Red Shaddock
Washington	Clementine	Limoneira			Valentine Pomelo
Navel	Fairchild's	Genoa			
Lentale	Clemor	-			
Sensation	Morr	-			

**Source:** Selinawamucii (2023), Food Lovers Markert (2021), Fresh Mark (n.d.) and South Africa (2023)

#### 6.1.3.4.3 Growing/ Cultivation practices

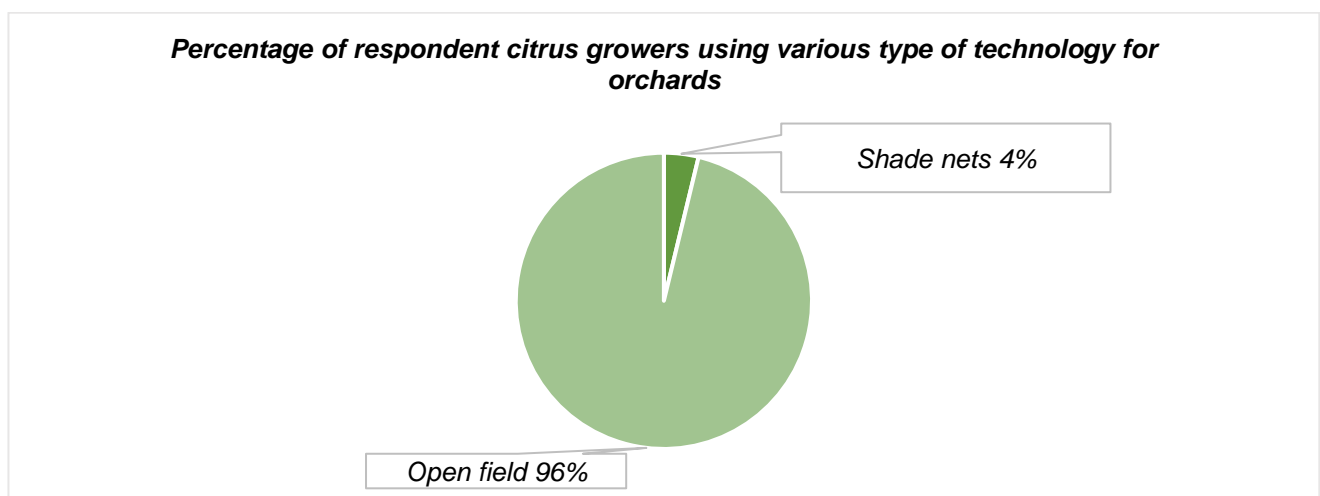
The study investigated the types of soil fertilisation and irrigation techniques that are adopted by citrus farmers, as well as the cultivation methods.

Figure 2 indicates that the majority (66%) of citrus growers are using organic fertilizers as opposed to mixed and inorganic farming. All small-scale citrus growers in Northern and North-eastern production areas are only using manure or compost fertilizers. Most medium-scale farmers use mixed (organic and inorganic) fertilizers, whereas large-scale farmers use inorganic fertilizers.



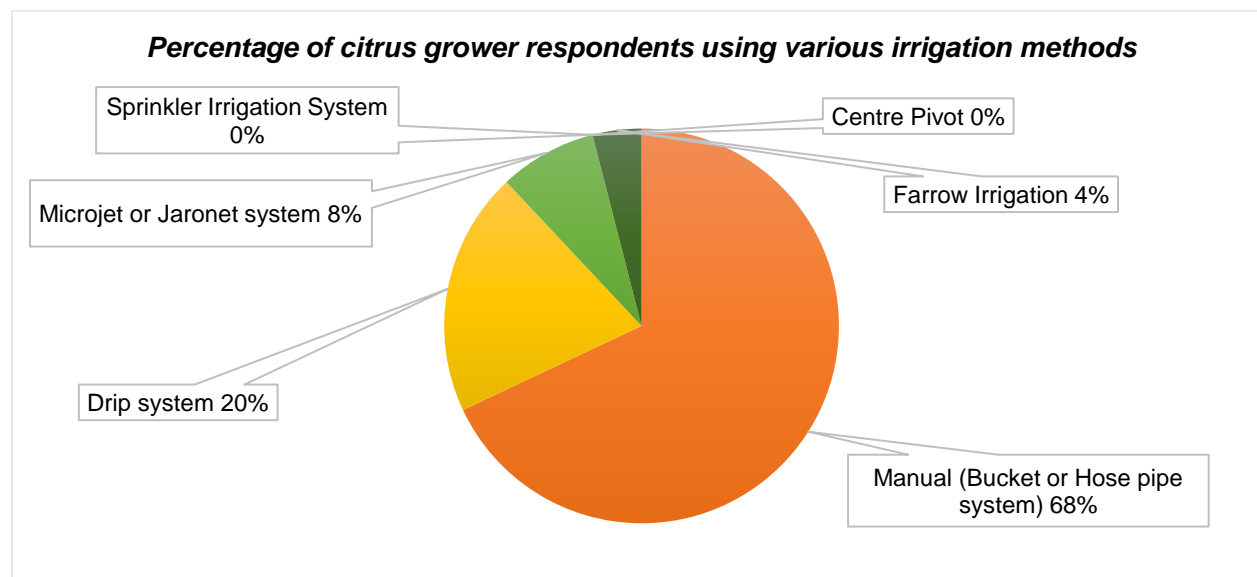
**Figure 2: Percentage of citrus growers using different types of fertilizers**

Figure 3 illustrates that open field (96%) is the common growing method practised by Namibian citrus growers who were visited during the current study. Only 4% of citrus growers planted citrus under shade nets. This is practised in the South production zone where extremely low temperatures are experienced sometimes.



**Figure 3: Percentage of citrus growers using different farming systems**

As visualised in Figure 4, the majority of citrus growers (68%) interviewed are still using traditional/manual irrigation methods such as buckets and hose pipe systems. This manual-based irrigation is mostly practised by small scale growers in the North Central, Kavango and Zambezi production zones. The drip irrigation system is used by 20% of the citrus growers interviewed, whilst the microjet is used by 8% of interviewed citrus growers and this is mostly the medium and large-scale growers.



**Figure 4: Percentage of citrus growers using different irrigation systems**

#### 6.1.4 Average Cost of Producing Citrus Fruits

Citrus growers were asked to share the approximate cost of citrus production per hectare in terms of both start-up capital and operational costs. As shown in Table 9, it could cost about N\$ 100,000.00 to N\$ 600,000.00 to establish one hectare of citrus, which is an average of about N\$ 250,000.00 per hectare. Although intensive citrus cultivation provides more yields (Haifa, 2021), it is more expensive to establish when compared to open-field orchards. On the other hand, it could cost an average of about N\$ 135,000.00 per hectare to run the operations of a citrus orchard. Intensive citrus cultivation could cost as high as N\$ 250,000 per hectare in establishment cost, whereas open fields could cost as low as N\$ 30,000.00 per hectare, depending on the population density of citrus trees per hectare.

**Table 9: Average start-up costs and annual operational costs per hectare of citrus trees**

Production Zone	Average start-up/establishment cost per hectare (N\$)	Average operational cost per hectare (N\$)
South	600,000.00	250,000.00
North Central	115,327.67	29,332.62
Kavango	322,100.00	313,400.00
Zambezi	104,085.71	33,800.00
Karst	135,246.95	51,561.94
<b>Average N\$/ Ha</b>	<b>255,352.07</b>	<b>135,618.91</b>



### 6.1.5 The Status Quo of Value Addition on Citrus Fruits

The study revealed that value addition is not existent in Namibia's citrus value chain. This was evident when all 52 citrus growers and 22 traders expressed that they are not involved in any formal value addition (Tables 10 & 11). Only two of the producers, one from Northern Central and the other from Kavango indicated having processed lemon juice at the domestic level for own consumption and informal sales. However, this was only about 180 litres of lemon juice per year.

**Table 10:** Number of respondent producers involved in citrus production

Production Zone	Producers: Are you doing any citrus value addition?	
	Yes	No
South	0	2
North Central	1	14
Kavango	1	7
Zambezi	0	12
Karst	0	15
Central	0	0
<b>Totals</b>	<b>2</b>	<b>50</b>

**Table 11:** Number of respondent Traders involved in citrus value addition

Production Zone	Trader: Are you doing any citrus value addition?	
	Yes	No
South	0	3
North Central	0	6
Zambezi	0	7
Kavango	0	2
Karst	0	2
Central	0	2
<b>Totals</b>	<b>0</b>	<b>22</b>

## 6.2 REGULATORY COMPLIANCE AND PROTECTION INFORMATION

This subsection describes the aspects of certification of nurseries and citrus orchards, the control of quarantine pests and diseases, food safety and ultimately the expectations of citrus value chain members on government protection to safeguard Namibia's citrus industry.

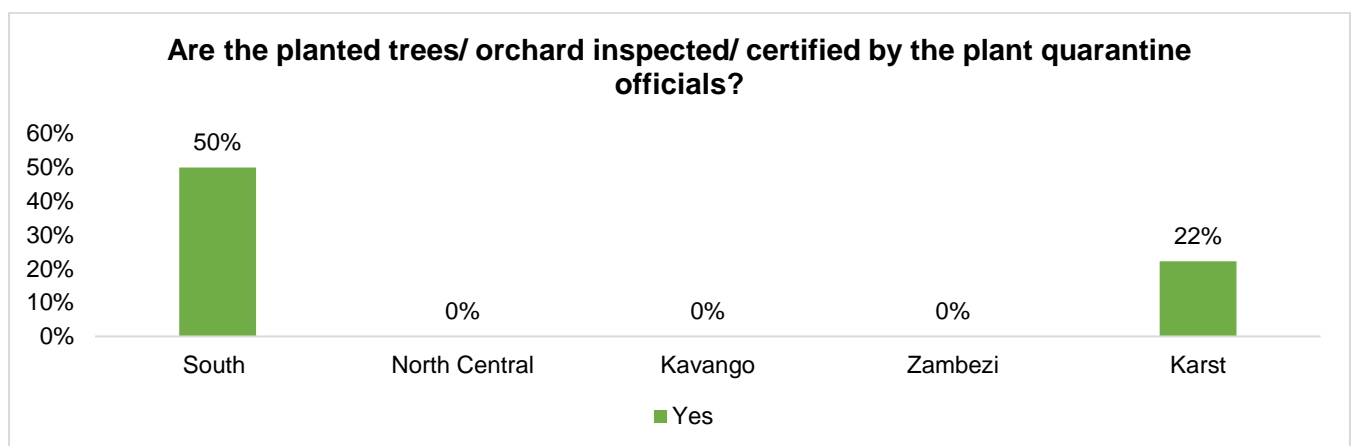
### 6.2.1 Certification of Nurseries and Citrus Orchards

Section (9) of the Seed and Seed Varieties Act No. 23 of 2018 requires horticulture nurseries to be registered. This Act entails certain criteria relating to infrastructure, equipment, and technical ability and knowledge that need to be in place for a nursery to be certified. Nurseries are supposed to "keep a complete record of origin or source of all planting material and performance record of mother trees in the nursery (Act No. 23 of 2018).

On another note, The Plant Quarantine Act No. 7 of 2008, demands that the imported seedlings be subjected to the Phytosanitary Certificate from the exporting government or country and vice versa when Namibia is exporting. Hence, orchards intending to export citrus fruits are supposed to inform the Quarantine Officers in advance so that they can start with the surveillance so as to smoothen the phytosanitary certification process, whenever it's required. The orchards that are isolated at more than 500m away from other fruit orchards that are not controlled favour the surveillance process, according to MAWLR quarantine officials.

Respondent citrus growers were asked to share whether their orchards were certified through inspections, especially by the Plant Health Department of the MAWRL.

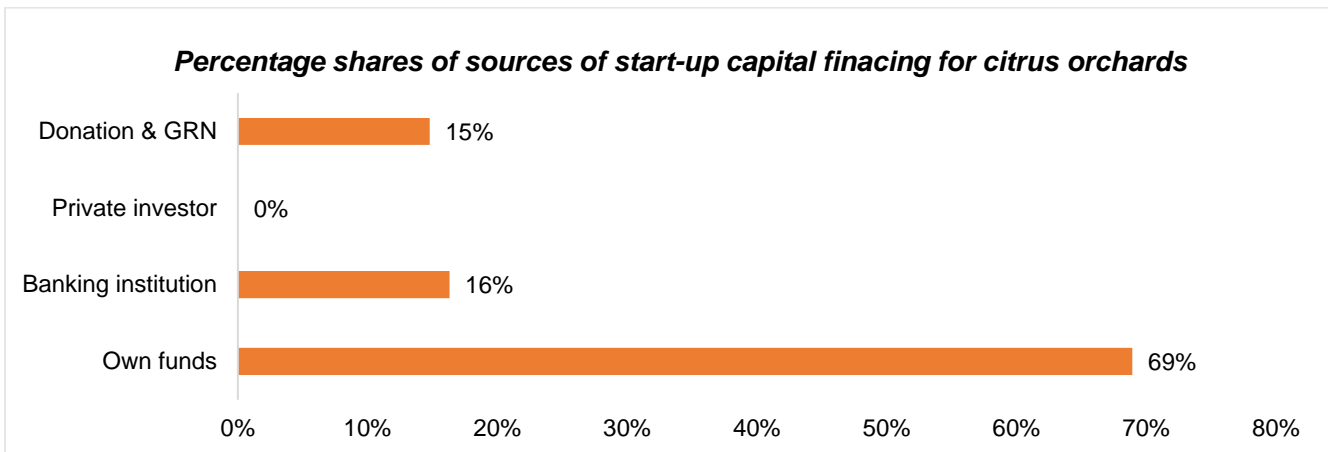
Figure 5 illustrates the percentages of citrus farms inspected for Plant Health assurance, whereby 50% of the citrus orchards in the South and Orange River areas and 22% in the Karst area were inspected, especially by the Plant Health division of the MAWRL. The rest of the orchards are still not inspected for certification, thereby making it difficult for them to acquire Phytosanitary Certificates in cases where they want to export citrus fruits.



**Figure 5: Percentages of citrus farms inspected for Plant Health assurance**

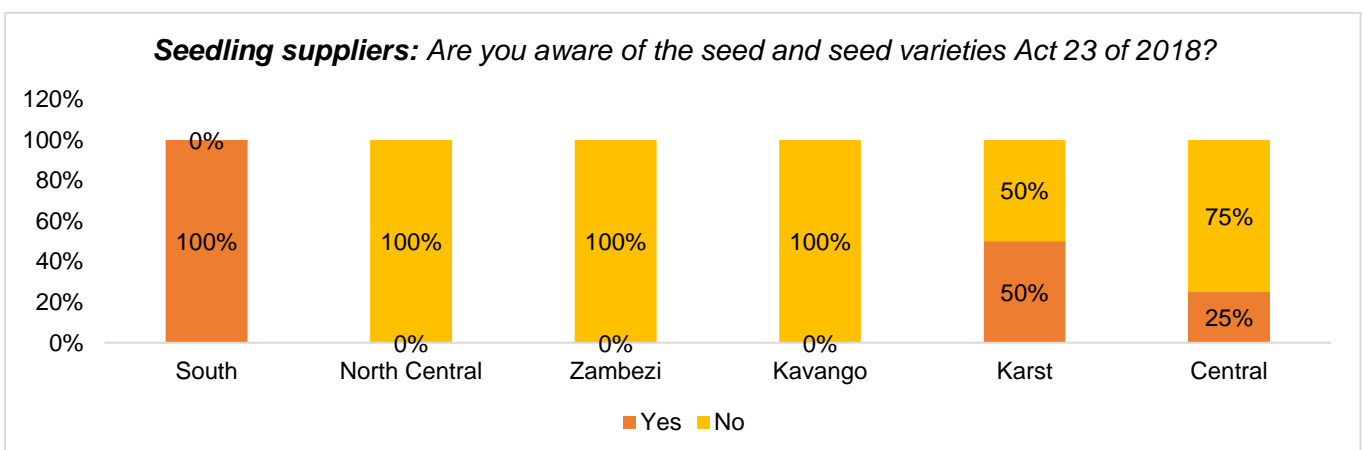
Respondent seedling suppliers were also asked whether their nurseries are certified and whether they are aware of the Seed and Seed Varieties Act No. 23 of 2018. Responses from seedling suppliers are presented in Figures 6 and 7 below.

Figure 6 shows that all of the nurseries at Kavango, Zambezi and North Central production zones are never certified with any kind of nursery certification. The majority of nurseries in the Central, Karst and Central production zones were certified. However, these are mainly distributors of imported citrus seedlings and the main certifying body was the Citrus Growers Association (CGA) from South Africa.



**Figure 6: Number of nurseries certified or inspected for plant health**

As presented in Figure 7, all respondent nurseries in Northern and North-eastern areas proved not to be aware of the Seed and Seed Varieties Act.



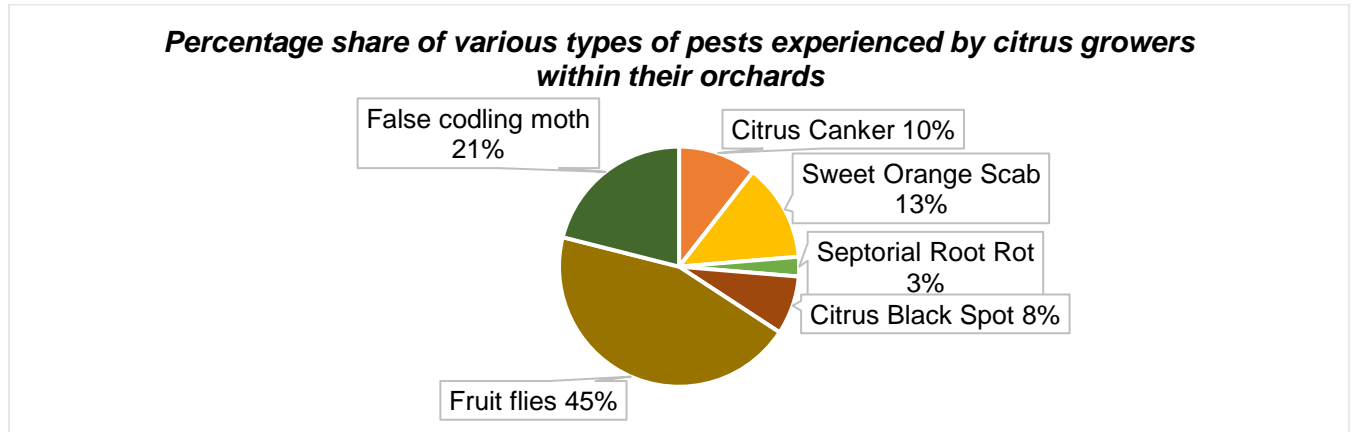
**Figure 7: Percentage of seedling suppliers that are aware or not aware of the requirements of the Seed and Seed Varieties Act**

### 6.2.2 Quarantine Pests

Common pests that attack citrus trees include aphids, false codling moth, whiteflies, leaf miners, thrips, fruit flies and common spiral nematodes, whereas common diseases are pseudocercospora leaf and fruit spot, Phytophthora spp and orange fruit scab (Otieno, 2021). Through the current study, Namibian citrus growers were asked to tell whether they have come across such pests and diseases in their orchards.

Figure 8 indicates the percentage of respondent citrus growers that have come across certain pests and diseases within their orchards. Fruit fly (48%) was the most pest confirmed, followed by False Codling Moth (21%) and a disease called Sweet Orange Scab (13%), while the rest of the pests were

experienced by less than 10% of the respondents. Although they are not part of the pests indicated in the pictogram, ants, termites, aphids and locusts were the other pests that were mentioned by citrus growers during the interviews.



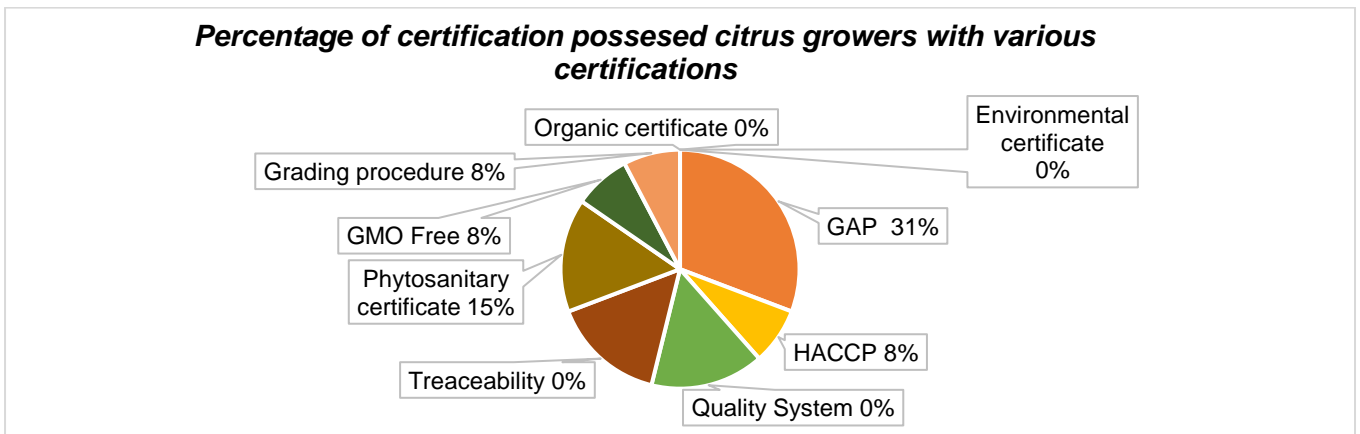
**Figure 8: Percentage of citrus growers who experience each type of pests and diseases**

### 6.2.3 Food Safety Certification and Fruit Handling

All food business operators (pack houses) are required to implement HACCP principles, whereas farmers are required to implement GAP principles (Namibian Food Safety Policy, 2014). During this study, various citrus value chain actors were interviewed for them to indicate whether they have any food safety-related certifications or systems in place, as well as a storage pack house.

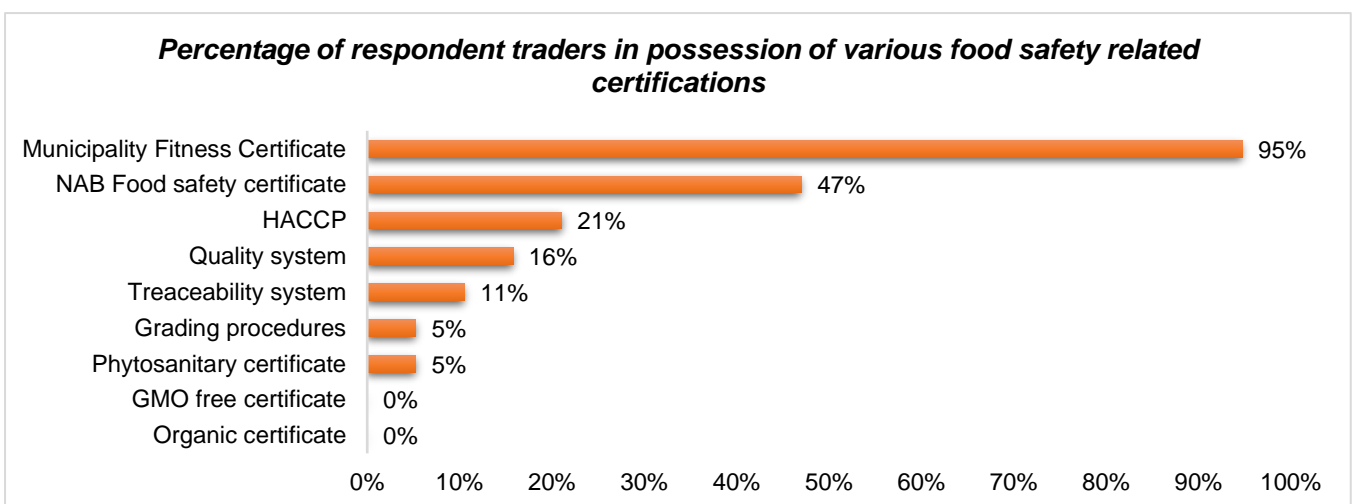
#### 6.2.3.1 Food Safety Certifications

Figures 9 and 10 show the percentage of respondent actors (growers and traders) in the citrus value chain regarding the possession of food safety certifications. Figure 9 indicates that at least 31% of the certifications possessed by citrus growers interviewed were confirmed to be GAP certifications, whereas, phytosanitary, traceability and quality system certifications each accounted for 15% of the certifications and systems in place by citrus orchards and these are normally issued by private certifying companies from South Africa such as Dynachem, Aspirata and SGS South Africa. HACCP principles and grading procedures for pack houses equally account for 8% of interviewed citrus growers certified by South African private certifying companies as well. The phytosanitary certificates, on the other hand, were issued by the exporting governments.



**Figure 9: Percentage of respondent citrus orchards with various certifications**

Figure 10 indicates that the business fitness certificate (95%) is the only certification that is possessed by almost all traders. Only 18% of interviewed traders confirmed having HACCP certification, whereas at least 14% of traders interviewed have quality system certifications in place. These certifications are issued by private standards certifying companies from South Africa, mainly Dynachem.



**Figure 10: Percentage of respondent citrus traders with various certifications**

### 6.2.3.2 Fruits Handling

At least 14 (26%) out of 52 citrus farms interviewed possess cold storage, though these facilities are not used to store citrus. Citrus fruits can be stored at ambient temperature if it is not intended to be stored for too long. In terms of packhouses, at least 13 (22%) out of 52 citrus growers have constructed packhouses for the general horticultural produce. The packhouses that are solely dedicated to citrus packaging are found in the Karst production zone (2 citrus packhouses) and the South and Orange River area (1 citrus packhouse).

### 6.2.4 Government Protection

The most trending responses when citrus growers were asked for advice on any kind of government protection required are as follows:

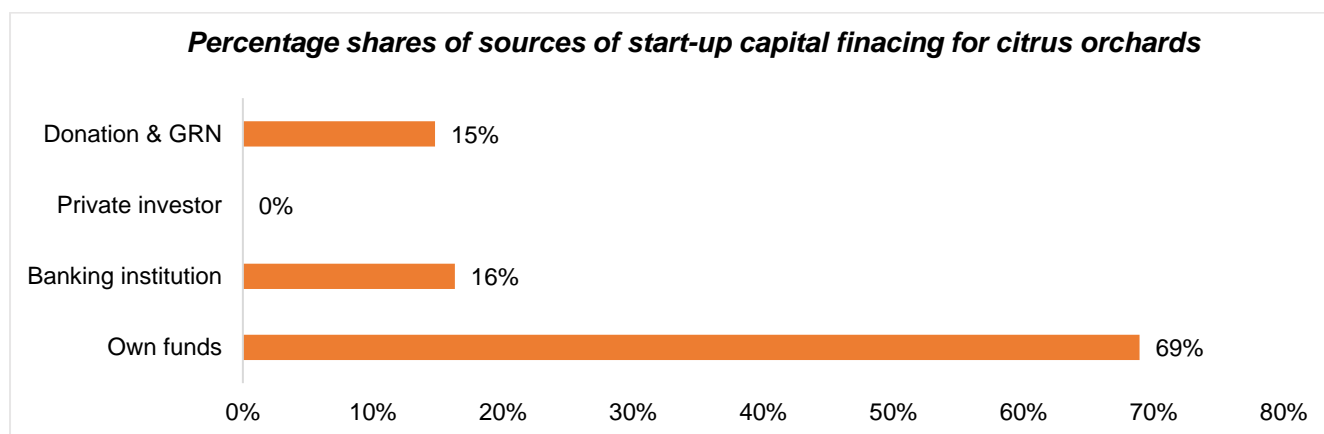
- Domestic market protection through MSP during Namibia’s peak harvest i.e. April to June.
- Training and advisory services on citrus production practices and control of quarantine pests and diseases.
- Training on value addition, especially on processing lemon fruits.
- Subsidies on inputs, irrigation systems and grafted seedlings.
- Pest and disease inspection and advisory services.

The development of Namibian domestic citrus production was the most trending call by the traders during the study when asked to tell whether there is any kind of protection needed from the government. Sensitizing local investors to consider processing citrus juice locally was also mentioned by some of the traders during the interviews. Citrus seedling suppliers on the other hand, called for access to affordable planting materials of improved varieties such as seeds and scions, and training on how to graft citrus trees.

### 6.3 FINANCING INFORMATION

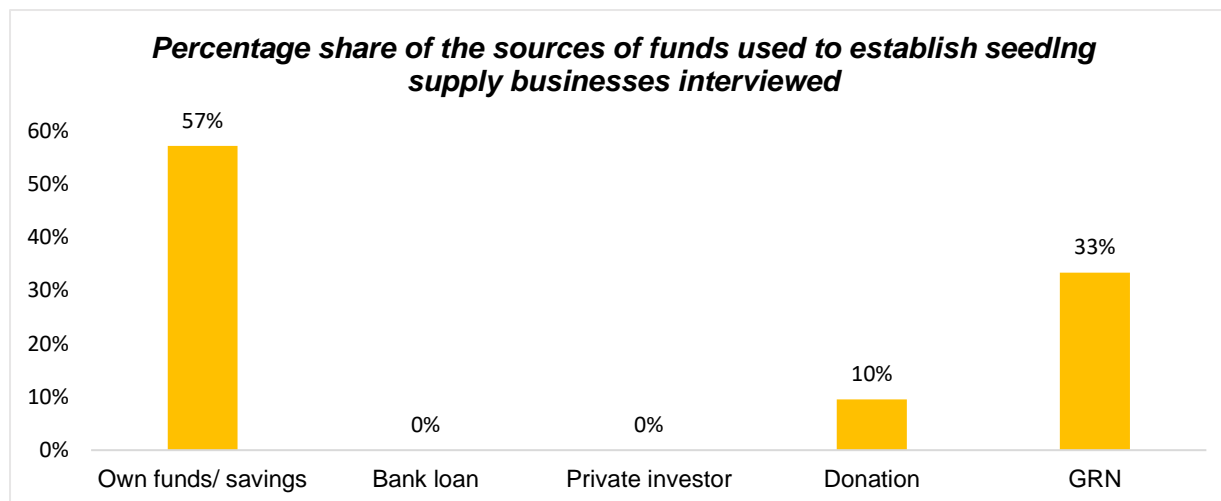
Actors in the citrus industry, namely, seedling suppliers and citrus orchard respondents were asked to reveal the source of capital used in financing the setup of their businesses. Results are as presented in Figures 11 and 12.

Results in Figures 11 and 12 show that own funds are the most common source of financing used in establishing both citrus orchards and seedling suppliers. At least 16% of the funds used in establishing orchards were borrowed from banking institutions, whereas none of the seedling businesses' financing was borrowed from banks.



**Figure 11: Percentage sources financed by respondent citrus orchards**

Figure 12 depicts that apart from using their own funds/savings (57%), some of the seedling businesses and citrus orchards were established by the government (33%) and donors (10%). Since there is a huge gap for locally raised grafted seedlings, this signifies an opportunity for both banking institutions and seedling supply businesses to make use of the banking financing opportunity.



**Figure 12: Percentage of sources financed by respondent seedling businesses**

## 6.4 CITRUS MARKETING AND PRICE INFORMATION

This subsection presents the trade statistics and price information of citrus seedlings and fruits as outlined under the following subsections.

### 6.4.2 Citrus Seedlings Marketing, Price, and Value

This study has exposed that there are no formally organised markets for citrus seedlings as most of the respondents sell their seedlings at the nursery gate, through individual orders and in the streets. None of the seedling suppliers has ever supplied the citrus seedlings through agro-dealers, retail shops or export markets.

As presented in Table 12, a total of 43, 239 seedlings valued at about N\$ 4.4 million per year were marketed by 22 seedling suppliers that were interviewed. Out of the total supplied seedlings, about 20,117 seedlings were imported from South Africa per year. This figure could be more as seedlings that are imported from Uganda and Kenya were not included due to respondents' unavailability and inaccessibility during the study period. About 23,122 citrus seedlings were raised locally, which are usually not grafted and 74% of these seedlings are lemons and they are mostly not improved. After lemons, the most selling seedlings are nartjies and oranges. Even if the number of local seedlings is more than the imported seedlings, the trade value of local seedlings is 8.5 times lower than the import value. There is, therefore, an urgent need to upgrade local nurseries to raise grafted seedlings.



**Table 12: Estimated yearly trade statistics of local (mainly not grafted) and imported (grafted) seedlings of citrus**

Citrus types by market names	Local seedlings	Average price of local seedlings	Local trade value N\$	Imported seedlings	Average price of imported seedlings	Imports trade value	Total No. of Seedlings	Total trade value
Orange	2,075	20	41,500	13,638	196	2,673,048.00	15,713	2,714,548.00
Lemon	17,111	20	342,220	2,450	196	480,200.00	19,561	822,420.00
Nasties	3,715	20	74,300	721	196	141,316.00	4,436	215,616.00
Lime	10	20	200	662	196	129,752.00	672	129,952.00
Pomelos	207	20	4,140	-	196	-	207	4,140.00
Clementine	-	20	-	232	196	45,472.00	232	45,472.00
Grape Fruit	-	20	-	510	196	99,960.00	510	99,960.00
Kumquat	4	20	80	54	196	10,584.00	58	10,664.00
Satsuma	-	20	-	-	196	-	-	-
Mineola	-	20	-	-	196	-	-	-
Mandarin	-	20	-	1,700	196	333,200.00	1,700	333,200.00
Tangelos/ Tangerine	-	20	-	150	196	29,400.00	150	29,400.00
<b>Totals</b>	<b>23,122</b>		<b>NAD 462,440.00</b>	<b>20,117</b>		<b>NAD 3,942,932.00</b>	<b>43,239</b>	<b>NAD 4,405,372.00</b>

### 6.4.3 Citrus Fruits Marketing, Price, and Value

Table 13 shows the quantities of fruits that were indicated as marketed by 52 respondent citrus growers. The study reveals that a total of 1,801 tons was traded per year as of 2022, at the total trade value of N\$ 23, 3 million (Table 13). The majority of this trade was through formal markets, which were 1300 tons, valued at N\$ 17.2 million. The marketed tonnage is less than the production tonnage which was estimated at 1,872.1 tons per year. About 501 tons were disclosed as sold via informal trading, valued at about N\$ 6.1 million, whereas there are no citrus exports. There is still a huge room for improvement as far as citrus production is concerned, considering the 7,850 tons which were imported from South Africa during the 2021/2022 reporting period at a total value of N\$ 55.7 million. The most marketed citrus fruits are oranges at 608 tons, lemons at 71 tons and nartjies at 61 tons. Kumquat are never marketed from local suppliers as they are not produced, whereas, satsumas, mineola (tangelos), and nectarines do not appear, perhaps because they form part of mandarin and nartjies.

**Table 13: Quantities of fruits disclosed as marketed by 52 respondent citrus growers**

Fruit type	Informal sales (tons)	Informal price N\$/ton	Trade value N\$ (Informal)	Formal sales (tons)	Formal price (tons)	Trade value N\$ (formal)	Total sales (tons)	Total trade value N\$
Orange	389	12,361	4,811,068	218.75	10,617	2,322,396	608	7,133,464
Lemon	37	10,388	388,555	33.65	12,167	409,408	71	797,963
Nartjies	55	12,673	690,950	6.6	10,750	70,950	61	761,900
Lime	3	15,644	39,424	0.8	18,000	14,400	3	53,824
Pomelos	2	10,000	20,000	0	10,350	-	2	20,000
Clementine	0		-	50	12,500	625,000	50	625,000
Grapefruit	15	9,333	142,333	50.8	12,000	609,600	66	751,933
Mandarin	0		-	940	14,000	13,160,000	940	13,160,000
<b>Totals</b>	<b>501</b>		<b>NAD 6,092,330.3</b>	<b>1,301</b>		<b>NAD 17,211,754</b>	<b>1,801</b>	<b>NAD 23,304,084</b>

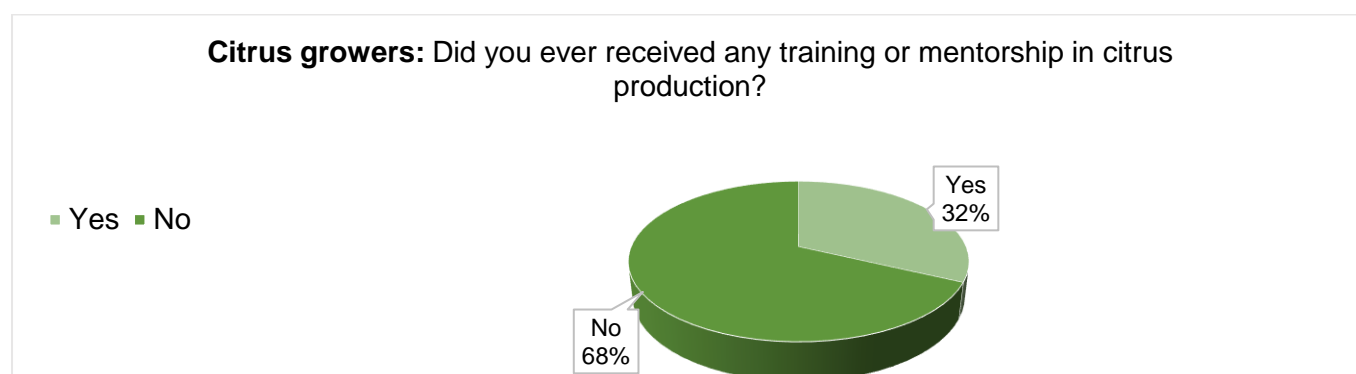
## 6.5 TRAINING AND INDUSTRY AFFILIATION

This subsection explains the training opportunities offered to citrus value chain members as well as the existence of relationships in the form of unions or associations. Training and advisory services can be pivotal to the success of a value chain as they can improve effectiveness. Relationships in the value chains can also improve effectiveness and efficiency, reduce waste, reduce costs, and increase profitability (Dent & Collins, 2021).

### 6.5.1 Training Opportunities

This study sought to establish whether the respondent citrus growers and seedling suppliers have ever received training in citrus production or nursery management. The percentage shares of value chain actors trained versus those never trained are presented in Figure 13.

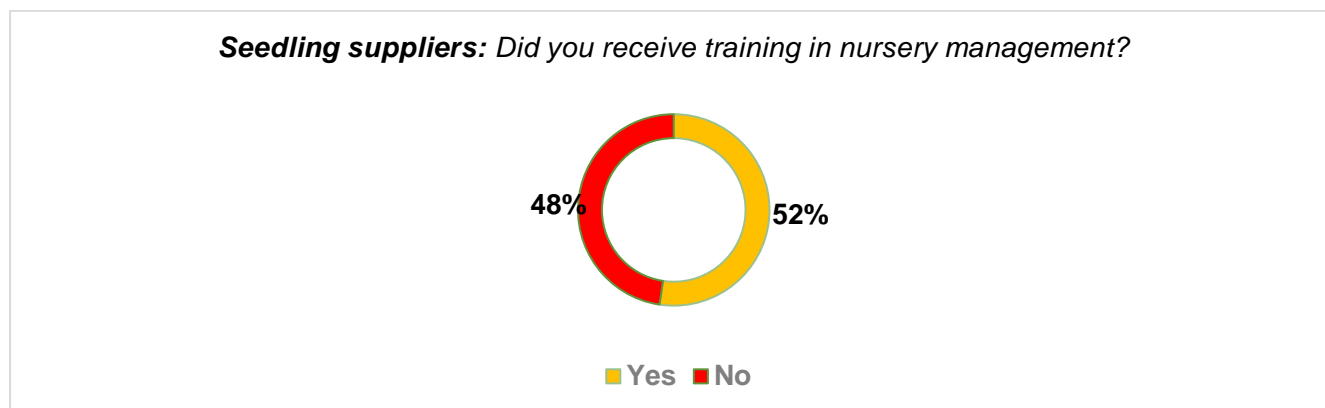
The majority (68%) of respondent citrus growers have never received any training or mentorship on citrus production practices. Only 32% received this kind of training or mentorship (Figure 13). Those who received training and mentorship are mainly some of the commercial farmers in the Karst, South and Orange River areas and those representing GRN institutions. This training was either provided through formal education or by the Citrus Research Institute South Africa (CRI). However, some citrus growers indicated that they also receive some training and mentorship from AgriGro, Intelligro, and Namibia Citrus Growers Association. Therefore, more interventions are required to ensure that all the producers are trained to develop the citrus industry.



**Figure 13: Percentage of citrus growers who received training or mentorship in citrus production**

Figure 14 shows the percentage of seedling suppliers who were trained in nursery management. Of the interviewed seedling suppliers, 52% were trained whilst 48% were never trained in nursery management (Figure 14). Nevertheless, most of the trained seedling suppliers are the GRN institution respondents such as DOF and UNAM nurseries. The seedling suppliers that are trained, rarely supply grafted

seedlings due to a lack of resources. Therefore, more still needs to be done to ensure that all seedling suppliers are trained, including private nurseries.

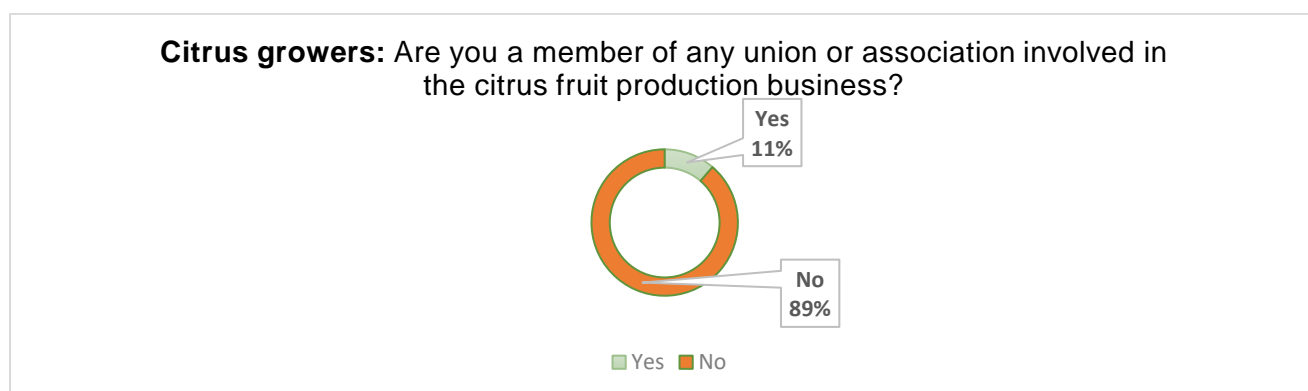


**Figure 14: Percentage of seedling suppliers trained in nursery management**

### 6.5.2 Value Chain Member Organisational Affiliations

Value chain members need to act in an interdependent way to address critical control points in the citrus value chain, such as genetic materials (varieties), inputs, packaging, food safety, and other standards (Dent & Collins, 2021). Hence, the study investigated whether value chain members are organised or not.

Figure 15 presents the percentages of citrus growers in terms of being members of any association involved in the citrus business. Only 11% of citrus growers confirmed being members of associations in the citrus business. One of the farmers in the Southern and Orange River area is a member of the Citrus Research Institute South Africa (CRI), whereas four (4) of the respondent producers in the Karst production zone are members of the Namibia Citrus Producers Association. The rest of the farmers are non-members of any citrus-related association. This applies to seedling suppliers as none of the respondents indicated being a member of any citrus-related association.



**Figure 15: Percentage of respondent citrus growers in terms of being members of any association involved in citrus production**

## 6.6 MAIN CONSTRAINTS AND OPPORTUNITIES ALONG THE CITRUS VALUE CHAIN

This section presents the main opportunities and constraints perceived by the citrus value chain members surveyed (seedling suppliers, citrus growers, and traders). Responses are presented in the next three (3) tables below.

### 6.6.1 Seedling Suppliers

**Table 14: Main challenges and opportunities perceived by citrus seedling suppliers**

Challenges	Opportunities
<ul style="list-style-type: none"> <li>✓ Lack of citrus seeds and scion materials</li> <li>✓ Lack of knowledge of tree grafting</li> <li>✓ High cost of transport to support the nursery activities</li> <li>✓ High water bill, high labour cost and high cost of making improved trees</li> <li>✓ Lack and cost of fertilizer and pesticides</li> <li>✓ Local competition in the non-grafted seedlings market and imported grafted seedlings by large retail shops</li> </ul>	<ul style="list-style-type: none"> <li>✓ High demand for grafted seedlings</li> <li>✓ Capitalising on the use of fertilizers, pesticides etc.</li> <li>✓ Training the seedling producers on grafting and raising</li> </ul>

### 6.6.2 Citrus Growers

**Table 15: Main challenges and opportunities perceived by citrus growers**

Challenges	Opportunities
<ul style="list-style-type: none"> <li>✓ Pests and diseases: aphids, birds, fruit fly and root rot</li> <li>✓ Frost and extreme heat in some areas</li> <li>✓ Electricity (water pumping costs)</li> <li>✓ Lack of preservation and storage facilities</li> <li>✓ Theft by community members</li> <li>✓ Lack of organised market and strong association</li> <li>✓ Absence of processing or value addition facility</li> <li>✓ Lack of market for lemon fruits</li> <li>✓ Lack of quality seedlings</li> <li>✓ High cost and lack of improved/ grafted varieties</li> <li>✓ Limited skills in citrus production</li> <li>✓ Lack of financial resources and collateral limitations</li> </ul>	<ul style="list-style-type: none"> <li>✓ High demand for citrus fruits</li> <li>✓ Export markets (Europe, Asia &amp; USA)</li> <li>✓ Value addition on lemons (juice, lemonade, cosmetics flavour)</li> <li>✓ Import root-rot-resistant cultivars.</li> <li>✓ Joint importation of citrus seedlings</li> <li>✓ Potential to establish a citrus grower association.</li> <li>✓ Good soil and water availability</li> <li>✓ Potential to create a Namibian citrus brand and be early in the market due to the unique climate.</li> </ul>

### 6.6.3 Traders

**Table 16: Main challenges and opportunities perceived by citrus traders**

Challenges	Opportunities
✓ Waste of fruits when it's not sold on time (Perishability)	✓ Potential to produce fruits locally
✓ Imported citrus is expensive due to transport	✓ Create awareness of citrus planting
✓ Lack of local supply of citrus (taste and colour)	✓ Treat citrus fruits for longer shelf life
✓ Lack of citrus during off-season in South Africa	✓ Plant more trees along rivers and dams
✓ Poor quality (taste & colour) and high price of local citrus fruits	✓ Process excess fruits into juice
✓ The market is flooded with citrus fruits when local production is at its peak	
✓ High cost to transport citrus fruits from South Africa	
✓ Unreasonably high prices of citrus fruits sometimes	

## 7. CONCLUSIONS

This study analysed the citrus value chain in Namibia, ranging from seedling tree supplies, fruit production, value addition, regulatory compliance, industry affiliations and training, marketing of citrus seedlings and fruits, and financing conditions. Key industry actors' perceptions on what kind of government protection is needed to develop the citrus industry, the main challenges experienced, and the opportunities foreseen in favour of Namibia's citrus industry were explored and revealed in this report.

Out of 43,239 citrus tree seedlings traded in Namibia during the year 2022, about 20,304 (47%) were imported at a value of N\$ 3.9 million, 8.5 times more than the value of 23,122 seedlings produced locally. Unfortunately, 74% of local seedlings are not grafted and mostly not the varieties preferred by the formal and export markets. Hence, there is room for improvement in ensuring that seedlings produced locally match the market requirements. The current production level is estimated to be about 1,872 tons from 121,288 mature trees. This production level is likely to increase by 50% by the year 2026, given the 64,580 young trees planted during 2022. However, there is still room for improvement as the imports of citrus fruits stand at 7,850 tons during the year 2022. There is currently no value addition to domestic citrus fruits. The study could not quantify the repacked juice at this juncture due to the wide range of juice brands.

Citrus trees are prone to extreme climatic and geographic conditions such as low temperatures, prolonged frost, high elevation and lack of irrigation. Hence, most areas in the Karst, North Central, Kavango, Zambezi and far South production zones could meet citrus favourable conditions. However, the citrus value chain has plenty of room for improvement regarding other critical success factors such

as production practices, regulatory compliance, government protection, industry affiliations and training services, and financing opportunities.

In terms of production practices, the availability of grafted citrus seedlings is scarce and expensive, whereas some farmers lack proper irrigation systems and modern fertilisation practices. In terms of regulatory compliance, quarantine pest and disease surveillance and control is not critically occurring at some citrus orchards, whereas a local certification system for nurseries and orchards is not yet available. Fruit flies and false codling moths were identified as the biggest problem pests in most production areas. On another note, caution should be put in place to curb the spreading of the black spot disease.

Some governmental protections expected by the citrus value chain actors include but are not limited to Market Share Promotion (MSP) during local harvest peak time, the provision of training and advisory services on production to producers and seedling suppliers, value addition, as well as subsidies on tree seedlings, inputs and irrigation systems. In terms of industry affiliations and training services, the majority of citrus growers and seedling suppliers are not yet members of the citrus growers association, nor trained in citrus technicalities. Last but not least, financing opportunities seem to be not so exploited by the citrus value chain actors, as the majority used their own funds to establish such businesses.

Limited skills, lack and cost of improved citrus varieties, poor industry affiliations, lack of pro-activeness on pests and diseases surveillance, and limited certification status are therefore among the shortcomings in the industry. Despite the shortcomings, the citrus industry stands opportunities to import citrus scions for grafting, graft citrus trees locally, substitute imports by planting more than 520ha with over 224,890 trees, do value addition on lemons, affiliate through citrus associations, create a Namibian citrus brand and ultimately exploit the export markets.

## 8. RECOMMENDATIONS

Based on the results and discussions and the conclusions above, the study provides the following recommendations that are targeted to various groups of actors within Namibia's citrus value chain.

- ✓ Seedling suppliers should invest in grafting materials and obtain scions to graft citrus types that are preferred by formal and external markets.
- ✓ DOF should invest in improved citrus varieties in the replacement of the current excessive raising of un-grafted citrus seedlings.
- ✓ Citrus growers should plant an extra of more than 520 hectares of over 224,890 grafted citrus trees of varieties that are found in the formal markets to ensure self-sufficiency and exports.
- ✓ The government, through the MAWRL and the NAB, should ensure the implementation of the pests and diseases surveillance system for diseases and pests to enhance the phytosanitary certification of citrus farms.
- ✓ The Namibia Citrus Producers Association (NCPA) should develop a Code of Conduct and register more citrus growers and seedling suppliers to facilitate the training and certification processes.
- ✓ The GRN, through the MARL, NAB and DOF should provide support to ensure the training of seedling suppliers and citrus growers on nursery management, citrus grafting, citrus production, storage and processing to improve productivity and efficiency.
- ✓ The NAB through research could explore the potential of lemon value addition e.g. lemon juice for human consumption and lemon flavour as ingredients for cosmetics.
- ✓ Banking institutions, especially the Agribank should consider establishing a citrus development fund where industry actors could borrow funds to establish citrus nurseries, citrus orchards and citrus pack houses.



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