

# **A literature review of the horticulture sector in Northern Australia**

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## **Executive Summary**

This literature review has been undertaken as part of conducting a situation analysis of the horticulture sector of northern Australia, funded by CRCNA. This review aims to provide an overview of the current status of the horticulture sector across northern Australia. Most of the information presented in this report is based on the literature collected from various federal/state/territory government databases, research publications, and farmers' organisations websites as well as personal contacts. Here, we present a snapshot of the north's horticulture sector in terms of crop production, area of cultivation, and economic returns for the Northern Territory, northern parts of Queensland and Western Australia. We also summarise the key issues, as highlighted in the literature, associated with the current and future development of the horticulture sector in the north.

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## **Acronyms and Abbreviations**

ABS	Australian Bureau of Statistics
ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
CRCNA	Cooperative Research Centre for Developing Northern Australia
DAF	Department of Agriculture and Fisheries
DITT	Department of Industry, Trade and Tourism
FGD	Focus Group Discussions
DPIRD	Department of Primary Industries and Regional Development
FNQ	Far North Queensland
NT	Northern Territory
Qld	Queensland
SWOT	Strengths, Weakness, Opportunities, Threats analysis
WA	Western Australia

## 1. Introduction

Horticulture is a fast-developing sector in northern Australia. A wide range of horticulture crops including fruits, vegetables, fodder crops, hays and nursery are produced in the region that meet the domestic as well as international demand. A CRCNA (2020) report suggest an estimate of 17 million hectares of potential arable soil suitable for agriculture development. In the recent past years, the Northern Territory (NT), northern parts of Western Australia (WA) and north Queensland (Qld) has also been considered an important gateway to Asian market offering a great opportunity for exporting horticulture crops.

This preliminary report aims to provide an overview of the current status of horticulture sector across northern Australia. It represents a first step of the research undertaken as part of CRCNA project on “a situational analysis of the horticulture sector across northern Australia”.

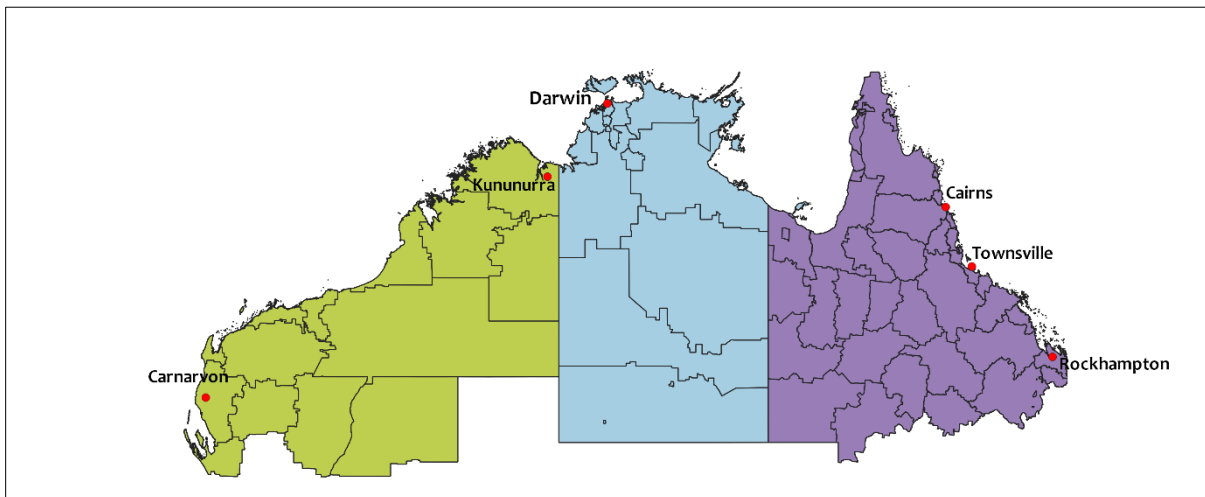


Figure 1: Map of Northern Australia covering the main horticulture regions (NT, north parts of WA and Qld).

## 2. Data analysis

This review presents a detailed analysis of available literature on the horticulture sector covering the current information on production, economic values and challenges in the region. A number of published and unpublished documents (grey literature) including research articles, institutional strategic and development reports and state/territory government statistics were reviewed for this analysis. Most of the documents were sourced through accessing web-database of different institutions as well as personal contacts at the local and state/territory levels. For all the three northern jurisdictions, most of the information was available at the state/territory level which was fine for the NT, but not so for the northern parts of Qld and WA comprising Northern Australia. At this stage of the

review, we summarise the state level information of horticulture for these two states with some indicative points for the north of these states.

Since mid-April 2021, we have organised a number of consultation meetings with the project partners-Department of Industry, Tourism and Trade (DITT)/NT Government, NT Farmers Association, Queensland Department of Agriculture and Fisheries (QDAF), WA Department of Primary Industries and Regional Development (DPIRD) and Australian Mango Industry Association (AMIA) to identify the key contacts for collecting the unpublished literature of the horticulture sectors on NT, Qld and WA. During the week of “Northern Australia Food Futures Conference” from 17-21 May, 2020 in Darwin, we arranged the first meeting of the Steering Committee Members for the project to seek their advice on accessing state/territory level reports, particularly for the northern parts of Qld and WA. Key sources of information used for the review were CRCNA, NT Farmers Association, QDAF, DPIRD (WA), Hort Innovation, Australian Mango Association, Australian Bureau of Statistics (ABS) and Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) as well as personal contacts.

### **3. Literature review**

#### **3.1. Status of the horticulture sector in the NT**

The agriculture, forestry and fishing industry are a significant contributor to the economic activity in regional and remote areas of the NT. In 2019-20, the agriculture, forestry and fishing industry together contributed \$649 million to the NT’s economy (NTG, 2021a). Over the past years, horticulture in the NT has expanded significantly. It alone, including fruits, vegetables, forestry, nursery products and turf and hay production, added \$341 million—almost half of the total economic value (NT Farmers Association, 2020a). The region's competitive advantages of suitable climate and sufficient land for development enables the long-term success and viability of the plant-based industries (NT Farmers Association, 2020b). At present over 45% of the land is used for agriculture including horticulture and cattle grazing in the NT (NT Farmers Association, 2020a). Of the total horticulture land ~85,000ha in the NT; 10,702 ha is managed for irrigated horticulture fruits, 17,500 ha for field and fodder crops, and 42,000 ha for plantation forestry (NT Farmers Association, 2020a, Figure 2). Darwin, Katherine and Central Australia, three horticulture regions of the NT are characterised by different climatic conditions i.e. monsoonal north-west in Darwin and Katherine, and semi-arid Central Australia. This diversity of climatic conditions offers a diverse use of the land for production throughout the year (NESP Earth Systems and Climate Change Hub, 2019). An average annual wet season also delivers a high volume of water to sustain farming of crops. The section below provides a summary of production, distribution and revenues of major crops for 2019 (Table 1).

##### **3.1.1. Mango**

Mango is the most cultivated horticulture crop in the NT with a steady growth rate over the past 35 years (NT Farmers Association, 2015). In 2019, mangoes accounted for 55% of the horticulture crops harvested (38 %-ripe and 17%-green mangoes) (NT Farmers Association, 2020a). Mango farms were established in the NT a long time ago, but the commercial production was recorded since 1981. The estimates of the mango production and economic impacts are only available since 2015. In 2015, mango was cultivated on 6,030 ha of land which increased to 7,120 ha in 2019 (NT Farmers Association, 2015, 2020c, Figure 2, 3). In 2019, mango production was estimated at 32,300 ton which is slightly higher than the average produce, 26,000 ton per annum, from 2015. Around 40% of the mangoes produced in Australia are sourced from the NT and the remaining 60% being shared between Queensland, New South Wales and Western Australia (NT Farmers Association, 2015).

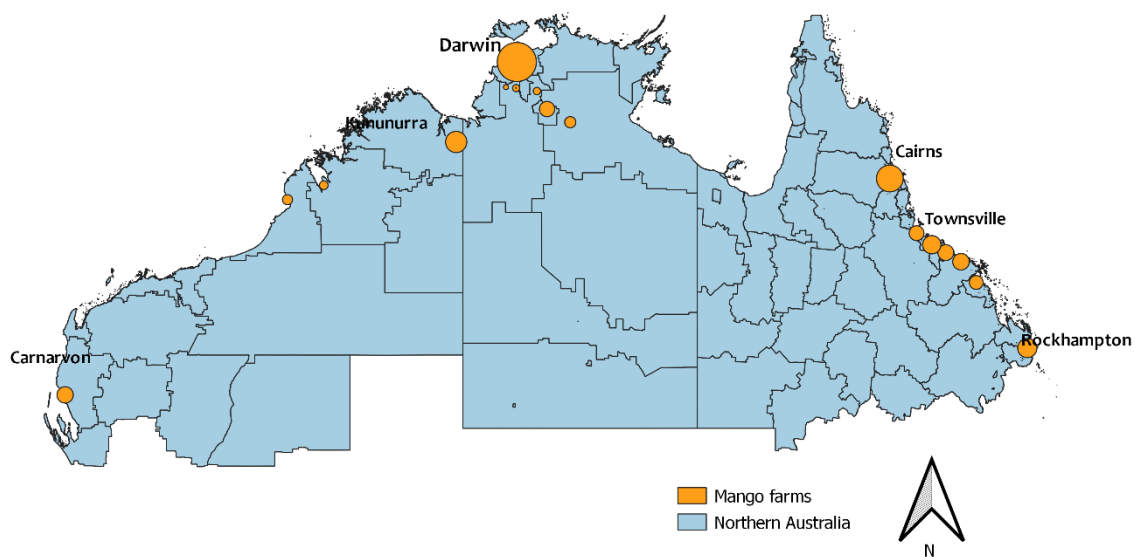


Figure 2: Mango production farms across northern parts of Australia (reproduced with permission from The Applied Agricultural Remote Sensing Centre, 2021)

The Darwin rural area and Katherine (incl. Douglas Daly and Mataranka) shares equally the production of mangoes in the NT. Mango season in Darwin and Katherine is from August to early December with the main production period during October and November (NTG, 2021b). There is potential for Central Australia for late mango production over the period mid-January to late March due to difference in weather conditions. The main mango varieties produced are Kensington Pride (KP), R2E2, Calypso, and Honey Gold in the NT. Kensington Pride is the major variety with around 54% of production followed by Calypso (25%), R2E2 and Honey Gold (14%). A variety of green mango (i.e. Nam Dock Mai, Phalang, and Keow Savoy) has increased recently which accounts for 7% of total production. New mango varieties enhance the economic revenues through early production and better quality for the market.

Mango industry generates a significant economic value, estimated at \$128.8 million, higher than any other horticulture crops in 2019. Compared to \$88.5 million mango economy in 2015, the economic value of the fruit increased \$40.3 million in 2019 (Figure 4). The NT



mango is sold in the major capital city markets of Brisbane, Sydney, Melbourne, Adelaide and Perth, with Sydney the largest market. The major supermarket chain stores are the main retail purchasers of NT mangoes. Overseas exports account for a small proportion of total sales, with most exported via Brisbane or Sydney markets to Hong Kong and New Zealand and smaller amounts to the Arab states, Singapore, Canada, and USA.

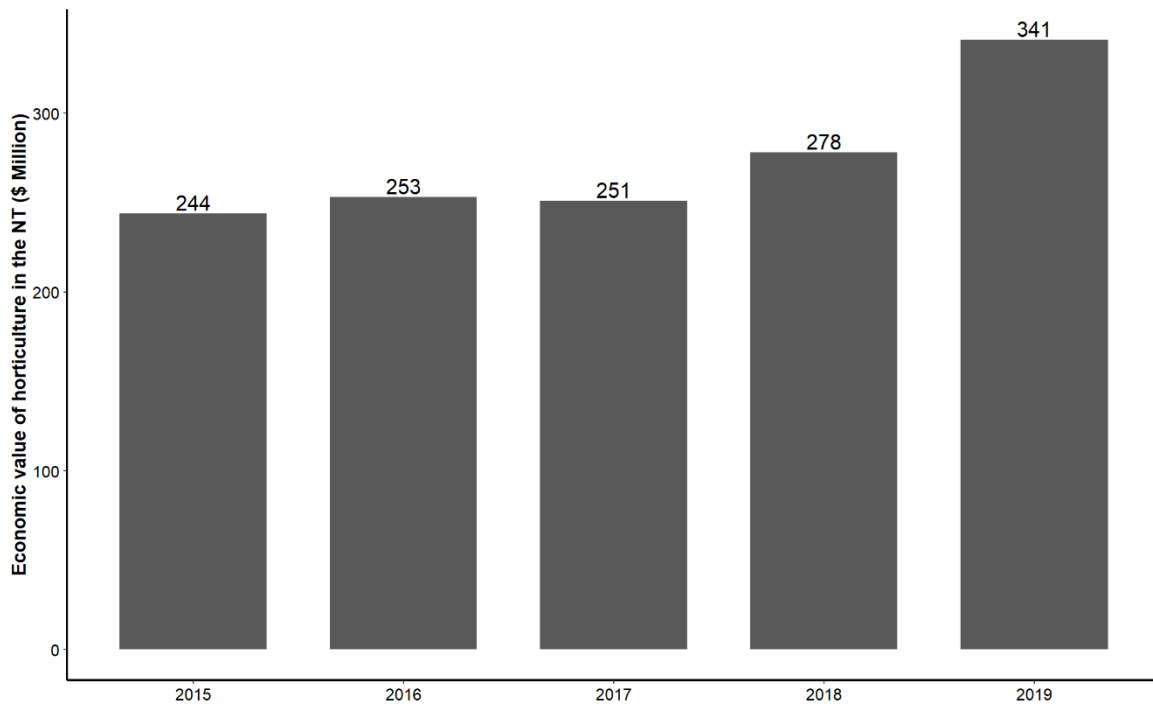


Figure 3: Trend in net economic value of the NT’s horticulture industry (excluding plantation forestry) (NT Farmers Association, 2015, 2020).

### 3.1.2. Melon

Melon is the second largest horticulture crop produced in the NT. The NT is a significant producer of winter melons in Australia, with other winter production from the Ord region in WA and Burdekin in Qld. Over half of the total melons is produced in Katherine and Mataranka regions, and a small amount in Litchfield Municipality and Central Australia (NT Farmers Association, 2015). The melon season is during May to early November in the Katherine and Mataranka regions. Central Australian melons are produced over November - December and April – May. The production of melons was estimated at 62,000 tons in 2019, higher than the previous year estimate (51,000 tons in 2015). Seedless watermelons are by far the largest melon crop in the NT with smaller production of rock melon and honeydew melon, estimated at around 10-15% of total melon production.

The revenue from melon in 2019 was \$69.4 million, compared to \$52.6 million in 2015 (Figure 3). There is potential for expanding melon industry considering its constant production possibility across summer and winter seasons from different locations in the NT. The growing conditions in Central Australia are favourable for expanding melon production. There is a small rock melon export industry focusing on Singapore and Hong Kong. However, the price of melon in the domestic market as well as the biosecurity and pest issues can potentially affect the production of this crop.

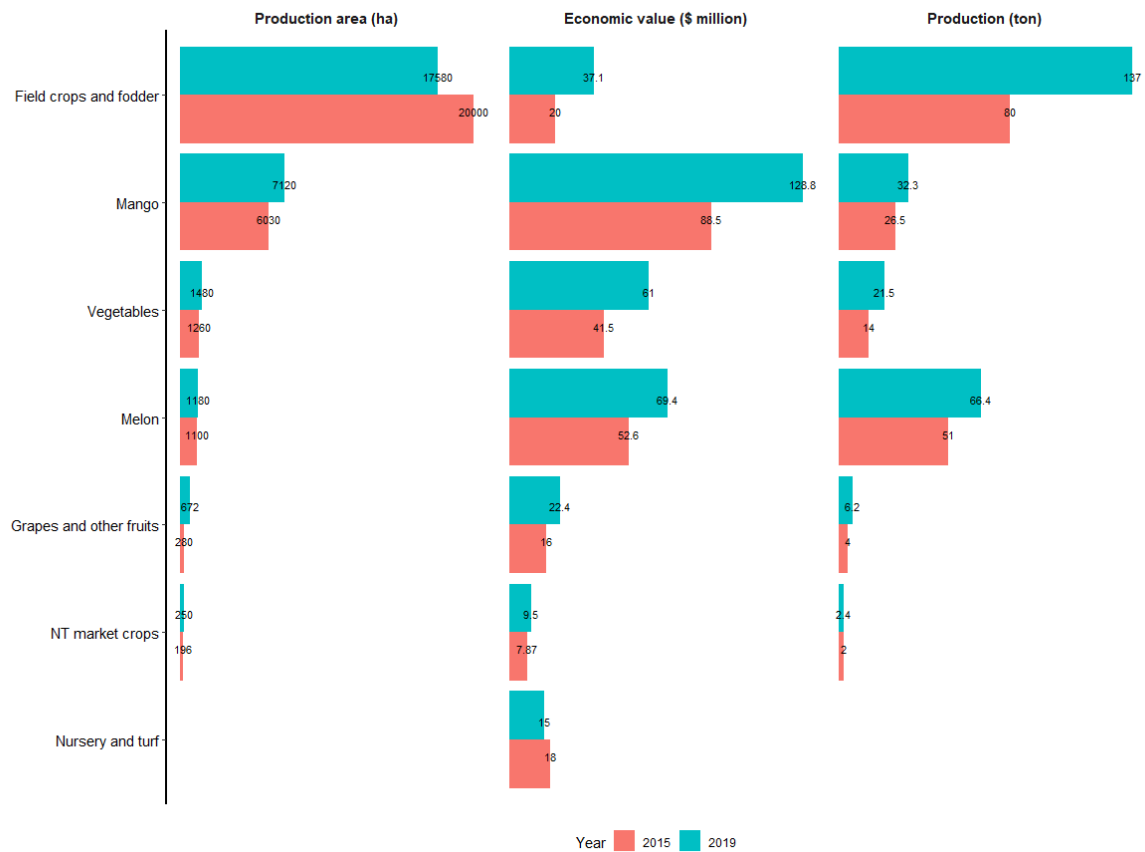


Figure 4: A comparison of horticulture crop production area, yield, and economic value between 2015 and 2019 (No data available for production area and size of nursery and turf, sources: NT Farmers Association, 2015, 2020a,b,c).

### 3.1.3. Vegetables

Vegetables are another important contributor to the horticulture sector over the recent past years. A quarter of the horticulture crops produced in the NT was different vegetables and herbs in 2019. The total vegetable produce in 2019 was 21,500 ton, almost 1.5 times higher than the production in 2015 (14,800 ton) (Figure 4). In 2019 the total value of the vegetables produced was \$61 million over \$41.5million in 2015. A wide range of vegetables including Asian crop varieties are currently grown across the three regions of the NT.

Production of the vegetables is mostly over the dry season from May to November. Some crops are also grown during summer in Central Australia.

Asian vegetables included lebanese cucumber, bitter melon, hairy melon, long melon, okra, snake bean and leafy vegetables and herbs (kankong, lime leaf, and basil). 80% of the total produce of the Asian vegetables are mainly lebanese cucumber, bitter melon, hairy melon, long melon and okra. Most of the Asian vegetables have been grown in the NT over a long time, but the size of production and market values increased in the recent past years. Most of the Asian vegetables are sold to the wholesalers in the city market of Melbourne and Sydney. These products are also readily available in local Darwin markets like Rapid Creek, Palmerston, and Parap. Few other vegetables produced in all regions of the NT include pumpkins, red salad onions, onions, lettuce, and asparagus. Some farmers are specialist producers of hydroponic fancy lettuce in Alice Springs, hydroponic tomatoes and capsicum in Litchfield Municipality, early asparagus in Katherine as well as opportune crops (i.e. Pumpkins). Onions are emerging as a crop in Katherine (red salad onions) and Central Australia.

#### *3.1.4. Field crops and fodder*

The growth of field crops and fodder for producing hay to feed the cattle is expanding in the NT. The hay industry of the NT is mainly tied to live cattle exports, with hay used in cattle yards and cattle boats. In the Top end, the most common pastures grown for hays are cavalcade and jarrah grass during the wet season rainfall and harvested at the end of the wet season. In Central Australia hay production includes irrigated lucerne and forage sorghums for local markets. In 2019, the pasture is grown on 17,580 ha of lands of the NT. Hay production expanded from 80,000 ton in 2015 to 137,000 tons in 2019. NT hay is mostly produced in the Katherine and Douglas Daly regions with some production in Litchfield Municipality and Central Australia. The current economic value of the NT hay industry is \$37.1 million which is higher than \$20 million in 2015. Much of the Australian cattle is exported through Darwin port which is a potential market opportunity of the NT hay industry to supply the cattle feed. The NT has also high quality cattle, Brahman/Brahman Cross (*Bos indicus*), and almost 1.8 million cattle in stock that means further understanding of the forage management will benefit the industry.

#### *3.1.5. Grapes and other fruits*

Grapes and minor crops such as date, limes, dragon fruit, jackfruit, rambutan, carambola and pineapples have expanded in the NT. Grapes are cultivated on 150 ha of land in Ti Tree and Alice Springs of Central Australia. The region's desert climate offers a greater advantage of early production of the grape for marketing to the cities in the south. Some other minor crops such as jackfruit, limes, rambutan, dragon fruit, carambola and pineapple are grown in Litchfield Municipality, as well as lemons in Katherine and dates in Alice Springs. Lemons

produced in Katherine from February to March are the first lemon in the Australian market other than the imported lemon from the USA. Small farmers in Litchfield Municipality are now cultivating the tropical fruits such as Rambutan, limes, dragon fruit and carambola for the Australian market. Pineapple production is likely to expand significantly over the next few years with a large Queensland producer developing technology for NT production to take advantage of gaps in the fresh fruit market.

The production area of the other fruits increased three times than any other horticulture crops. The economic value of other fruits in the NT estimated \$22.4 million in 2019 that increased from \$16 million in 2015 (NT Farmers Association, 2015; 2020a). Among other fruits, the grape production was estimated at 2,000 ton with an economic value of \$8 million in 2015 (NT Farmers Association, 2015). A wide range of the tropical fruits are also sold in local NT markets, especially in the Greater Darwin Region including the supermarket chains and local markets e.g. Rapid Creek, Parap, Palmerston, Mindil Beach and Nightcliff.

#### *3.1.6. Nursery and turf*

The nursery and turf industry was valued at \$18 million in 2015, including the value of plants sold from nurseries and turf production. In 2019 the economic value slightly declined to \$15 million. Nursery production is dominated by a small number of large nurseries both retail and production nurseries. In addition, there is a significant number of small nurseries. There is a significant volume and value of plants sold interstate, mainly to Brisbane and Perth markets. Turf production is mainly for the Darwin market from a small number of producers.

#### *3.1.7. Forestry*

The estimated area of plantation forestry in the NT is 42,000 ha with its harvestable value of \$ 115 million per annum (NT Farmers Association, 2020a). Over the next five to ten years, the scope for the forestry and forest products industry is expected to potentially triple in value (\$300 million), due to increasing harvest levels, an expansion of forest resources and potential for downstream processing and value-adding (Stephens et al., 2020). Three major plantations in the NT are African mahogany (*Khaya senegalensis*), black wattle (*Acacia mangium*) or Indian sandalwood (*Santalum album*). All of these plantations have distinct regional employment and income generation opportunities. The African Mahogany plantations has been planted in 13,000 ha of lands in the Douglas Daly catchment for producing a high value sawn timber used for flooring, fine furniture or veneers. *Acacia mangium* plantations have been established on 32,000 hectares in Tiwi Islands for pulpwood production. There is also 6,000 hectares of sandalwood plantation established around Katherine.

Table 1: A summary of horticulture industry in the NT as of 2019 (source: NT Farmers Association, 2015, 2020a,b,c)

Main features	
Physical contexts	<ul style="list-style-type: none"> <li>Over 45 percent of the NT's land is used for agriculture including horticulture practices.</li> <li>Of the total farming area in the NT, 10,702 ha is managed for irrigated horticulture, 17,500 ha for field and fodder crops, and 42,000 ha with plantation forestry.</li> <li>Darwin, Katherine and Central Australia, three horticulture regions are characterised by different climatic conditions (monsoonal tropics in Darwin, tropical in Katherine and semi-arid Central Australia). This diversity of climatic conditions offers a maximum use of the lands through diversified horticulture crop production throughout the year.</li> <li>52 percent of the agriculture business in Darwin, 37 percent in Katherine and 11 percent in Central Australia.</li> </ul>
Economy	<ul style="list-style-type: none"> <li>In 2019, the agriculture, forestry and fishing industry contributed \$649 million to the NT's economy.</li> <li>The horticulture sector including fruit, vegetables, nursery products, turf and hay production added \$340 million almost half of the total economic value.</li> <li>The gross production values of the horticulture increased over \$89 million since 2016.</li> <li>2 percent of the NT's population work in the agriculture, forestry and fishing industry.</li> <li>Horticulture provides high turnover per hectare and higher job creation intensity (from 10 to 30 FTE per 100 ha).</li> </ul>
Mango	<ul style="list-style-type: none"> <li>Mango is the most cultivated horticulture crops in the NT with a steady production growth over the past 35 years.</li> <li>Mango cultivation area has increased to 7120 ha of lands in 2019 from 6030 ha in 2015.</li> <li>In 2019, mango production has been estimated 32,300 ton which is slightly higher than the average produces 26,000 ton per annum from 2015.</li> <li>Around 40 percent of the mangoes produced in Australia is sourced from the NT and the remaining 60 percent being shared between Queensland, New South Wales and Western Australia.</li> <li>Mango industry generates a significant economic contribution which is estimated \$128.8 million higher than any other horticulture crops in 2019. The economic value of the fruit increased \$40.3 million from \$88.5 million in 2015.</li> </ul>
Melon	<ul style="list-style-type: none"> <li>Melon is the second largest horticulture crop produced in the NT. The NT is a significant producer of winter melons in Australia.</li> <li>The production of melons was estimated 62000 tons in 2019 that increased from 51,000 tons in 2015.</li> <li>The economic value of melons produced in 2019 was \$69.4 million over \$52.6 million in 2015. The melon industry employs a large employer for a long production period from May to November.</li> </ul>
Vegetables	<ul style="list-style-type: none"> <li>A wide range of vegetables including Asian crop varieties are currently grown in all three regions of the NT.</li> <li>The total vegetable produces in 2019 were recorded 21,500 ton almost 1.5 times higher than the production in 2015 (14,800 ton).</li> <li>In 2019 the total value of the vegetables produced was \$ 61 million over \$41.5 million in 2015.</li> <li>Most of the Asian vegetables have been grown in the NT over a long time, but the size of productions and market values increased in the recent past years. Asian vegetables included lebanese cucumber, bitter melon, hairy melon, long melon, okra, snake bean and leafy vegetables and herbs (kangkong, lime leaf, and basil).</li> </ul>
Field crops and fodder	<ul style="list-style-type: none"> <li>The growth of field crops and fodder for producing hay to feed the cattle is expanding in the NT. The hay industry of the NT is mainly tied to live cattle exports, with hay used in cattle yards and cattle boats.</li> <li>In 2019, the pasture is grown on 17,580 ha of lands of the NT.</li> <li>Hay production expanded from 80,000 ton in 2015 to 137,000 tons in 2019.</li> <li>The economic value of the NT hay industry was \$37.1 million in 2019 higher than \$20 million in 2015.</li> <li>NT hay production is mostly in the Katherine and Douglas Daly regions with some production in Litchfield Municipality and Central Australia.</li> </ul>
Grape and other fruits	<ul style="list-style-type: none"> <li>A number of other fruits including grapes and minor crops such as date, limes, dragon fruit, jackfruit, rambutan, carambola and pineapples expanded in the NT.</li> <li>Grapes has been the largest industry developed on 150 ha of lands in the Ti Tree and Alice Springs of Central Australia. The region's desert climate offers a greater advantage of early production of the grape for marketing to the cities of the south.</li> <li>The production area of the other fruits increased three times than any other horticulture crops. The economic value of other fruits in the NT estimated \$ 22.4 million in 2019 that increased from \$ 16 million in 2015.</li> <li>In 2019, the grape produces estimated was 1382 ton with an economic value of \$2.4 million.</li> </ul>
Nursery and turf	<ul style="list-style-type: none"> <li>The nursery and turf industry was valued at \$15 million in 2019, including the value of plants sold from nurseries and turf production.</li> <li>Nursery production is dominated by a small number of large nurseries both retail and production nurseries. In addition, there is a significant number of small nurseries both retail and supplying the landscape industry. There is significant volume and value of plants sold interstate, mainly to Brisbane and Perth markets. Turf production is mainly for the Darwin market from a small number of producers</li> </ul>
Forestry	<ul style="list-style-type: none"> <li>The estimated area of plantation forestry in the NT is 42,000 ha with its harvestable value of \$ 115 million in 2019.</li> <li>Over the next five to ten years, the projected value of the forestry and forest products industry is \$300 million.</li> </ul>

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- Three major plantations in the NT are African mahogany (*Khaya senegalensis*), black wattle (*Acacia mangium*) or Indian sandalwood (*Santalum album*).
  - The African Mahogany plantations has been planted in 13,000 ha of lands in the Douglas Daly catchment for producing a high value sawn timber used for flooring, fine furniture or veneers. *Acacia mangium* plantations have been established on 32,000 hectares in the Tiwi Islands for pulpwood production in the Northern Territory. There is also 6,000 hectares of sandalwood plantation established around Katherine in the Northern Territory. Apart from that plantations have been expanded in a number of indigenous-owned forests across Arnhem Land.
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### 3.2. Status of the horticulture sector in Qld

Qld has the largest agriculture land use, over 144 million hectares (almost 84% of the total area in the state), higher than any Australian state (DAF, 2020). The agriculture sector is key to the current economic development and continued sustainability of the region. More than half of Qld’s agriculture and food output is exported overseas, around one-fifth is ‘exported’ to other states in Australia, and around one-quarter is consumed within the state. In most rural and regional local government areas, over 25% of businesses are agriculture, fisheries and forestry businesses. In line with this, the agriculture, forestry and fishing sector are a major regional employer, accounting for up to 25% of total direct employment. The value estimate of primary industries including agriculture, fisheries and forestry sector was \$14.75 billion for 2018-2019 (DAF, 2019). Out of that, horticulture crop value was estimated at \$4.59 billion in 2019. A wide variety of horticulture crops such as fruits, nuts and vegetables and nurseries, turf and cut flowers are grown in the region.

Northern Queensland region is one of the key horticulture production areas in Qld. The abundance of natural resources (productive lands), water allocation and vegetation planning enable opportunities for expanding horticulture in the region (Dale and Marshall, 2020). Northern Queensland is a significant producer of a wide range of horticulture crops (DAF, 2021).

In recent years, there has been observed a substantial growth and diversification of the horticulture sector (KPMG, 2020). About 50% of horticulture production in Qld is currently consumed domestically. There is significant potential for some products such as mango, avocado, lychee and macadamia for international exports, especially in the Asian market (KPMG, 2019). This section summarises information on the current horticulture industries in Qld with a particular focus on the northern areas (Figure 5; Table 2).

Table 2: A summary of horticulture industry in Qld as of 2019-20 (ALGA, 2021; Avocados Australia, 2021; Cao et al., 2020; DAF, 2018, 2019, 2020; Hort Innovation, 2020a,b,c,d)

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#### Main features

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General	<ul style="list-style-type: none"> <li>▪ Gross value of primary industry including livestock, horticulture and fisheries was estimated \$14.4 billion in 2019-20. Horticulture (i.e. fruits, vegetables and nurseries) alone accounts for \$4.1 billion.</li> <li>▪ In 2018–19, Qld exported more than \$300 million worth of fruit and vegetable produce, including mangoes, citrus and avocados to Asian markets.</li> </ul>
Lychees	<ul style="list-style-type: none"> <li>▪ Lychee production is an emerging industry with 18% of produce exported to international markets. The lychee industry has doubled in value, growing from \$16.8 million in 2013/14 to \$34.4 million in 2018/19.</li> <li>▪ More than 99% of lychees are produced in tropical and subtropical regions of Qld. Lychee production occurs predominantly in Qld, during the summer months (November to February).</li> <li>▪ In the year 2019-20, Lychee production was estimated 2434 tons. Over the past five years, Lychee production remained within the range from 2232 to 2660 tons.</li> <li>▪ Around 70% of Lychees are grown in north Qld with Rockhampton a major producing region. Other areas include north Qld including Atherton and surroundings, and SE Qld including Bundaberg and Sunshine coast.</li> </ul>
Mango	<ul style="list-style-type: none"> <li>▪ Qld produced approximately 32,410 tonnes of mangoes in 2019-20 which is 45% of Australia’s total mango production.</li> <li>▪ The estimated gross value (at the farm gate) for all Qld mango produce was \$113 million in 2018-19 and \$90 million in 2019-20. Most Queensland mangoes are sold in the domestic markets of Brisbane, Sydney, Melbourne and Adelaide. Export markets are slowly increasing, with over 12% of Qld crop exported in 2017/18. Facilities within Qld also process several thousand tonnes of mangoes into mango juice and a wide range of mango flavoured products each year.</li> <li>▪ Qld is the largest mango exporting state in Australia, accounting for 66% of the total exported mangoes in 2019-2020.</li> <li>▪ Mareeba and Dimbulah (north Qld) produce account for 55% of the total production followed by Bowen and the Burdekin (33%), with central and south Queensland (11%). Mangoes are grown in 7000 ha of lands in Qld. Burdekin/Bowen, Bundaberg and Mareeba/Dimbulah regions of the northern Queensland are the main production areas.</li> <li>▪ The mango harvest in north Qld starts in late October and ends in early April. The harvest commences in the dry tropical regions in mid-November, then Mareeba–Dimbulah in early December and central Queensland in late December.</li> <li>▪ The main varieties grown are Kensington Pride and B74 (marketed under the registered trade mark CALYPSO®), R2E2 and Honey Gold® while Other varieties include Keitt, Kent, Palmer, Brooks, Keow Savoey and Nam Doc Mai, which are grown on a limited scale, extending the seasonal availability of mangoes or supply niche for domestic and export markets.</li> </ul>
Citrus	<ul style="list-style-type: none"> <li>▪ Qld produces 54% of the lemon/limes and mandarins in Australia. The main citrus fruits grown are lemon/lime, mandarin and a small amount of grapefruit.</li> <li>▪ Lemons/limes are grown in Mareeba, Bundaberg and Burnett area, and Mandarins in Emerald and Mundubbera areas of northern Qld.</li> <li>▪ Central Burnett produces 11% of the total grapefruit production in Australia.</li> </ul>
Avocados	<ul style="list-style-type: none"> <li>▪ Australia produced just over 87,546 tonnes of avocados in 2019-20, and Qld accounts for 43,069 tons (49% of total production).</li> <li>▪ Region wise, north Qld is the second largest contributor of 26% of the national avocado production in 2019-20. Within Qld, half of the avocados are produced in northern Qld. Avocados are mainly grown in Atherton Tablelands and Mareeba/Dimbulah. There is increase of avocado planting and production in northern Qld over the past five years.</li> <li>▪ Hass is the main avocado variety (80%) produced almost all year round. Shepard is harvested in Queensland through late Summer and Autumn, made up 17% of production, and at that time of year, is the dominant Australian variety on the market.</li> <li>▪ Avocados, being perennial crops, are grown year-round. They flower in late winter to spring, through August and September, and harvest from approximately March through to July, depending on the variety.</li> </ul>
Banana	<ul style="list-style-type: none"> <li>▪ As a tropical fruit, banana production predominantly occurs in north Qld, northern NSW, the Northern Territory and Western Australia. There is minimal international trade of fresh bananas, with some limited trade of dried banana products.</li> </ul>

	<ul style="list-style-type: none"> <li>▪ In 2019-20, 381,676 ton bananas were produced with the value of production \$596.2 million in Australia.</li> <li>▪ 94% of bananas are produced in Qld, with a value of \$576 million. Banana farming is centered around the Cassowary Coast region (Tully, Innisfail and Kennedy), the Atherton Tablelands, and at Lakeland, north of Cairns.</li> </ul>
Pineapples	<ul style="list-style-type: none"> <li>▪ Most of the state's pineapple production occurs in the Wamuran, Yeppoon, Bundaberg Region—North, Elimbah, Glass House Mountains and Beerwah.</li> </ul>
Custard apples	<ul style="list-style-type: none"> <li>▪ Qld produced 52% of the custard apples in Australia with main growing area in Atherton and Sunshine coast.</li> </ul>
Strawberry	<ul style="list-style-type: none"> <li>▪ Qld is the second largest producer of strawberries after Victoria</li> <li>▪ 42% of the strawberries were produced in Queensland, mainly from Beerwah</li> </ul>
Macadamia	<ul style="list-style-type: none"> <li>▪ 54% of the total Australian macadamias are produced in Qld during Feb-July. Qld is the second largest exporter of macadamias after NSW.</li> <li>▪ Macadamias as perennial crops, flower in spring, with harvest from February to July.</li> <li>▪ Most of the state's macadamia nut production occurs in the SA2 geographical areas of Bundaberg North—Gooburrum, Bundaberg Region—North, Bundaberg Region—South, Gympie Region and Glass House Mountains.</li> </ul>
Table grapes	<ul style="list-style-type: none"> <li>▪ The Central Highlands region accounts for around 70% of Queensland's table grape production, producing early-season grapes.</li> </ul>
Melons	<ul style="list-style-type: none"> <li>▪ Australia produces fresh watermelons and muskmelons (Rockmelons and Honeydew melons). Over 60% of Australian melons are exported from Qld.</li> <li>▪ Total melons produce was 64,296 tonnes in Qld.</li> <li>▪ Major watermelons growing areas are located in Bowen, Bundaberg and Chinchilla of Northern Qld. Melons are grown all the year round in Northern Qld.</li> </ul>
Passionfruit	<ul style="list-style-type: none"> <li>▪ Passionfruit is grown in the north of Australia, with the majority grown in Queensland (60%). Major production areas are in Cooktown, Mareeba, Wide Bay and Sunshine Coast of the region.</li> <li>▪ There is a year-round fruit, but mostly available during the Dec-Jan.</li> </ul>
Papaya/Pawpaw	<ul style="list-style-type: none"> <li>▪ 85% of the papaya are grown in Mareeba and Tully of northern Qld.</li> <li>▪ As a tropical fruit, red papaya and yellow pawpaw production predominantly occurs in north Queensland, as well as some production in the Northern Territory and Western Australia.</li> </ul>
Persimmons	<ul style="list-style-type: none"> <li>▪ Persimmons are grown around Australia, with half of all production occurring in Queensland. There is a small export crop, but the majority of production is used in the fresh market. For the year ending June 2020, 2,771 tons produced and valued at \$11.0 m.</li> <li>▪ The fruit is grown in South East Queensland.</li> </ul>
Pineapples	<ul style="list-style-type: none"> <li>▪ Qld produces the majority of pineapples (99%).</li> </ul>
Beans	<ul style="list-style-type: none"> <li>▪ Half of the beans are produced in Qld (53%), mainly in Innisfail and Bundaberg. Beans are largely harvested from April to August.</li> </ul>
Beetroot	<ul style="list-style-type: none"> <li>▪ 85% of Australia's beetroots are grown in Qld region. This is grown all year round, but harvested during June-August in Qld.</li> </ul>
Vegetables	<ul style="list-style-type: none"> <li>▪ Vegetable production occurs year-round with winter production in the north (mainly the Bowen–Burdekin area) and summer/spring/autumn production from Central Queensland, down through Bundaberg and Lockyer to as far south as the Granite Belt. The main vegetable crops are sweet potatoes, tomatoes, capsicums, zucchinis, melons, pumpkins, sweet corn and beans. Each of these has their own starting point, with most having at least two preferred planting times during the year. Due to shorter crop rotations, several crops can be grown in a year.</li> <li>▪ Tomato is the largest valuable vegetable in Qld with a value of \$238 million.</li> <li>▪ Majority of sweet potatoes in Australia are produced in Qld (88%). In 2019-20, 93910 tons of sweet potatoes are produced in the region with a value of \$59 million.</li> </ul>



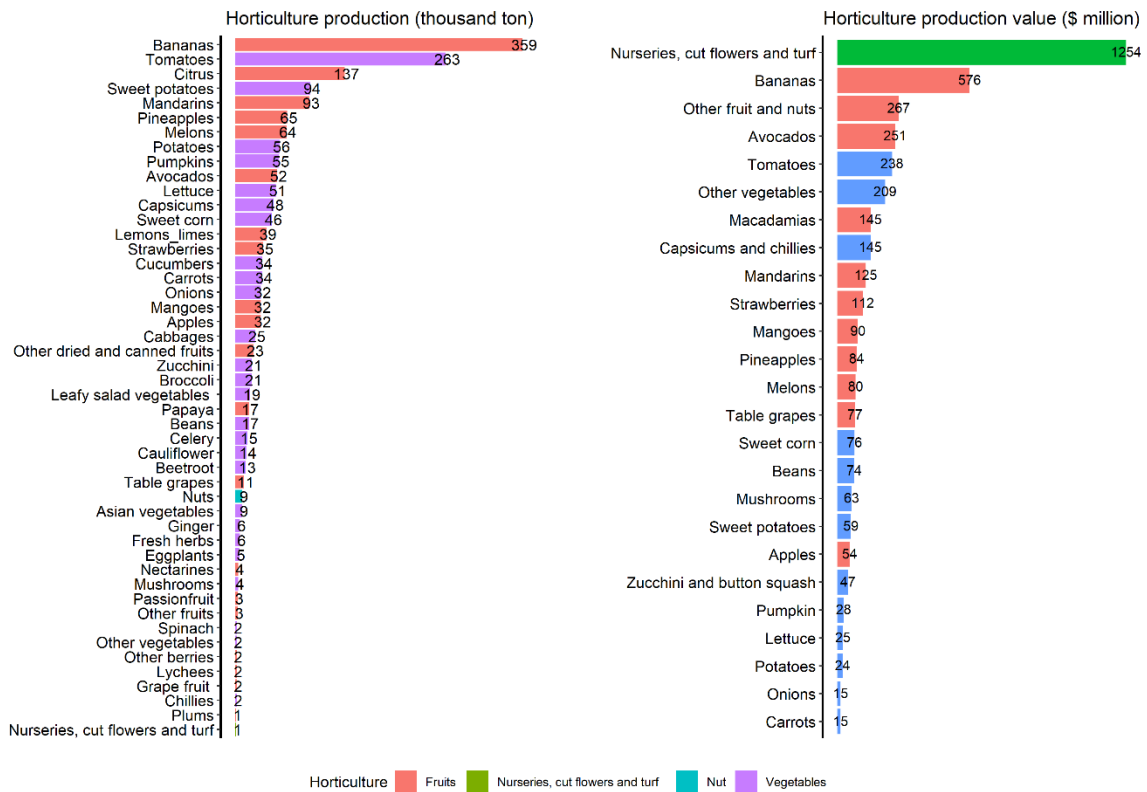


Figure 5: Horticulture production and gross values in Qld for 2019-2020 (DAF, 2020; Hort Innovation, 2020 a,b,c,d)

### 3.3. Status of the horticulture sector in WA

The WA’s geographic diversity allows a year-round fruit and vegetable production (Figure 6; Table 3). The fruit growing industries extend from Kununurra in the far north to Albany on the cool south coast in WA. Carnarvon and Kununurra in northern parts of WA are the main mango producing areas in WA. Strawberries are the highest value export in WA, supplying around two-thirds of the Australian total exports. Key export markets of the strawberry from WA are Singapore and New Zealand followed by Thailand, Hong Kong, Malaysia and the United Arab Emirates. In the recent past years, there are increasing planting and production areas of avocado, citrus and mango trees. 80% of the agriculture produces from WA is exported to the international markets – with 70% going to Asia (DPIRD, 2021). WA is the second largest producer of avocado after Qld and supplies a quarter of the total avocado produces nationally in Australia. Avocado is highly available throughout the seasons from September to December. The geographical location of the region offers a greater advantage of earlier avocado production in Kununurra through September to April followed by Broome, Carnarvon and Gingin.

WA produces a wide variety of vegetables, mainly carrot, leeks, chillies, artichokes, broccoli, parsnips, celery, pumpkins, cauliflower, head lettuce, cucumber, onions, beetroot, capsicum and cabbages. Australia is a net exporter of carrots and turnips, typically exporting between 100,000-110,000 tonnes every year, predominantly from WA. WA accounts 39% of total carrots produces at national level (Hort Innovation, 2020d) and over 70% of the total carrots production are exported. Other major vegetables are parsnip, chilies, leeks and artichokes. WA is the second largest producer and the major exporter of parsnip in Australia. Other notable export produces in WA are grapes, celery, head lettuce and pumpkins.

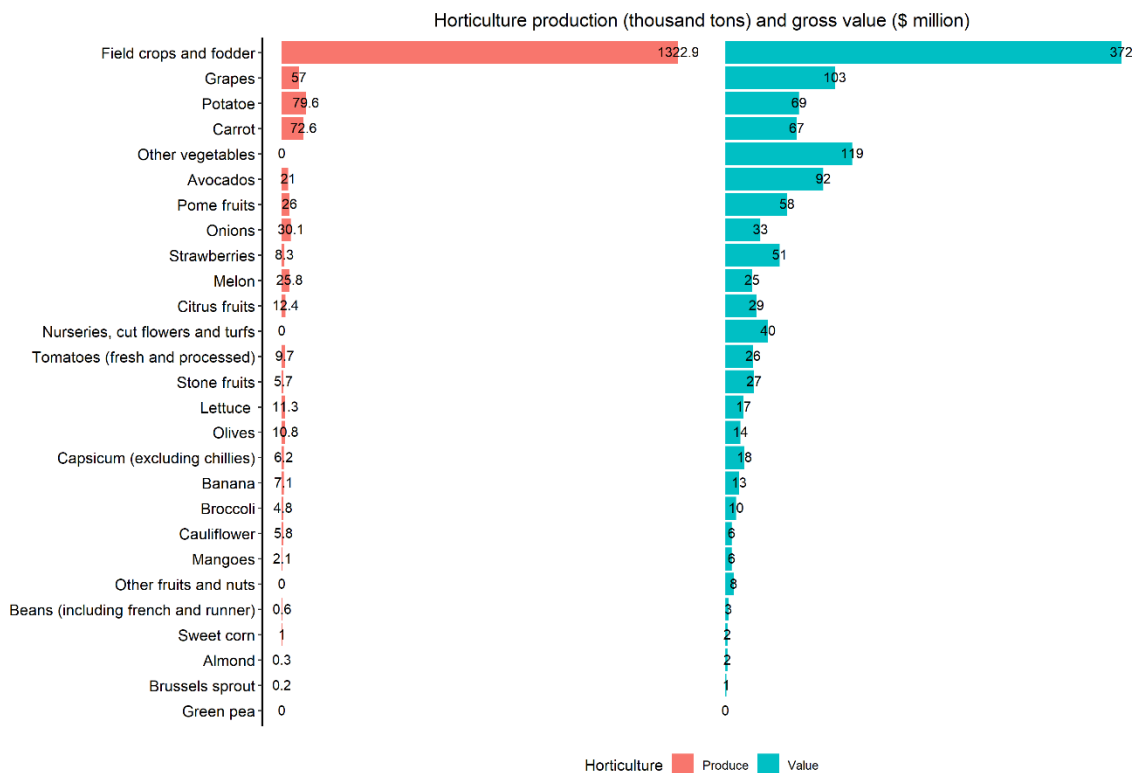


Figure 6: Horticulture production and gross values in WA for 2018-19 (ABS, 2019).

Table 3: A summary of the horticulture sector in WA (source: Cao et al., 2020; Hort Innovation, 2020a,b,c,d). The following table reflects the main production and economic values of the horticulture sector in WA and also indicates the north specific information.

Main features	
General	<ul style="list-style-type: none"> <li>▪ The WA exports fresh horticulture products with a value of \$5.4 million (6% of the Australian fresh horticulture products). Vegetables account for 70% of the total horticulture exports from WA.</li> <li>▪ Carrots, potatoes, onions and melons are the highest value vegetables grown in WA, and particularly produced from the north Geraldton and Carnarvon regions.</li> <li>▪ The north outback of WA covering Broome, Exmouth, Geraldton, Kununurra and Port Hedland has a diverse agriculture sector. In the recent past years, horticulture crops mainly melons produce increased in the north region of WA.</li> </ul>
Carrots	<ul style="list-style-type: none"> <li>▪ Carrot is one of the highest value horticulture products in WA. WA accounts for 39% of total carrots produces at national level.</li> <li>▪ WA is also the largest exporter of carrots in Australia accounting for a value of \$97.38 million in 2019-2020.</li> </ul>
Potatoes	<ul style="list-style-type: none"> <li>▪ WA is the second largest exporter of potatoes with a value of \$7.8 5 million.</li> </ul>
Chillies	<ul style="list-style-type: none"> <li>▪ WA is the second largest producer of chillies, accounting for 21% in Australia after QLD.</li> <li>▪ The majority of chillies are grown in Carnarvon area.</li> </ul>
Strawberries	<ul style="list-style-type: none"> <li>▪ WA is the largest producer of Strawberry in Australia, and also a key exporting state.</li> <li>▪ The WA's export of strawberries was estimated 4730 tons with a value of \$35.15 million in the last year.</li> </ul>
Avocados	<ul style="list-style-type: none"> <li>▪ WA contributes 30% of the avocado production in Australia with a small production is currently recorded from Carnarvon only.</li> <li>▪ In 2019-2020, WA exported 1389 ton of avocados with a value of \$8.53 millions.</li> </ul>
Melons	<ul style="list-style-type: none"> <li>▪ WA is the second largest exporter of melons after QLD in Australia. In 2019-2020, WA exports 3845 tons of musk melons with a value of \$5.67 millions.</li> <li>▪ WA exported watermelons estimated at 876 tons with a value of \$2.20 millions in the last year.</li> </ul>
Mango	<ul style="list-style-type: none"> <li>▪ WA contributes a small amount of mango just 3% of the total production in Australia. Kununurra is the major supplier of mangoes in WA accounting for over half of the produce from the region.</li> </ul>

## 4. Key issues in the horticulture sector of northern Australia

From literature analysis, this section summarises the specific issues that impact on horticulture sector in the north. Addressing these issues will help drive the growth and economic sustainability of the horticulture sector in northern Australia. Some broad issues relevant for horticulture development in northern Australia have been summarised such as land use suitability and irrigation facilities, emerging market and crops, supply chain and workforce.

### 4.1. Availability of land and water resources, and irrigation facilities

The climate of northern Australia provides a comparative advantage for the production of some horticultural crops, providing fruit to markets when other regions cannot do so (e.g. early season mangoes, melon production in the middle of the year) (Ash and Watson 2018). Physical resources mainly land and water sources for irrigation facilities are key factors in expanding horticulture in northern Australia. A detailed analysis of land and water resources in northern Australia estimated about 1.34-1.84 Mha of land could be developed for irrigated agriculture within the existing and new irrigation facilities (Petheram et al., 2018). At a broad scale, large and contiguous areas could be annually irrigated across Pilbara, Riverless, Fitzroy (WA), Ord–Bonaparte, Daly, South-West Gulf, South-East Gulf and Western Cape regions of northern Australia. The priority water catchment areas in the region are identified to be Fitzroy catchment in WA, Darwin catchment (Adelaide, Finnis, Mary and Wildman) in the NT and Mitchell catchment in Qld (Petheram et al., 2018). In particular, the Darwin catchment presents a unique opportunity across northern Australia for a water storage that could supply water for agriculture as well as high-security water for urban users. To realise this opportunity of land and irrigation into horticulture development, however information is required on where the water could most effectively be harvested, used and delivered to developing areas.

Horticulture land development in the north will require several considerations including location specific soil conditions, irrigation facilities, salinity risks, infrastructural investments, social, and offsite environmental impacts and markets of the commodities. The effects of site-specific variations of soil conditions and salinity should be reduced to maintain the production in the long run. Most of the agriculture soils are moderately suitable for production, having limitations especially as much of the land in the north is marginal (land class 4 and 5) with a small amount of suitable land with minimal limitations (Petheram et al., 2018). Inappropriate classification of land as suitable for irrigated agriculture often unsuitable for dryland agriculture due to the seasonality of the rainfall. At present the site assessment of potential irrigation areas considers only land and proximity to water catchment. Due to seasonality, inter-annual variations of rainfall, surface-water storage potential is generally more limiting than land suitable for irrigation. The average rainfall in the region ranges from <250 mm in the Riverless region to >4000 mm in the Wet Tropics region. In most cases the annual rainfall is highly seasonal and concentrated between November and April of the year which is opposite to the climate of the southern Australia (Petheram et al., 2018).

Climatic variability in terms of the changes in temperature are most likely to affect sustainable production of horticulture crops in the north. A recent study reported that the changes in the region-specific temperatures are most likely to affect the inductive conditions required for flowering

and production of the mango production in the NT, and Kununurra of northern Australia (Clonan et al., 2020). The most limiting threshold of the temperatures are 35°C, 32°C, 20°C or 18°C for the flowering induction of the four mango production regions- Darwin, Katherine, Central Australia (NT), and Kununurra (WA) in the north. Any above and below temperatures of this threshold will affect the timing of mango flowering differently in these four regions. Any changes in flowering (earlier or later) than the present conditions may result lower yield or a decline in fruit quality.

#### 4.2 Land tenure

Despite the fact that there is potential for expanding agriculture land uses including horticulture in the north, land ownership and the involvement of the Indigenous population will remain a vital issue in achieving a locally viable and sustainable industry. It is estimated that the legally recognised Indigenous land title exists on the 56% of the total land in the region (Russell-Smith and Sangha, 2018). Half of this Indigenous estate is however currently managed for the freehold title, the other half under non-exclusive Native Title arrangements, which recognise ongoing affiliation with traditional estates but without granting economic property rights. The future agriculture development needs to consider the Indigenous people's interests through ensuring their genuine participation for enhancing well-being of all.

#### 4.3. Markets for existing and emerging crops

Northern Australia has emerged as a vibrant horticulture production and potential export zone for several reasons. The difference in the seasonality of the production and the types of growers (Asian background) contributes to a wide variety of tropical fruits, vegetables (Asian) and nuts produced from the north, with a few differences within the region. At large scale, the NT and northern parts of Qld (Mareeba/Dimbulah, Burdekin/Bowen) jointly account for almost 96% of the mango production in Australia (Hort Innovation, 2020a). Over the past years, the international market of mango has been well established, mainly sourced from the north. Qld has dominated the mango exports, while there is a strong domestic market of the mangoes from the NT and WA. At present, 80% of the exported mangoes are sourced from Qld and 10 % from the NT. Higher export prices of mangoes than domestic favours more exports in Qld.

Australia has advantages of taking over export market for horticulture commodities mainly due to its counter production season than countries from northern hemisphere (Cao et al., 2020). For instance, the avocado can be grown year-round in Australia. Further exploration of market access for other potential crops including lychees, melons, avocados will increase export values across the year. The northern Australia is a large producer of melons mainly watermelons, and also an exporter. Most significantly, the NT has increased emerging crop growers of Asian vegetables, fruits and specialist crops. Majority of the Asian vegetables are currently produced and sold in the local markets of Darwin, and also supplied to the southern markets. Information about these emerging crops, their supply, and demand over the year at different markets is yet inadequate. A clear knowledge about the export market price and market-specific demands for quality products will be strong basis for Australian growers to determine the production of the most demanding crops.

Australia has already established a strong trade relationship with the ASEAN<sup>1</sup> countries and further market development will benefit two-thirds of the growers in the north (CRCNA, 2019). The recent urban growth and increased income capacity of the population in the ASEAN countries has led more demand for healthy foods. Health has been a growing area of concerns due to obesity and an increasing health expenditure in this region, and result changes of food preferences for quality foods. All these have positive implications for developing the north as a production and export hub to ensure a quick export of fresh and quality horticulture fruits and vegetables. Over the past years, the export of agriculture commodities mainly beef from the NT has shown a positive trend in the ASEAN markets. Apart from the beef, horticulture commodities mainly, mango, avocado, lychee, and macadamia could be potential export crops, specifically from the north.

The prospects of increasing production and marketing of the horticulture commodities will build on a detailed understanding of the selling partners in the target countries, local demand, price elasticity, and competitions with other supplying countries. Crop-specific market research covering the north are currently underway for mango, Avocadoes, Lychees and Macadamia which will benefit in deciding strategies and set competitive price for Australian produces in the international market (Cao et al., 2020). In addition to that half of the Australia's imported horticulture products are fresh and processed fruits demanding more production of specific crops required locally in Australia. For example, Avocado is largely grown in the Atherton Tablelands in northern Qld, and projected to increase production to 50 percent by 2025, which will reduce its import. Likewise, vegetables production can be increased across the north of WA and NT meeting the domestic demand and possibility of the exports.

#### 4.4. Supply chain

Northern Australia's horticulture sector faces a wide range of challenges across the supply chain process. An ideal supply chain process in horticulture industries typically involve 4-5 stages i.e. different growers/sectors, packhouse, transport company, wholesaler/agent and retailer. Lack of proper infrastructure and some distance related issues mainly transportation capacity through road, sea and air, storage facilities (particularly refrigerated), processing and distribution hubs, currently affect the functionality of the supply chain across the north (Babacan et al., 2020). Most of the agriculture industries located in the north are relying on road-based freight only for accessing inputs and supplying products to markets. The large portions of the road across the north are unsealed and often affected by floods and monsoon rain, offering low reliability for transport. The distance and magnitude of freight cost also hinders any substantive investment on the logistic sectors required for horticulture sector in the region. Furthermore, the inconsistent and inefficient supply of the horticulture products from the north is another reason of a high cost freight.

Within the north, the producers of northern Qld have relatively well-established supply chain for domestic and international markets compared to the NT. Qld growers have direct and strong linkage to market with different level of buyers including wholesale agent and manufacturers in the southern cities. By contrast, the growers in the NT, particularly those producing tropical fruits (i.e.

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<sup>1</sup> Association of Southeast Asian Nations (ASEAN)

jackfruit, rambutan, dragon fruit, guava) are at a very early stage of the industry life cycle (Howells, 2004). Most of the NT's production is marketed through wholesalers and retailers in southern markets. The NT growers have the most access to the packers and transporting company who determine the price and freight arrangements, and lesser controls on the third and fourth level of the supply chain (wholesaler/agents and retailer). It often results inadequate understanding for the growers on the product demand in the wholesale and retail market. Moreover, inappropriate preservation of different fruits at the same temperature and timing required throughout the freight also impedes the quality of the fruits before marketing to other markets.

Looking at the export-oriented supply chain, there are potentials for adding value products from the north to the global market. For example, the Far North Queensland (FNQ) can double high-value food exports to \$120 million by 2030, particularly in seafood, horticultural tree products, vegetables and beef (KPMG, 2019). Some limitations in terms of trade regulation and certification of the destination countries, cold chain management, freight costs, global competitions and changing local demand most likely challenge to achieve a sustained export in specific ASEAN region (Tremblay et al., 2020). Regulatory barriers in terms of tariff on imported beef, certification standards and technical inefficiency have a strong negative impact on the Australian beef exports in the long run. The freight costs remain a common setback for the region to ship the fruits. The high cost of shipping through Cairns and Darwin are still an issue that required further development of the air freight infrastructure (Cao et al., 2020). Cold chain is another key aspect in the long shipment of the products to maintain quality of the products. In the NT and WA, the export capacity of specific commodities like mangoes, avocados and lychees are affected due to no facilities for vapor heat treatment required before shipping to protocol markets.

A limited knowledge about the export markets and lack of collaboration among different stakeholders involved in the supply chain remain barriers in expanding the markets for new products (Akbar et al., 2019). For instance, a clear knowledge of the growers on the supply chain process, market demand for a tropical fruit, and the collaboration with the wholesalers remain key issue in order to strengthen the supply chain of the NT. Establishing an inter-and intra- regional coordination of the stakeholders across the north and a working framework will be the first step in order to reduce the additional costs for freight as wells for long-term priority investment on common infrastructure issues for exporting products. Due to limited or absence of information sharing or integration within the growers and the end users, the growers remain unaware of the market signals about their products. In some instances, collaborative marketing companies promoted a united branding of the commodities for the growers to achieve a competitive price and maintain consistent quality (Cao et al., 2020). Exporters also assisted the growers to gain access to protocol markets which eventually increase the bidirectional flow of information from the customers and markets to the growers.

The collaborative supply chain in the horticulture sector is sporadic, and is not well established within and across the regions in the north. The cost-oriented thinking often mask any further investment in infrastructure development, although a value creation-based approach through a strong collaboration in the supply chain process would benefit infrastructure improvement. Fragmentation and lack of collaborations within the horticulture sector, across different sectors and jurisdictions are still key barriers to develop a strategic partnership and priority-based planning. The sectoral coordination within and across the horticulture sectors will reduce the burden of transport

costs within the north and to south as an example. On the other hand, the cross-jurisdictional coordination across north-north will attract further investment.

#### 4.5. Workforce development

The workforce demand throughout the supply chain of agriculture in Australia is growing at 2-6% annually. The recent growth of the intensive agriculture including horticulture production demands a skilled and experienced workforce for northern Australia. Labor shortage has been recently exacerbated by the COVID outbreak and limited immigration of the seasonal workers (DAF, 2021). Historically the low level of human capital has been a significant driver to the failure of agricultural developments than climatic or agronomic constraints across the north (Ash and Watson, 2018). For many years, the skills and experiences required for agriculture development in this region was not fully realised, and limited consideration was given due to centralised decision-making. Most human skills used and developed on the farms occurred through learning by doing without a long-term strategic need for developing the engaged farmers who have on-farm knowledge.

Skill shortage exists at all levels of the horticulture production system whether it's outdoor growing and harvesting, and technical and managerial. Low level of understanding among farmers to apply new digital technologies, conduct data analytics, cybersecurity as well as soft skills such as leadership, management, problem solving and communication are currently identified as key limiting factors for strengthening the workforce of the NT (NT Farmers Association, 2020b). At the farm level, technological augmentation and automation typically lead to gains in productivity and in turn profitability (Azarias et al., 2020). The limited application of the new technology places individual farms and industries at a competitive disadvantage relative to international competitors in other developed countries. Since the labor shortage during harvesting period pose an economic risk to the horticulture sector in the region, the application of automation may save costs and ensure profitable and viable industry in the long-run. This is particularly true given that new technology underpins modern supply chain traceability programs, which are gateway requirements to supply global value chains.

There is no adequate vocational education training on supply chain industries for the farmers. Although agriculture could be potential profession for the youth due to the growing demand of skilled expertise required in the precision agriculture, research, database management for production and harvesting, monitoring market and real time decisions. Some professional training and traineeship programme exist on youth training and the placements which are limited to meet the required scale of the works and skills. The engagement of indigenous youth is extremely low in any of the agriculture sectors in the NT in particular. An effective engagement with universities and other education providers in relation to industry needs and potentials may overcome the gaps in finding the skilled professionals of different age and education levels. Furthermore, working conditions including the locations of the industry and low-priority of horticulture job in the territory wise occupation plan is a major barrier in attracting people from inter-state and overseas.

#### 4.6. Biosecurity



Biosecurity risks is another concern in managing sustainable plant industries including horticulture sector in Australia. Northern Australia's vast, sparsely populated 10,000 kilometre coastline is at the frontline for many high-risk animal and plant pests and diseases—particularly Torres Strait, whose northern islands are only a few kilometres from Papua New Guinea (PNG) (Australian Government, 2021)<sup>2</sup>. Northern Australia is mainly considered as a biosecurity 'buffer' for southern Australia. Agriculture in the north is at risk from pests and diseases arriving from all directions. Wind, water and animal threats are increasing as the region faces growing biosecurity pressures from pests, weeds and a range of high-risk plant and animal diseases. The mango industry has had a series of biosecurity and pest issues that have seen production fluctuate. Various exotic plant pests and diseases found in the NT are currently impacting production for commercial fruit and vegetable growers. In March 2020, fall armyworm moths (*Spodoptera frugiperda*) were detected in agricultural areas around the NT. Fall armyworms are an invasive pest that threaten more than 350 plant species, including maize, sorghum, corn, fruits and vegetables. In the recent past years, citrus canker, Asian honey bee and banana freckle put a huge pressure on biosecurity measures in the NT. In WA, the prevalence of pathogens (Pepper Mild Mottle virus and Tomato Spotted Wilt virus) were identified to be affecting the horticulture sector.

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<sup>2</sup> <https://www.agriculture.gov.au/biosecurity/australia/northern-biosecurity/report-a-pest>

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