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SESAME

THE $250M DIVERSIFICATION OPPORTUNITY IN NORTH WEST QUEENSLAND

FINAL REPORT; v1.03; December 2018

CORIOLIS

Queensland Government

QUEENSLAND GOVERNMENT
Department of Agriculture and Fisheries

SESAME

The $250m diversification opportunity in North West Queensland

FINAL REPORT

December 2018

V1.02

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GENERAL

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This research on agricultural diversification opportunities emerged from the Strategic Blueprint for North West Queensland

Strategic priority 2:
Diversifying the regional economy and creating employment opportunities

The Province has a strong regional economy built predominantly on mining and minerals processing. The Queensland Government is committed to maximising commercially viable economic development and job creation opportunities for the Province by adopting a whole-of-government diversification approach, with additional funding of almost $5.5 million over four years for initiatives within this strategic blueprint priority.

Key actions to be delivered in developing the strategy include:

- **Scope opportunities for increasing agricultural production**

  The state's North West presents unique prospects for further agricultural development. In recognising these opportunities across the Province, the Queensland Government will be developing an integrated North West Queensland agriculture plan. The plan will focus on continuing to grow a sustainable and diversified agricultural sector, and will be developed in collaboration with key stakeholders across the supply chain and linked with the broader regional economic diversification strategy.

Source: "A Strategic Blueprint for Queensland's North West Minerals Province; Supporting Strong And Prosperous Regional Communities", Queensland Government

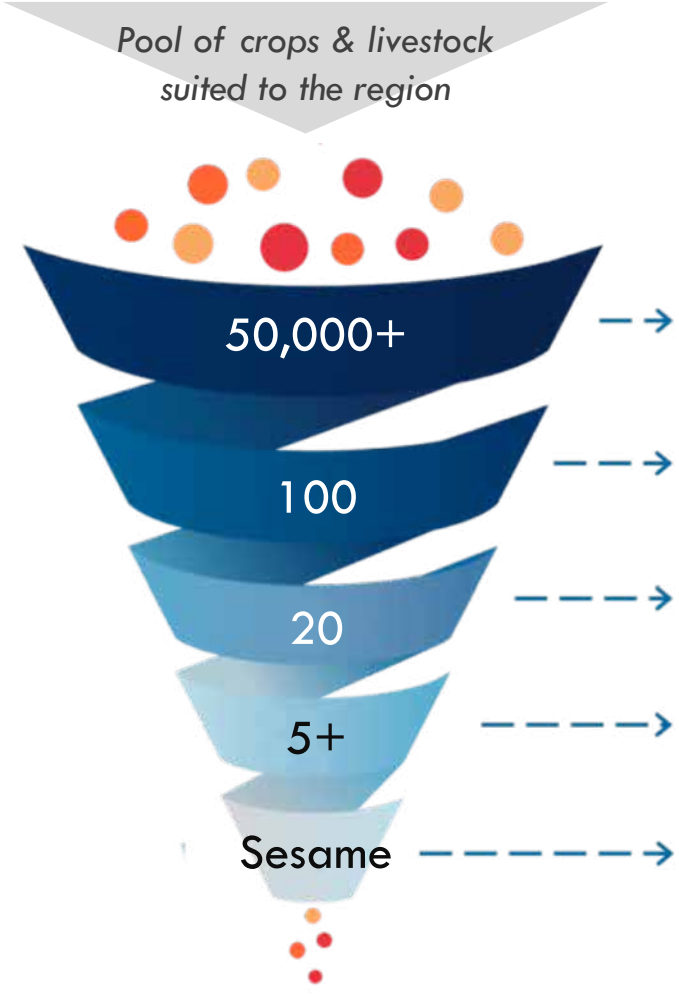
Sesame is one of 20 identified high potential products that both fit regional conditions and have large & attractive global markets

FOCUS OF THIS PROJECT

Source: Coriolis analysis

Sesame emerged from a multi-stage screening process as a star product with high growth potential

See related research for details of screening process



Hypothetical Universe	→	All plants and animals ever farmed by humans in some way
Existing or Potential	→	Products identified as potentially having merit in the region
Solid Opportunities	→	High potential products with robust demand
Potentially Transformative	→	Products that could potentially transform agriculture in the region
Profiled in this Document		

Source: Coriolis analysis

Executive Summary

THE NORTH WEST QUEENSLAND OPPORTUNITY

North West Queensland is a massive region with huge untapped potential for agricultural growth. It is the size of Japan or Germany, with the population of the City State of Monaco. African climatic peers currently produce 10 times as much food per hectare.

This report forms part of a wider body of research designed to identify opportunities for increasing and diversifying agricultural production in the North West Queensland region. The research identifies high potential products that both fit regional conditions and have large and attractive global markets. Sesame emerged from a multi-stage screening process as a star product with high growth potential.

WHY SESAME? DEMAND IS GROWING

Sesame seeds are a US$2.2b global market, growing at 8% per year, on the back of high demand from Asia and the Middle East. Macro drivers are pushing growth in global seed and oil trade volume and value. The global trade growth (i.e. demand) in both sesame oil (7% pa) and sesame seeds (8% pa) is growing faster than supply, increasing value.

WHY SESAME? SUPPLY IS CHALLENGED

Sub-Saharan Africa currently supplies effectively all of the world's growing demand for sesame seeds. Sesame is succeeding in Africa due to its tolerance of hot dry conditions. However, there are numerous challenges to producing sesame in Africa.

THE $250m SESAME OPPORTUNITY FOR NORTH WEST QUEENSLAND

Sesame has the potential to be a $250m industry for North West Queensland, with exporting bulk sesame seeds being the main "prize".

NW Queensland is ideally positioned to supply Asia's growing demand for sesame seeds. It is "the right place to grow", being both close to key markets in Asia and a safe and trusted supplier of food. Only NW Queensland can deliver a region that combines a modern, developed economy with African climatic conditions.

STAGE 1 – THE LOCAL AUSTRALIAN MARKET

The domestic Australian market for sesame (both seeds and oil) is attractive, with Australians consuming a wide range of products containing sesame. To supply this market, North West Queensland can produce 1,400-6,700t of sesame seeds, at a value of A$4-18m.

STAGE 2 – SESAME SEED EXPORTS

Sesame seeds are the seventh largest globally traded cereal crop by value, accounting for US$2.2b in cross-border trade in 2017. NW Queensland can achieve 0.5% to 7% of global sesame trade (or 9,000t to 122,000t of sesame seeds), worth A$14 to 225m, in export markets.

STAGE 3 – SESAME OIL EXPORTS

Fifty-seven percent of sesame seed production is ultimately used to produce oil. NW Queensland could develop sesame oil production for export. Australia is a major producer and exporter of oils and fats. However, the market is not relatively large as most sesame oil is processed "fresh" in key markets. Potential export volumes for Australian sesame oil range from 100t to 1,100t, valued at A$0.6 to A$7m, depending on share.

Realising the NW Queensland sesame opportunity will require investment across four broad development themes: (1) developing sesame requires land and water ("best location"), (2) the best available genetics ("proven genetics"), (3) systems optimised to local conditions ("efficient systems"), and (4) selling the product to key markets ("targeted market").

DEMAND IS GROWING

01

+ Drivers of growth
+ Market size
+ Sesame seed demand
+ Sesame oil demand

There is strong global demand for sesame

- Sesame seeds are a US$2.2b global market, growing at 8% per year, on the back of high demand from Asia and the Middle East
- Macro drivers are pushing growth in global seed and oil trade volume and value
- Sesame has a wide range of uses, limiting exposure to any one sector or industry
  - Sesame is used extensively as a named ingredient in wide range of foods across Asia
  - Sesame oil is used extensively in cooking and as a flavouring across Asia
- Sesame is a "superfood" with recognised properties across Eastern and Western health systems
  - Some very strong claims are made around the curative properties of sesame oil by some online promoters
- There is a wide range of customers for sesame across East/South East Asia and globally
  - There is significant global interest in the black sesame trials in Central Queensland

Sesame seeds are a US$2.2b global market, growing at 8% per year, on the back of high demand from Asia and the Middle East

11m hectares
Harvested globally in 2016

6.8m tonnes
Produced globally in 2016

Africa & India
Currently supply most world trade

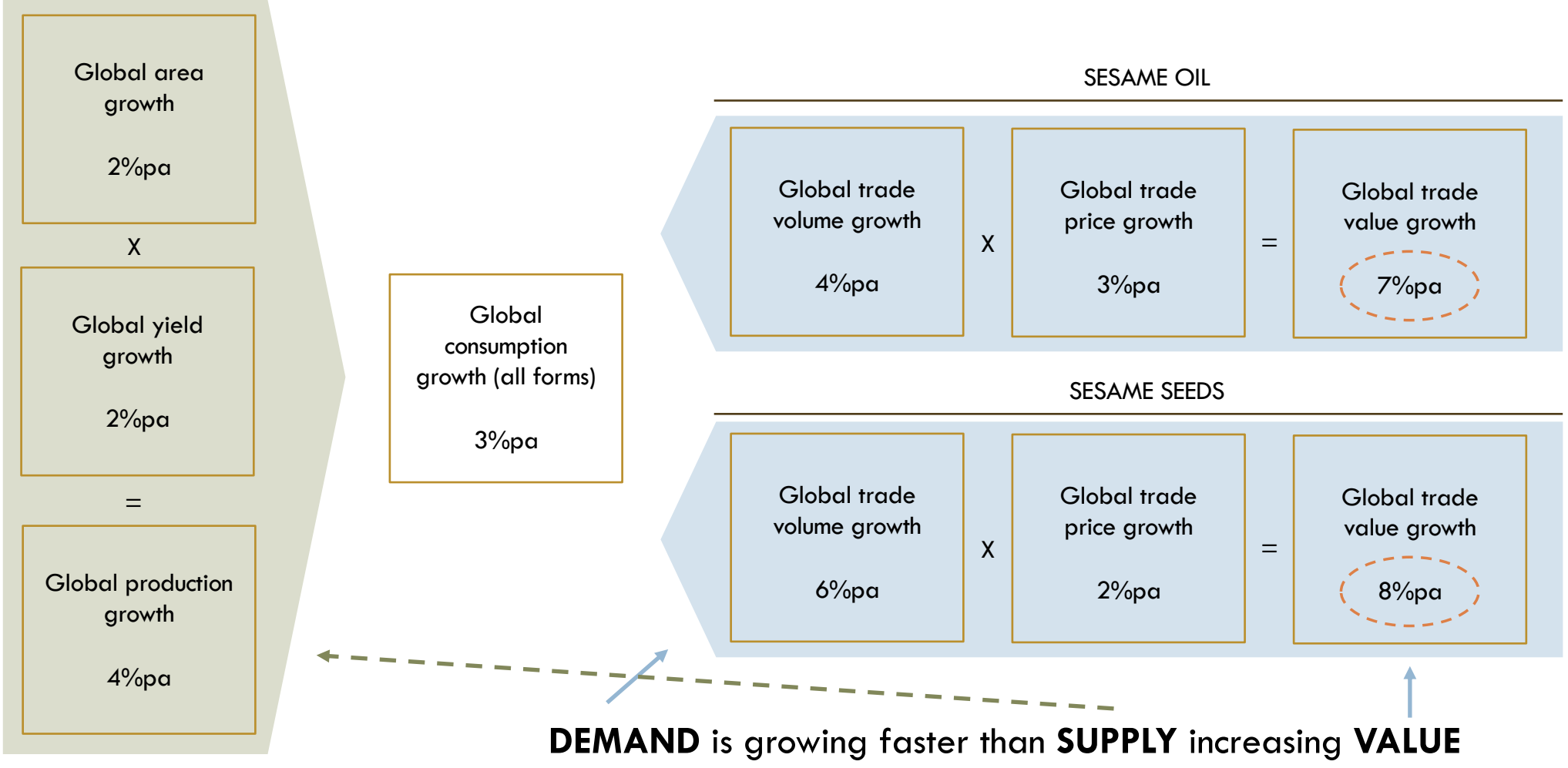
8% year
Global demand growth (20y CAGR)

US$2.2b
Global trade value in 2017

931,159 tonnes
Imported by China in 2016

Source: various published articles; UN FAOSTAT; Coriolis analysis and estimates. Photo Credit: Freepik from www.flaticon.com

Macro drivers are pushing growth in global seed and oil trade volume and value



Source: Coriolis analysis and estimates

Sesame has a wide range of uses, limiting exposure to any one sector or industry

FOOD

Used across many cultures globally

Whole seeds
Paste & spread (Tahini)
Confectionery
Muesli and snack bars
Hummus
Breads
Ice cream and desserts
Sushi

OIL

Seeds are 50% oil

Cooking oils
Flavour/Salad oils
Dressings
Baking ingredient

PHARMACEUTICAL & COSMETIC

Health giving and beauty enhancing

Health & Beauty care
Soaps
Cosmetics
Nutraceutical extracts

INDUSTRIAL & OTHER

Unique, specialised properties

Lubricants
Paints
Biodiesel
Illuminants

ANIMAL FEED

Excellent high-protein feed (35-50% protein)

Cattle
Poultry
Others

Source: various published articles; Coriolis analysis. Photo Credit: fair use/fair dealing; low resolution; complete product/brand for illustrative purposes

Sesame is used extensively as a named ingredient in wide range of foods across Asia

EXAMPLE: SELECT SESAME PRODUCTS IN SINGAPORE

Late 2018

Source: Coriolis analysis. Photo Credit: fair use/fair dealing; low resolution; complete product/brand for illustrative purposes

Sesame oil is used extensively in cooking and as a flavouring across Asia

EXAMPLE: SELECT SESAME OIL PRODUCTS IN SINGAPORE

Late 2018

"The price difference between standard sesame oil and black sesame is about five fold."

Surya Bhattarai, Central Queensland University

PURE	WHITE	BLACK	FRAGRANT	FLAVOURED
				

Source: Coriolis analysis. Photo Credit: fair use/fair dealing; low resolution; complete product/brand for illustrative purposes

Sesame is a "superfood" with recognised properties across Eastern and Western health systems

Sesamin, Sesamolin, Cephalin, others
Nutraceutical extracts

Laxative, emollient, demulcent, antibacterial, anti-viral, anti-inflammatory and antioxidant effects

AYUVERDIC/INDIA

CHINESE

This innovative formula also contains sesame lignans. Sesame lignans have been shown to stimulate fatty acid oxidation in the liver, and help stimulate fat breakdown — a process known as lipolysis.

WESTERN

Source: Coriolis analysis. Photo Credit: fair use/fair dealing; research or study; criticism or review; low resolution; complete product/brand for illustrative purposes

Some very strong claims are made around the curative properties of sesame oil by some online promoters

While it is highly unlikely sesame "cures cancer," there are strong indications it has health giving properties that will support and grow consumer demand into the future

Source: Coriolis analysis. Photo Credit: research or study; criticism or review; low resolution; complete product/brand for illustrative purposes

There is a wide range of customers for sesame across East/South East Asia and globally

EXAMPLES: MAJOR GLOBAL CUSTOMERS FOR SESAME SEEDS AND OIL

Global firms

East/South-East Asia firms

Source: various company websites; Coriolis analysis

There is significant global interest in the black sesame trials in Central Queensland

"Rockhampton Regional Council has already introduced possible trade and investment opportunities with South Korea's largest food manufacturing company, CJ, visiting the crop farm this week…CJ has an interest in growing sesame in Australia as their research team has already developed a variety of seeds…" *Article, CQU, May 2018*

"A group of European representatives looking at agricultural opportunities in Australia is interested in Australia's black sesame seed… "We can take them to Turkey and produce them for our market, our neighbouring countries, but also continue producing here as we are close to the biggest market like China and India." *Ali Tetik, Turkey, ABC article, August 2018*

The sesame seed trade is large (US$2.2b), growing (8%) and pays high prices (US$1,255/t)

- The global sesame seed trade is growing value (20y CAGR 8%) through greater volumes (6%) across limited price increases (2%)

- East Asia, Europe, the Middle East and the US dominate the US$2.2b global demand for sesame seed imports

    - Growing global sesame seed import volumes are going primarily to China, other parts of Asia and the Middle East; Europe and North America are more mature and low growth

- The US, Japan and Europe stand out as large market that pay high prices; China is a large market, but at lower prices

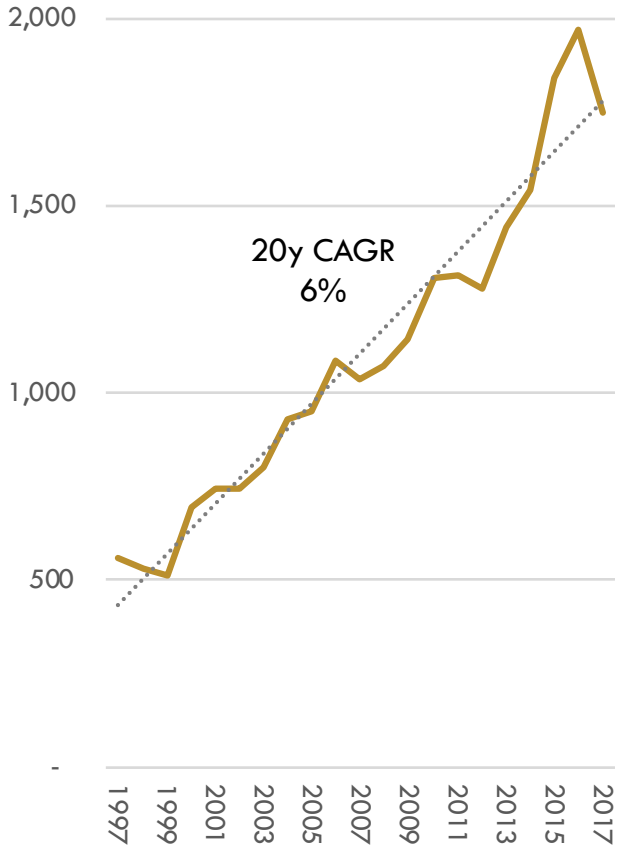
- China, developing Asia and Europe have driven sesame seed import value growth over the past decade

- Fifty-seven percent of sesame seed production is ultimately used to produce oil; forty-three percent for all other uses

Global sesame seed trade is growing value (20y CAGR 8%) through greater volumes (6%) across limited price increases (2%)

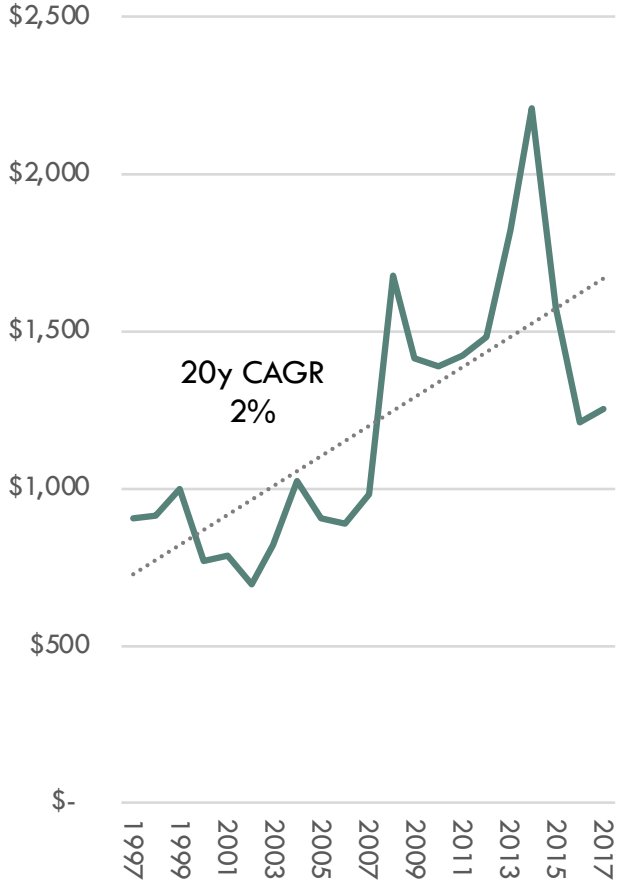
GLOBAL IMPORT VOLUME

Tonnes; 000; 1997-2017



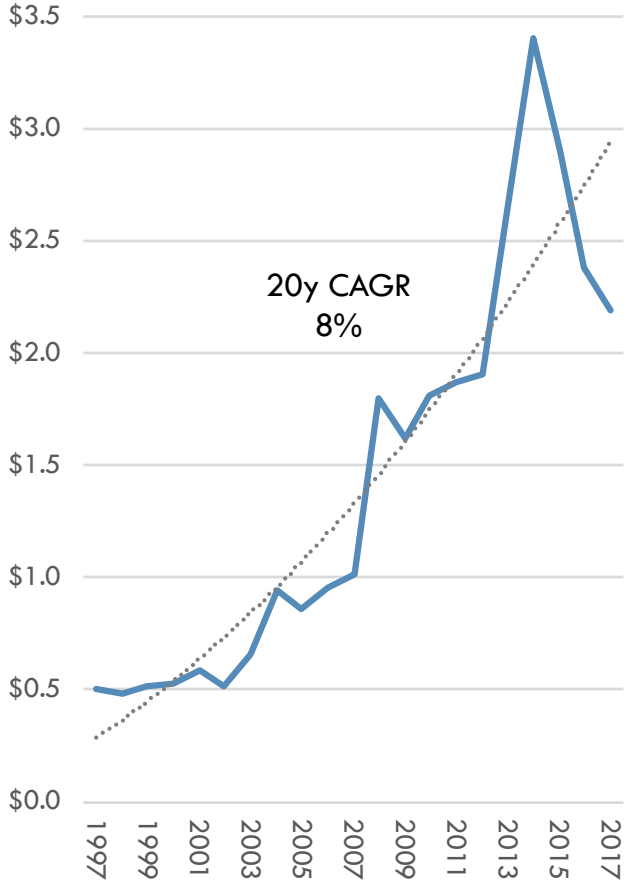
AVERAGE CIF PRICE

US$/t; landed CIF; 1997-2017



GLOBAL IMPORT VALUE

US$; b; landed CIF; 1997-2017

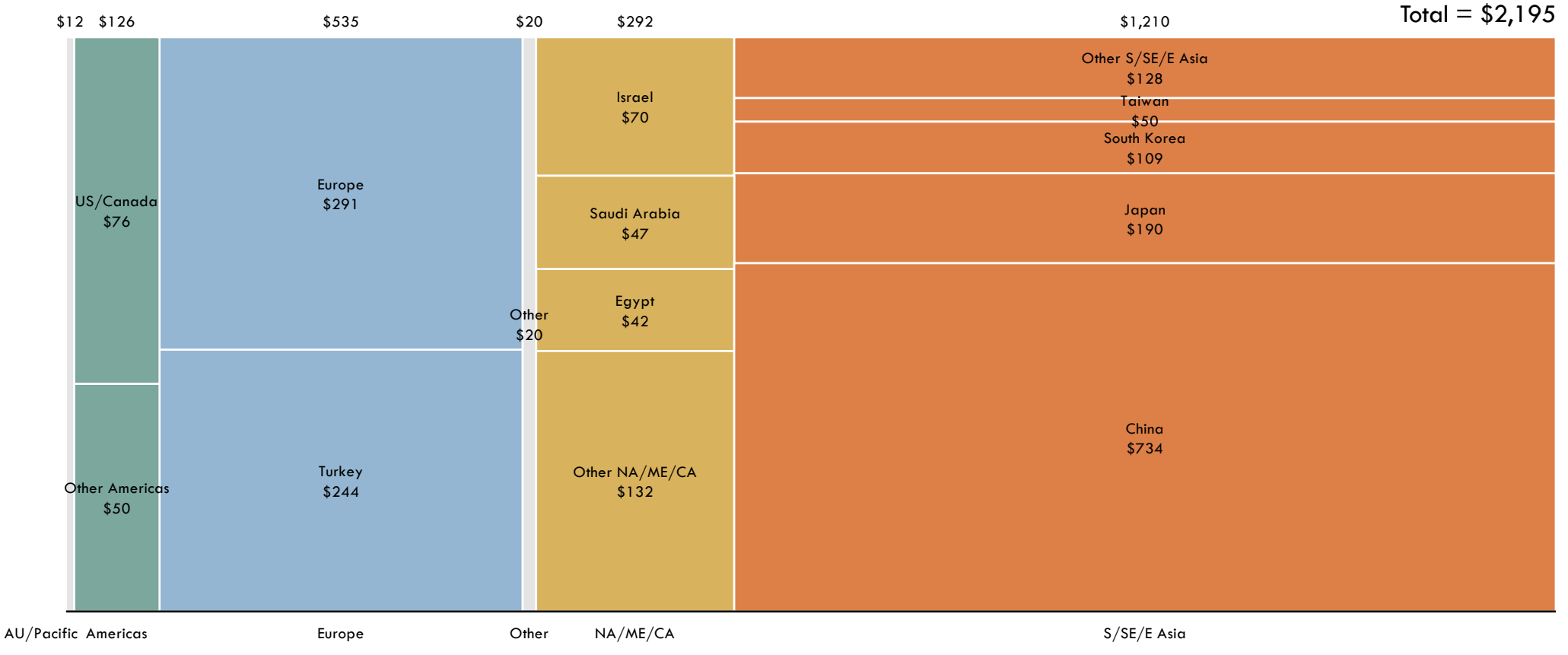


Source: UN Comtrade; Coriolis analysis

East Asia, Europe, the Middle East and the US dominate the US$2.2b global demand for sesame seed imports

TOTAL GLOBAL SESAME SEED IMPORT VALUE BY COUNTRY/REGION

US$; m; 2017

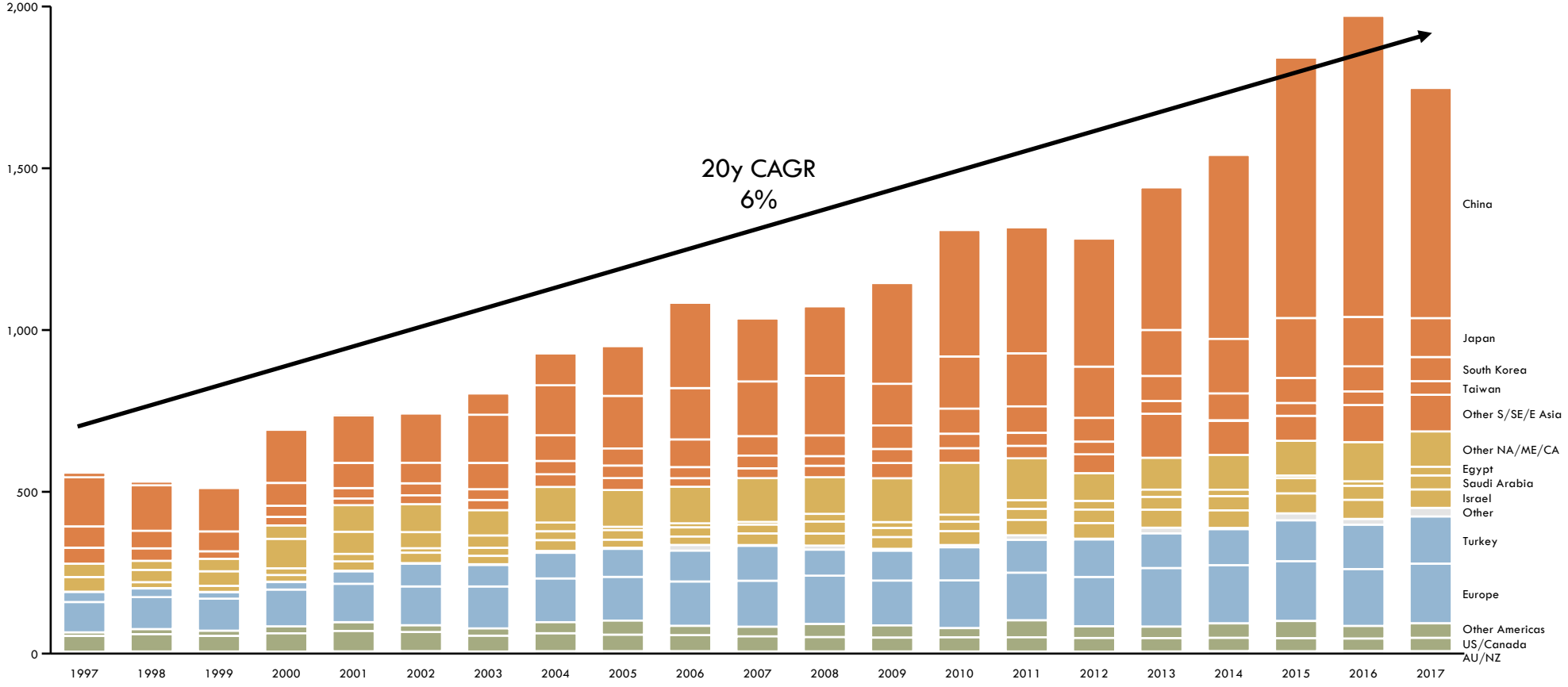


Source: UN Comtrade; Coriolis classifications and analysis

Growing global sesame seed import volumes are going primarily to China, other parts of Asia and the Middle East

TOTAL GLOBAL SESAME SEED IMPORT VOLUME BY COUNTRY/REGION

Tonnes; 000; 1997-2017



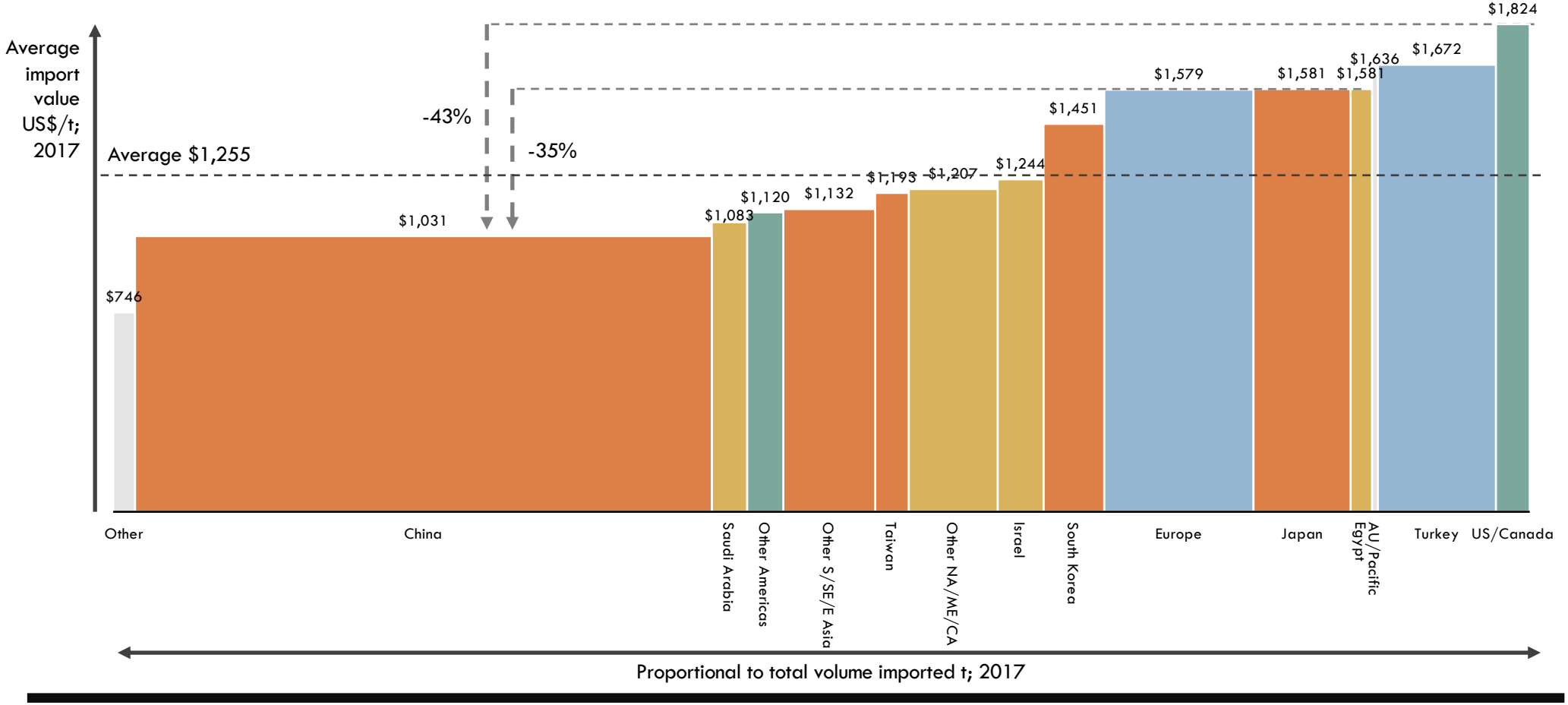
Source: UN Comtrade; Coriolis classifications and analysis

The US, Japan and Europe stand out as large market that pay high prices; China is a large market, but at lower prices

MARKET VALUE BUILDUP: IMPORT VOLUME VS. PRICE PER TONNE

US$/t; 2017

Area is proportional to value ($/t x t = $)

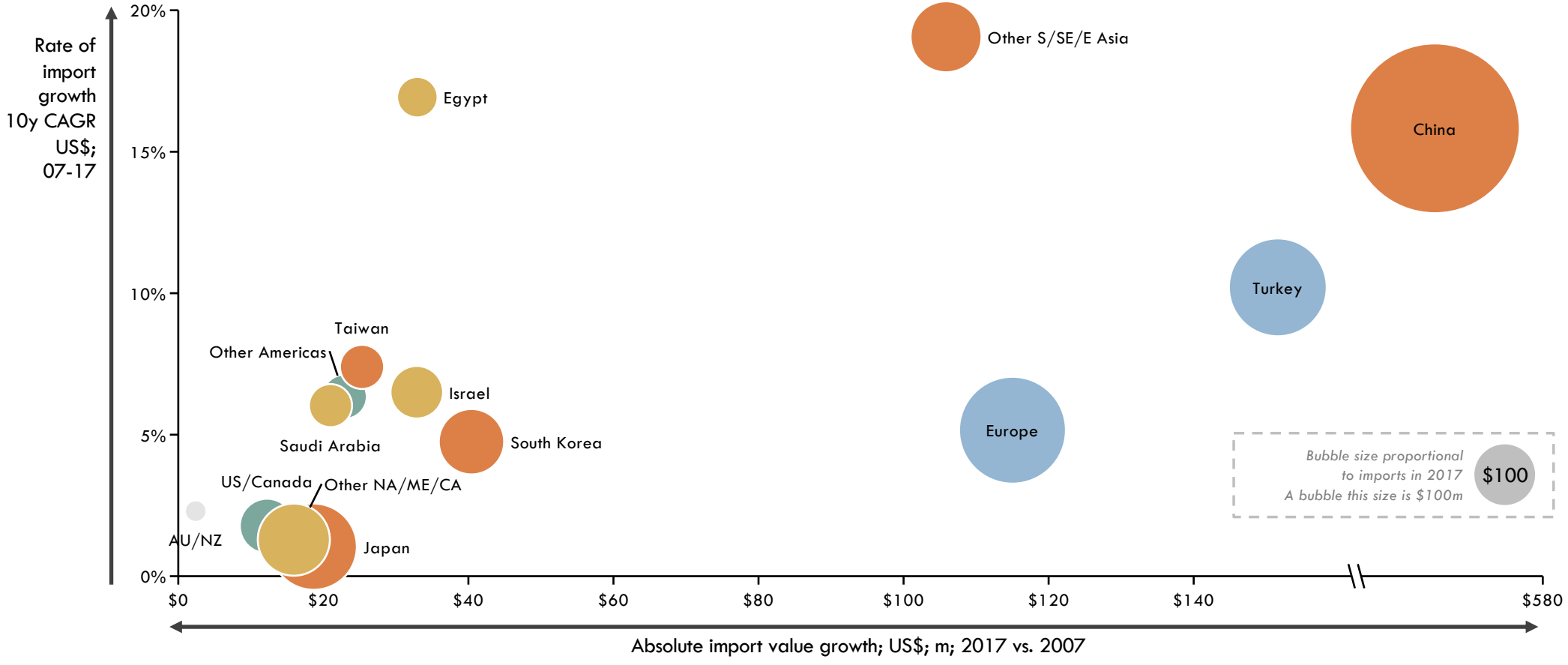


Source: UN Comtrade; Coriolis classifications and analysis

China, developing Asia and Europe have driven sesame seed import value growth over the past decade

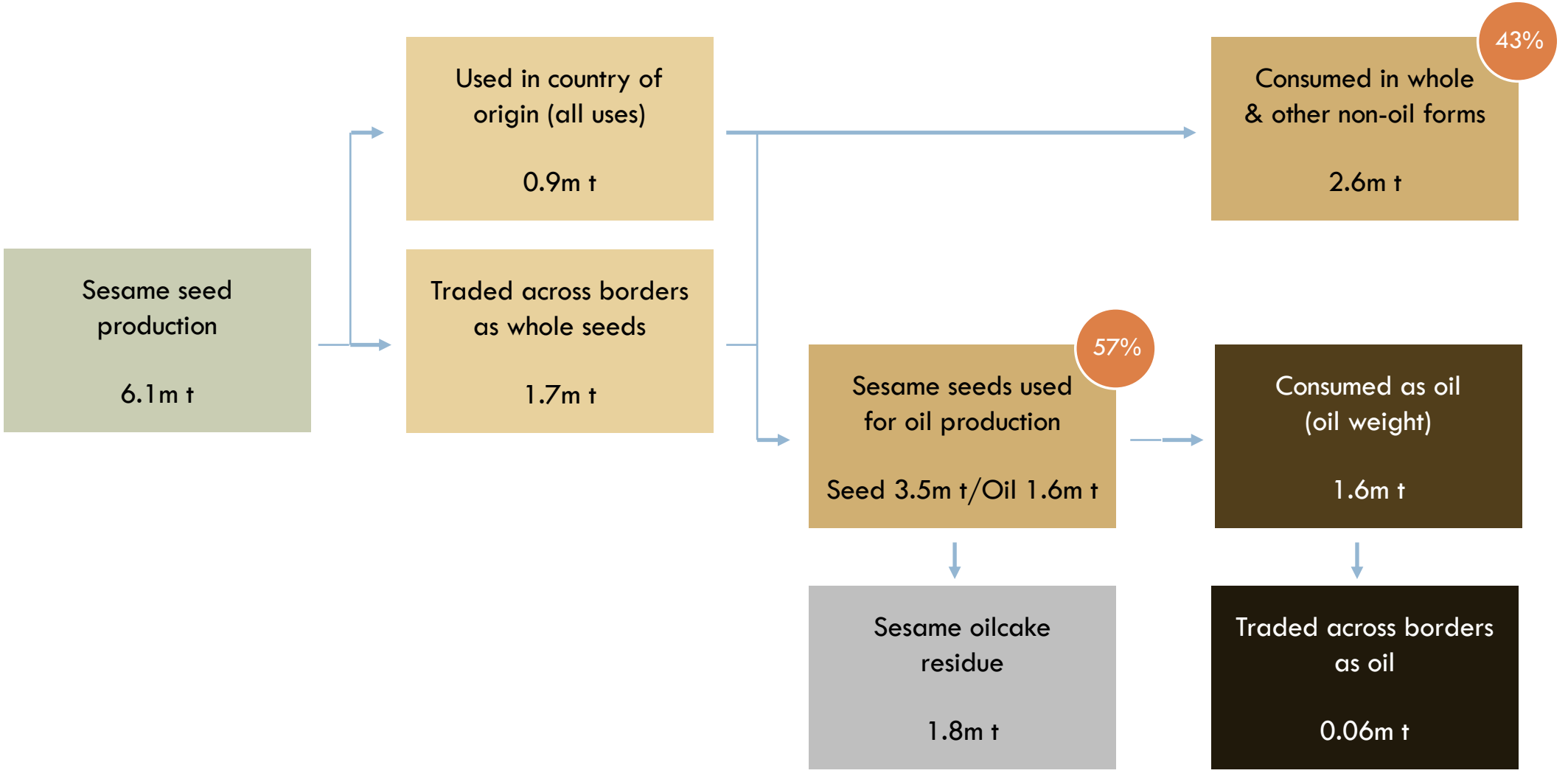
GROWTH MATRIX: ABSOLUTE VALUE GROWTH VS. RATE OF GROWTH

US$; m; 2007 vs. 2017



Source: UN Comtrade; Coriolis classifications and analysis

Fifty-seven percent of sesame seed production is ultimately used to produce oil; forty-three percent for all other uses



Source: UN FAOSTAT; UN Comtrade; Coriolis analysis

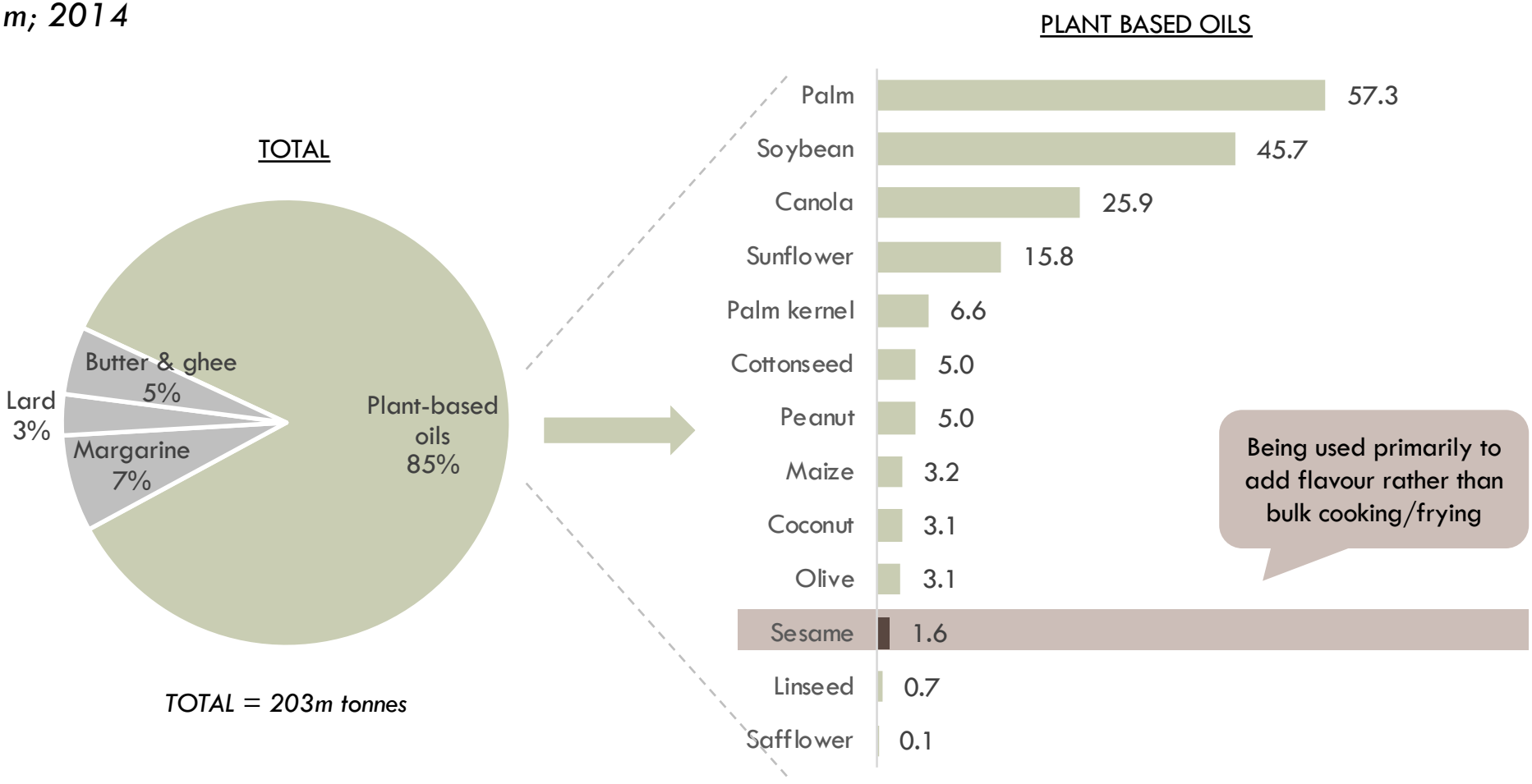
Sesame oil is an attractive market due to its high price, but difficult to access due to it being primarily produced in-market

- Sesame oil is a relatively minor edible oil/fat globally by volume, accounting for about 1% of global plant-based oils
- Sesame oil achieves a much higher price than other major oils, effectively on par with virgin olive oil
- Most sesame oil is consumed in the country of production; very little sesame oil crosses borders
  - Sesame oil is produced globally; however, three countries stand out for total volume: Tanzania, Myanmar and China
- Global sesame oil trade is growing value (20y CAGR 7%) through greater volumes (4%) across growing prices (3%)
  - The key markets for sesame oil imports are the US ($87m), Europe ($62m), rich East Asia ($43m) and Australia ($10m)
  - Global spending on imported sesame oil is growing from the US, Europe and developed Asia
  - North America and Europe stand out as large market that pay high prices for sesame oil; East Asia appears more competitive

Sesame oil is a relatively minor edible oil/fat globally by volume, accounting for about 1% of global plant-based oils

TOTAL GLOBAL EDIBLE OIL & FAT PRODUCTION

Tonnes; m; 2014

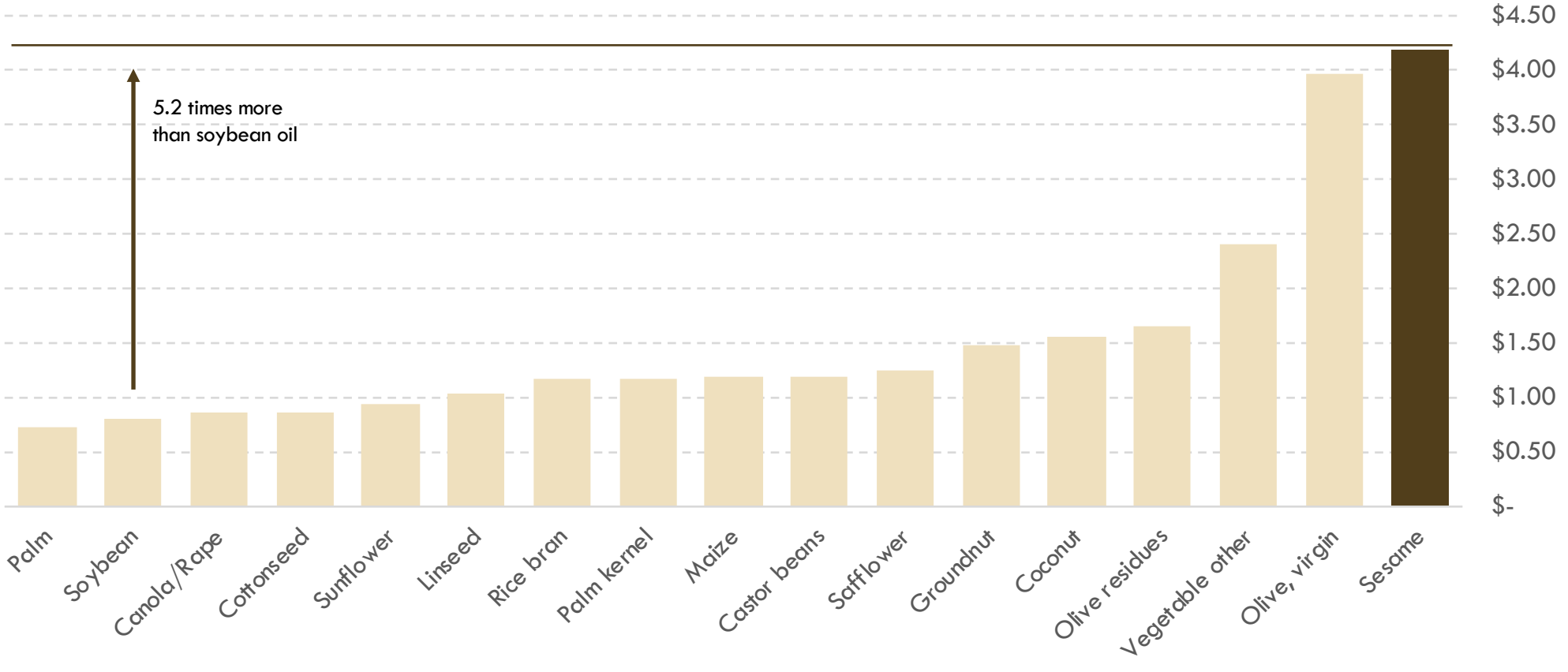


Note: data is major "commercial" plant oils only and excludes minor plants and nut oils. Source: UN FAOSTAT; Coriolis analysis

Sesame oil achieves a much higher price than other major oils, effectively on par with virgin olive oil

AVERAGE GLOBAL IMPORT PRICE

US$/kg; 2016 or 2017

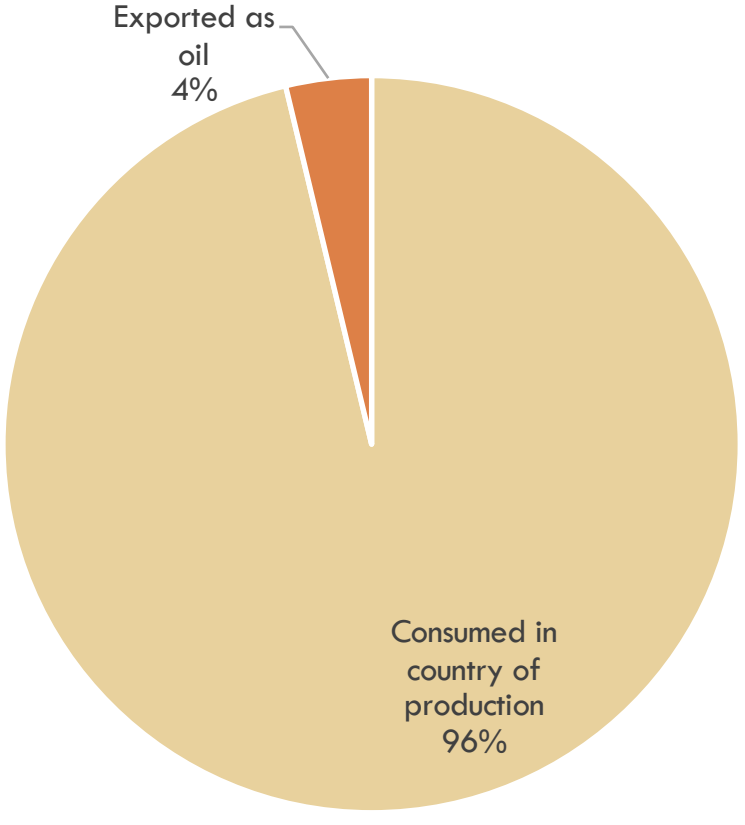


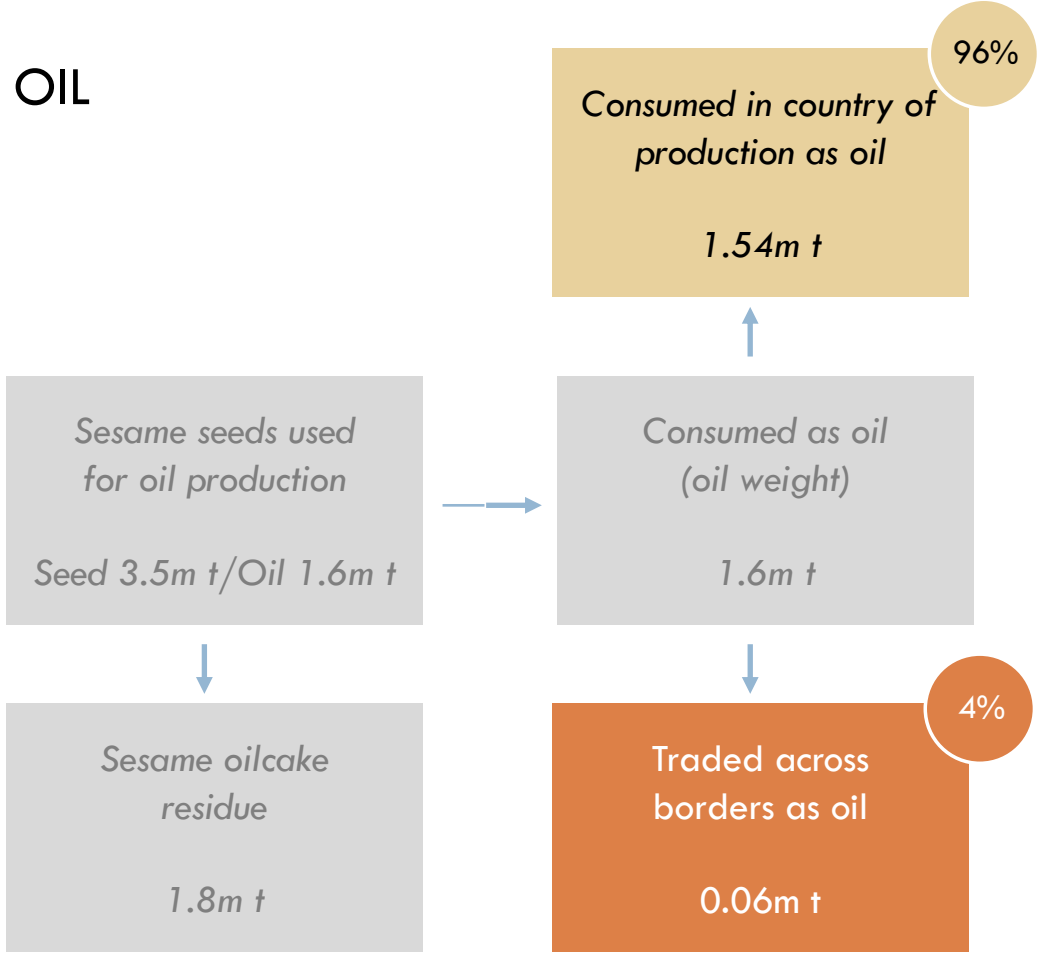
Source: UN FAOSTAT; Coriolis analysis

Most sesame oil is consumed in the country of production; very little sesame oil crosses borders

LOCATION OF CONSUMPTION OF SESAME OIL

% of volume; 2016



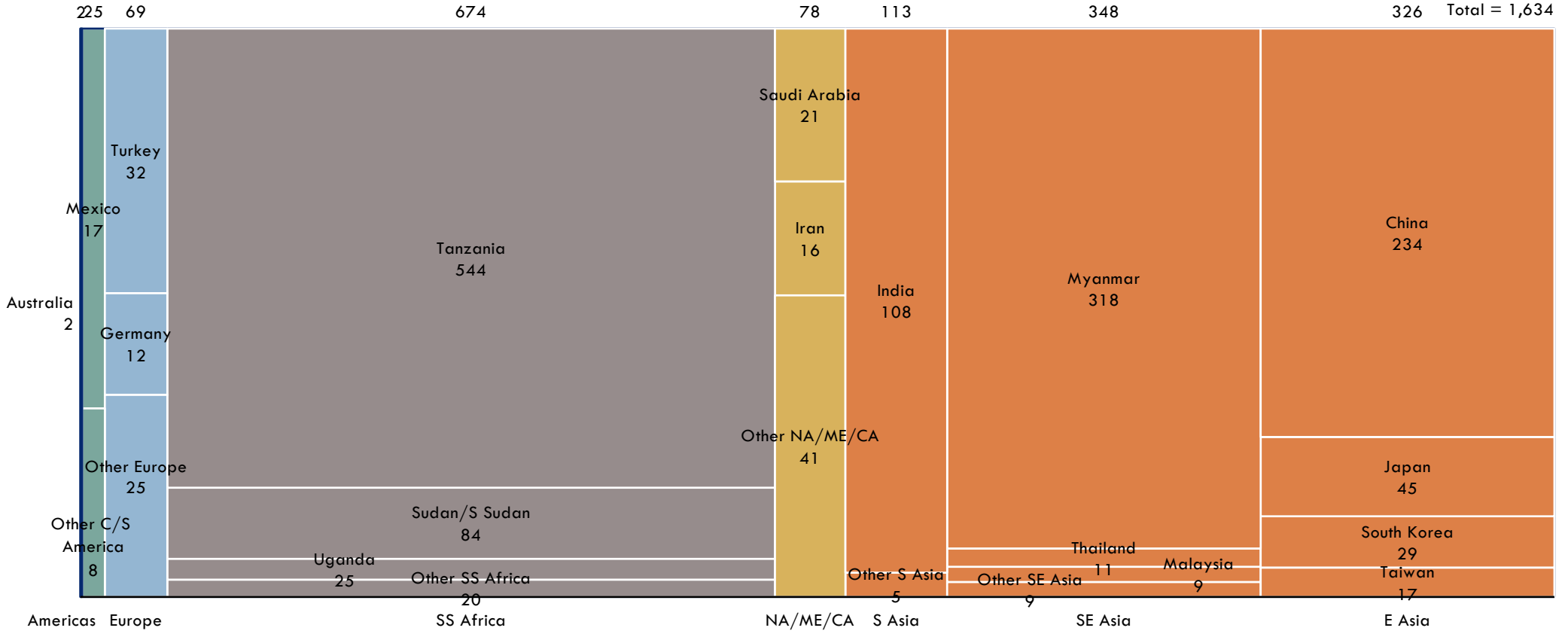


Source: UN FAOSTAT; UN Comtrade; Coriolis analysis

Sesame oil is produced globally; however, three countries stand out for total volume: Tanzania, Myanmar and China

GLOBAL SESAME OIL PRODUCTION BY COUNTRY/REGION

Tonnes; 000; 2016



Source: UN FAOSTAT; Coriolis analysis

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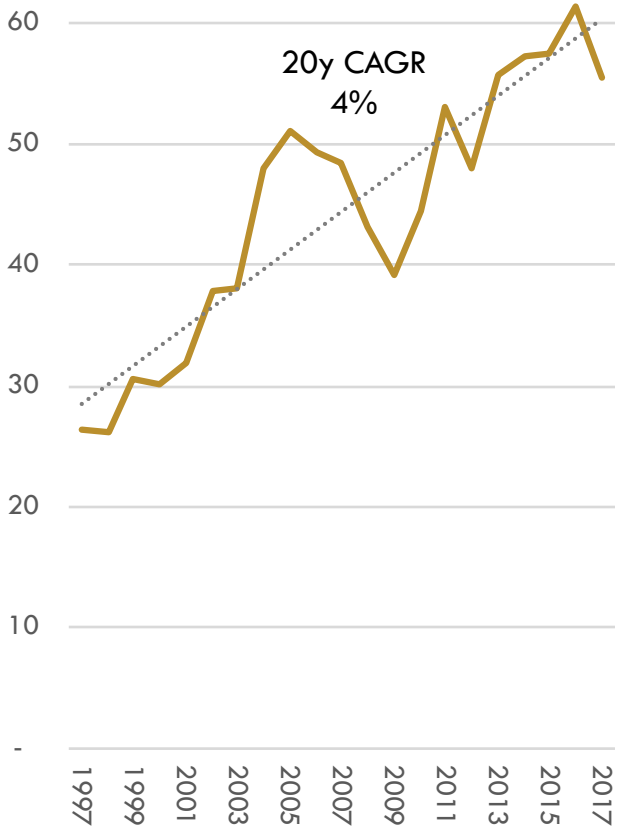
GLOBAL IMPORT VOLUME

Tonnes; 000; 1997-2017

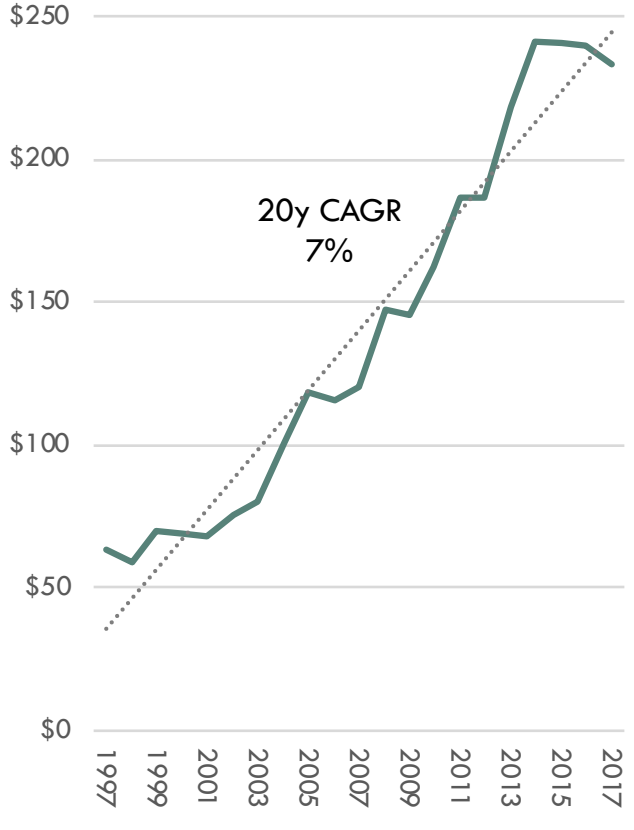


AVERAGE CIF PRICE

US$/t; landed CIF; 1997-2017

GLOBAL IMPORT VALUE

US$; b; landed CIF; 1997-2017

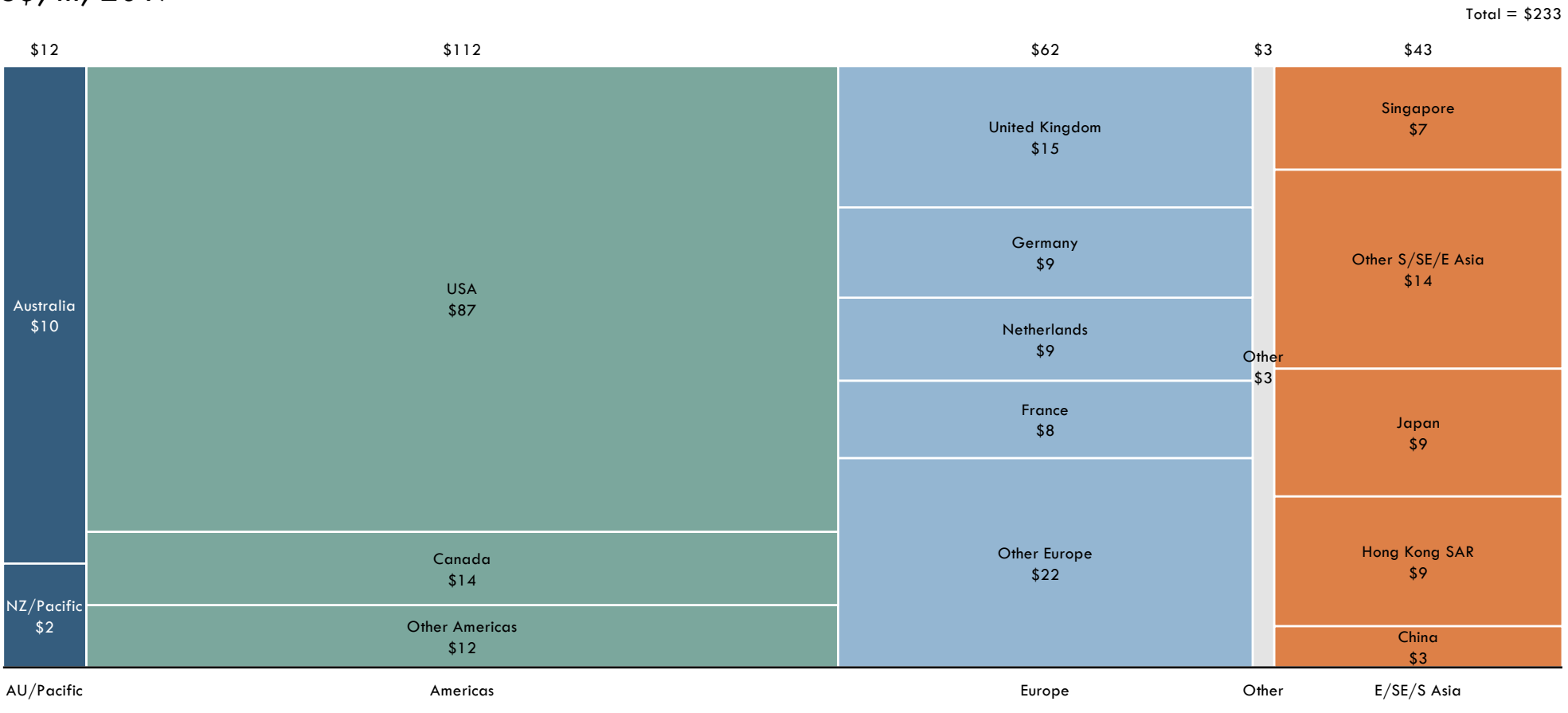


Source: UN Comtrade; Coriolis analysis

The key markets for sesame oil imports are the US ($87m), Europe ($62m), rich East Asia ($43m) and Australia ($10m)

TOTAL GLOBAL SESAME OIL IMPORT VALUE BY COUNTRY/REGION

US$; m; 2017

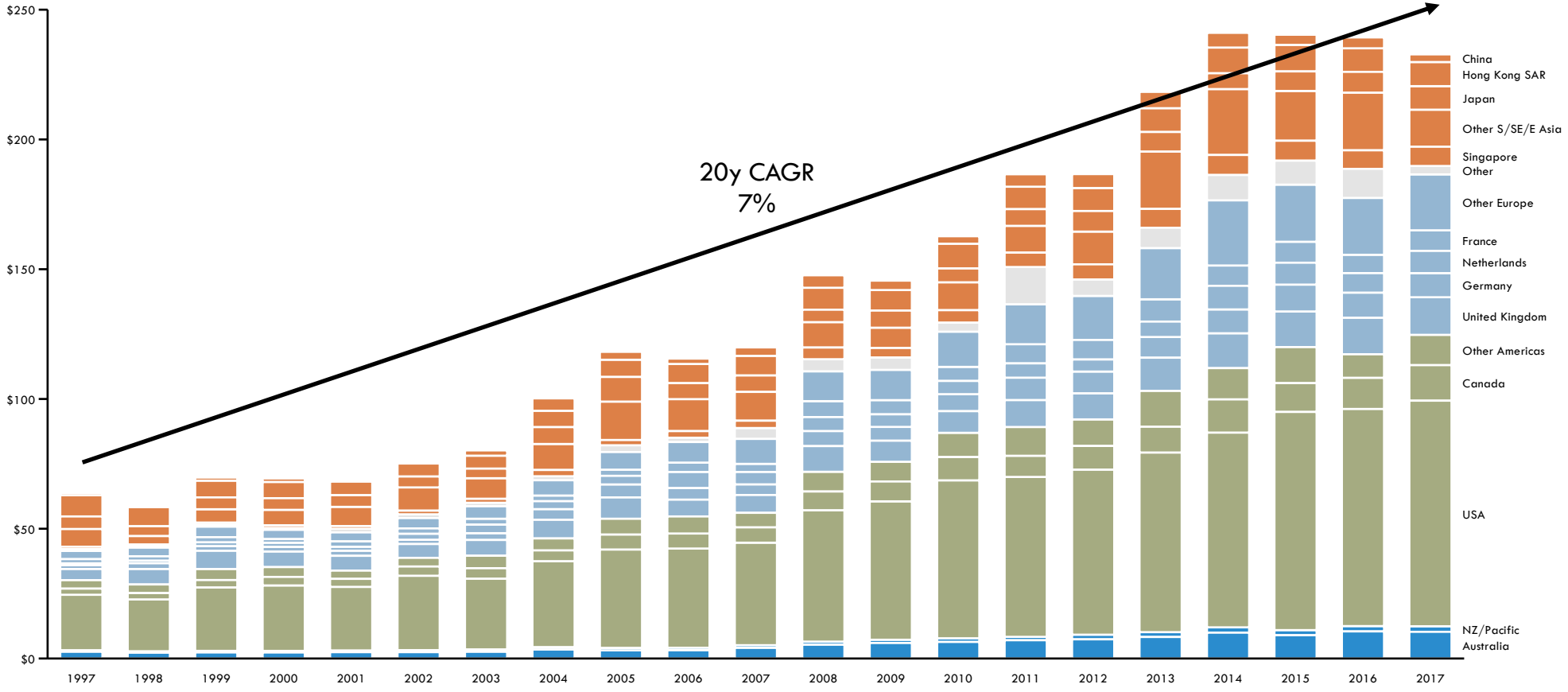


Source: UN Comtrade; Coriolis classifications and analysis

Global spending on imported sesame oil is growing from the US, Europe and developed Asia

TOTAL GLOBAL SESAME OIL IMPORT VALUE BY COUNTRY/REGION

US$; m; 1997-2017



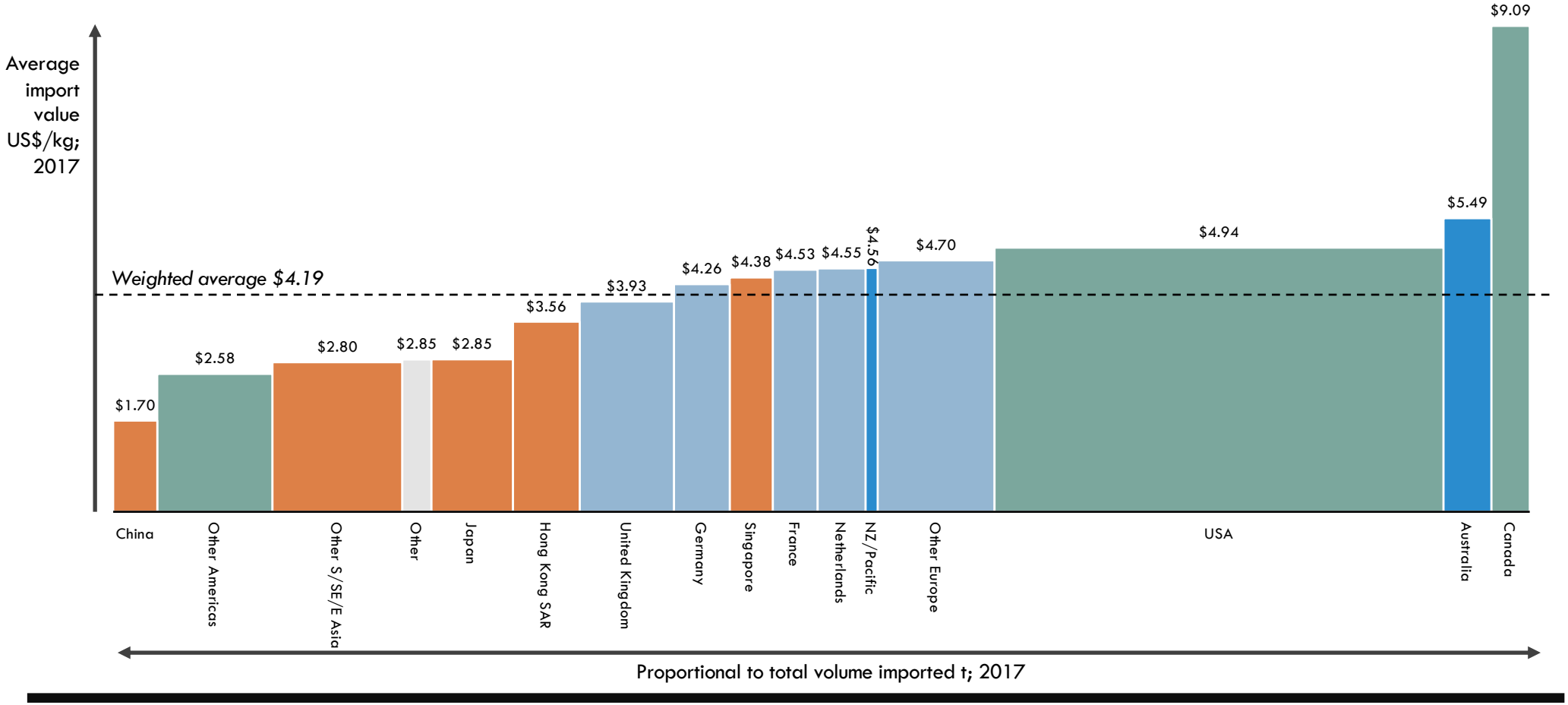
Source: UN Comtrade; Coriolis classifications and analysis

North America and Europe stand out as large market that pay high prices for sesame oil; East Asia appears more competitive

MARKET VALUE BUILDUP: IMPORT VOLUME VS. PRICE PER TONNE

US$/kg; 2017

Area is proportional to value ($/t x t = $)



Source: UN Comtrade; Coriolis classifications and analysis

SUPPLY IS CHALLENGED

02

+ Global production
+ Production growth
+ Production challenges
+ Export supply
+ Export supply growth

Sub-Saharan Africa currently supplies effectively all of the world's growing demand for sesame seeds

- Sesame is a highly drought tolerant crop that originated in Sub-Saharan Africa
- Sesame seeds are primarily grown in hot, dry regions, particularly in Africa and parts of Asia
- Sub-Saharan Africa, South/South East Asia and China currently dominate global sesame seed production
- Almost all long term sesame seed production growth is coming from Sub-Saharan Africa
  - Sesame is succeeding in Africa due to its tolerance of hot dry conditions
  - Tanzania – in particular – stands out for medium-term sesame seed production growth, while China has falling production
- However, there are numerous challenges to producing sesame in Africa

Sesame is a highly drought tolerant crop that originated in Sub-Saharan Africa

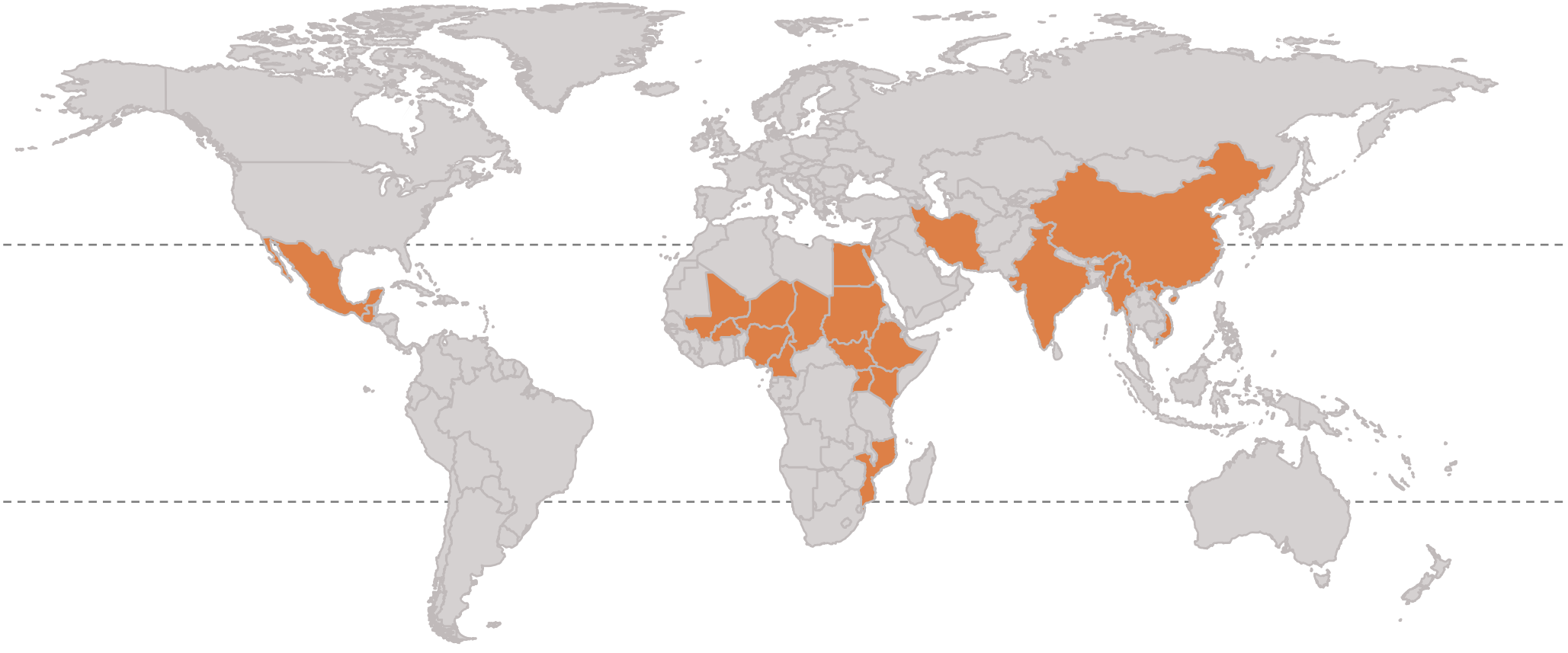
Common names	Sesame
Scientific name	*Sesamum indicum*
Type of plant	Annual flowering shrub
Cultivation cycle	90 to 120 frost free days
Suited climate	Dry arid, tropical and subtropical climate Highly drought tolerant
Uses	Consumed whole, raw or roasted Used a cooking and ingredient oil Used as a paste (tahini) Used as an ingredient in breads, crackers, cakes, snack bars, muesli, sushi, salad dressing, hummus, confectionary
Origin	Sub-Saharan Africa
Established in AU	Trials in 1979-1982; breeding programme by CSIRO in 1989; current trials of new, non shattering, high yield varieties in southern Queensland/NSW and Far North

Source: various published articles and websites; Coriolis analysis. Photo Credit: Hermann Adolph Kohler, public domain

Sesame seeds are primarily grown in hot, dry regions, particularly in Africa and parts of Asia

TOP 20 GLOBAL SESAME SEED PRODUCING COUNTRIES

By total production volume; 2016

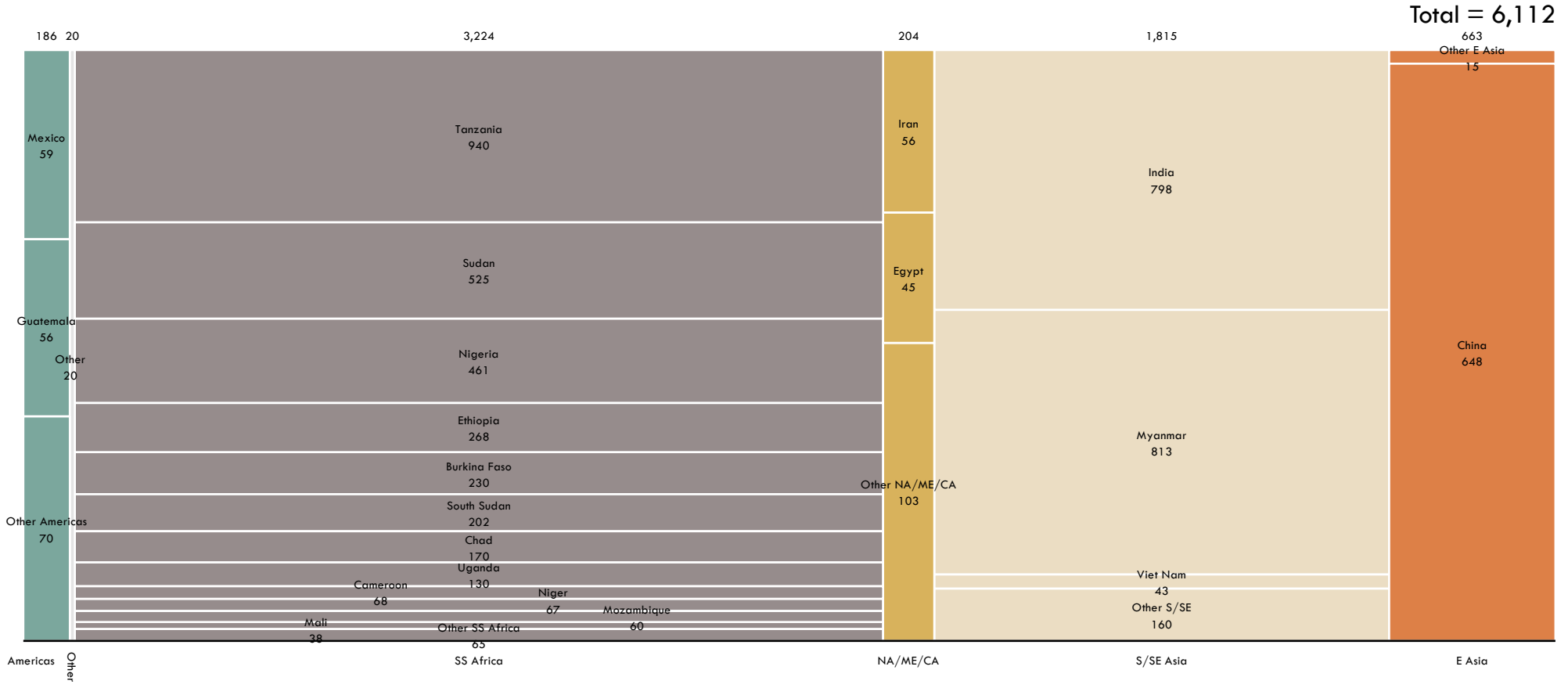


Source: UN FAOSTAT; Coriolis analysis

Sub-Saharan Africa, South/South East Asia and China currently dominate global sesame seed production

GLOBAL SESAME SEED PRODUCTION BY COUNTRY/REGION

Tonnes; 000; 2016

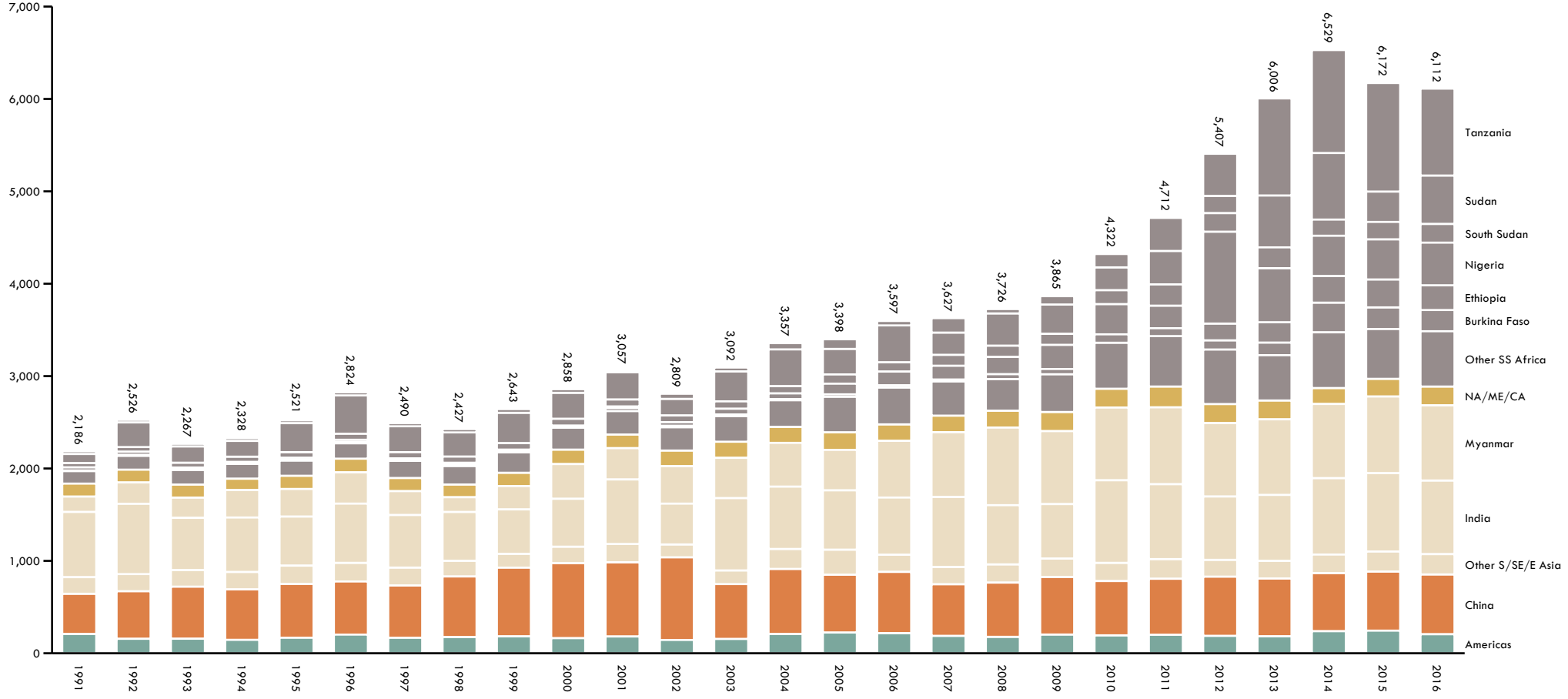


Source: UN FAOSTAT; Coriolis analysis

Almost all long term sesame seed production growth is coming from Sub-Saharan Africa

GLOBAL SESAME SEED PRODUCTION BY COUNTRY/REGION

Tonnes; 000; 2016



Note: Americas includes "other". Source: UN FAOSTAT; Coriolis analysis

Sesame is succeeding in Africa due to its tolerance of hot dry conditions

"Sesame is popular amongst African farmers and is commonly referred to as the 'survivor' plant – it can resist drought where other crops fail and it doesn't require much fertiliser making it less expensive to cultivate. It is this remarkable drought resistance, requiring 66 percent less water than grain sorghum and an impressive 75 percent less water than corn to cultivate, that makes it noteworthy of its tag as the 'survivor plant'." *Nigeria Agribusiness Group*

"It is a drought tolerant crop making it suitable for cultivation in drought-prone areas of Zimbabwe." *Newsday Zimbabwe*

"It is a drought-tolerant crop with a really deep root system and it is very forgiving as far as when it gets rain." *Danny Peeper, SESACO Seed Co.*

"Sesame, though small, is tough, growing and thriving in areas where most other crops would find it hard to flourish – namely dry conditions. Surprisingly, the crop's output does not increase significantly with the application of fertilisers." *Hacking Africa*

"West Africa's Sahel is characterized by a dry and hot climate with limited rainfall that impairs the production of several crops. Sesame is a resilient crop that is well suited to this environment… In West Africa's Sahel, more agricultural areas are expected to get drier and hotter in the predicted scenario of climate change, resulting in unsuitable weather conditions to further the production of many crops… It is crucial to prioritize and encourage the production of crops that are able to survive and give high yields in an increasingly harsh environment.

In this context, sesame is undoubtedly one of the resilient crops best-suited to the West African Sahel's arid climate. It is considered as one of the most ancient oilseed crops, and it is cultivated in marginal lands and inclement areas under frequent droughts and/or high heat.

Africa accounts for more than 50% of the world's sesame seed production... Its seeds have one of the highest oil contents (~ 55%) among major oilseed crops.

Beyond the traditional use of direct consumption, sesame seeds have diverse applications. The potentially beneficial effects of sesame on human health, because of the presence of natural antioxidants such as sesamin, sesamol and sesamolin, have recently prompted renewed interest in this ancient crop.

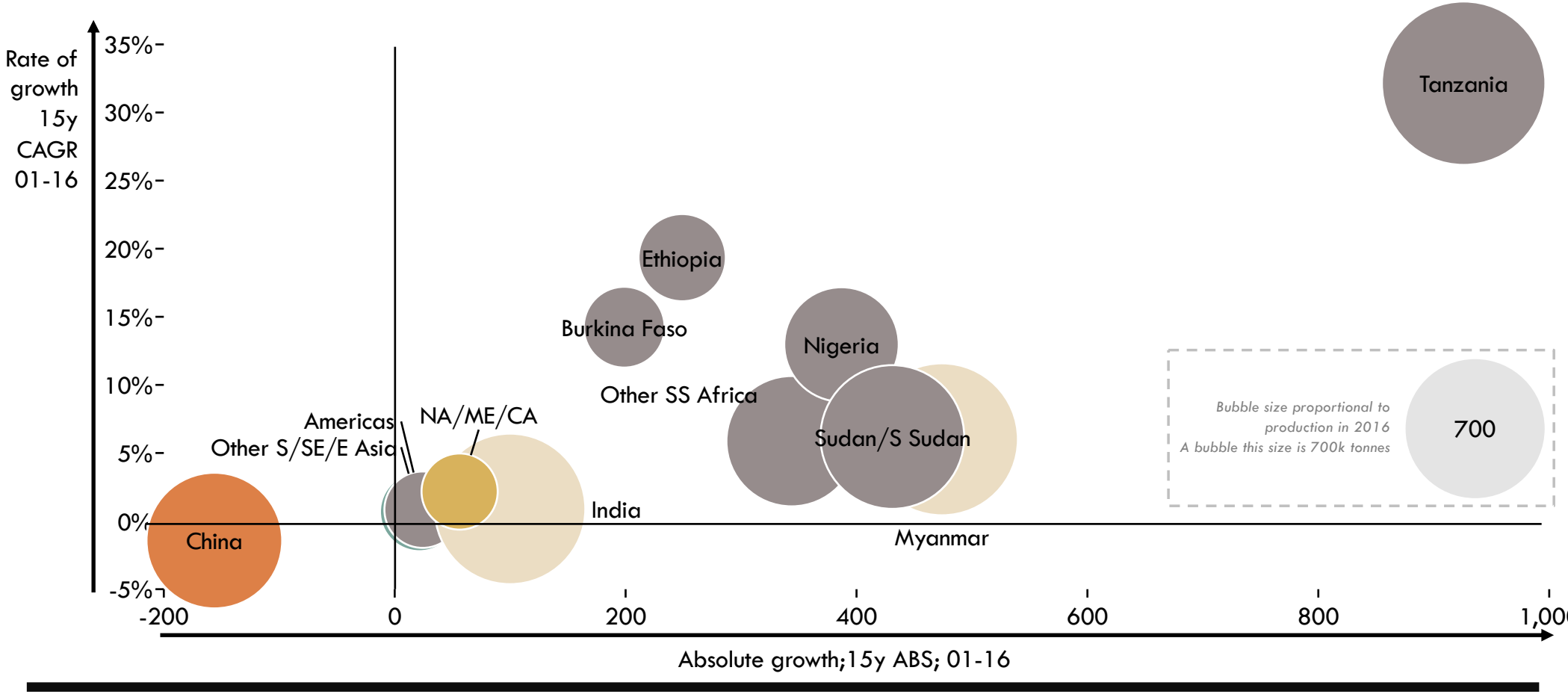
While the production of many crops has declined over the last decade in West Africa's Sahel, the traded quantity of sesame has more than doubled in this area, showing growing interest in the crop. Indeed, sesame is able to provide incomes in this area where the options are quite limited… Moreover, the world's demand for sesame seeds is rapidly increasing and the West African sesame seed is particularly appreciated because it is largely produced without chemicals." *Komivi Dossa, Agriculture & Food Security 2018 6:68*

Source: various published articles; Coriolis analysis

Tanzania – in particular – stands out for medium-term sesame seed production growth, while China has falling production

15y SESAME SEED PRODUCTION GROWTH MATRIX

Tonnes; 000; 2001 v 2016



Note: Americas includes "other". Source: UN FAOSTAT; Coriolis analysis

However, there are numerous challenges to producing sesame in Africa

"[Tanzanian farmers] cannot benefit from global markets of sesame due to a number of factors, including poor produce quality… Farmers are producing sesame with a variety of colours as opposed to white colour which has high demand in the world market… other [challenges include] failure to meet export orders, poor storage facilities, poor farm management, lack of mechanised sesame farming that causes a spread of sesame pests and diseases and post-harvest losses… As a result… the destination of sesame exports has remained India and largely local consumers who buy sesame seeds without assessing their quality." *Ebron Mwakalinga, Agribusiness consultant, Tanzania, 2016*

"There is only one sesame processing plant in Masasi with the capacity to process five tonnes a day. However, the plant owner is facing chronic problems of power interruptions and the plant is still in its infancy." *Gilbert Waigama, Development Officer, TanTrade, Tanzania, 2016*

"There are also other problems: the lack of extension services, the use of weights which are not calibrated by the Weights and Measures Agency, the shortage of high quality seeds and inability to collect reliable data on farm productivity by the responsible ministry." *The Citizen (Tanzania), Jan 2016*

"During the survey, the farmers in the four areas listed major constraints… Sesame seed marketing was reported as the most pressing constraint in all the regions. Marketing problems included the low market price and its fluctuations, the difficulty to find buyers, and other factors… In Senegal, sesame producers are mainly faced with insufficient agricultural implements, a lack of technical assistance and insufficient agricultural inputs." *Komivi Dossa, Agriculture & Food Security 2018 6:68*

"The sesame market is erratic... There is no warehouse receipt system for this crop. We are being exploited by unreliable buyers." *Abdallah Umande, sesame farmer, Tanzania, 2016*

Source: various published articles; Coriolis analysis

Cross-border sesame seeds come primarily from Africa and India and sesame oil from E/SE Asia and Mexico

SESAME SEED EXPORTS

- Global demand for sesame seeds is primarily supplied by the drier parts of Africa and India
- Effectively all growth in global trade in sesame seeds in the past fifteen years has come from Africa
- The average global landed price for sesame seeds was $1,255/t in 2017; the African countries generally have lowest prices than India and elsewhere
- Sudan, Ethiopia, Nigeria, Niger, Tanzania and a range of other African countries are growing exports to meet global demand

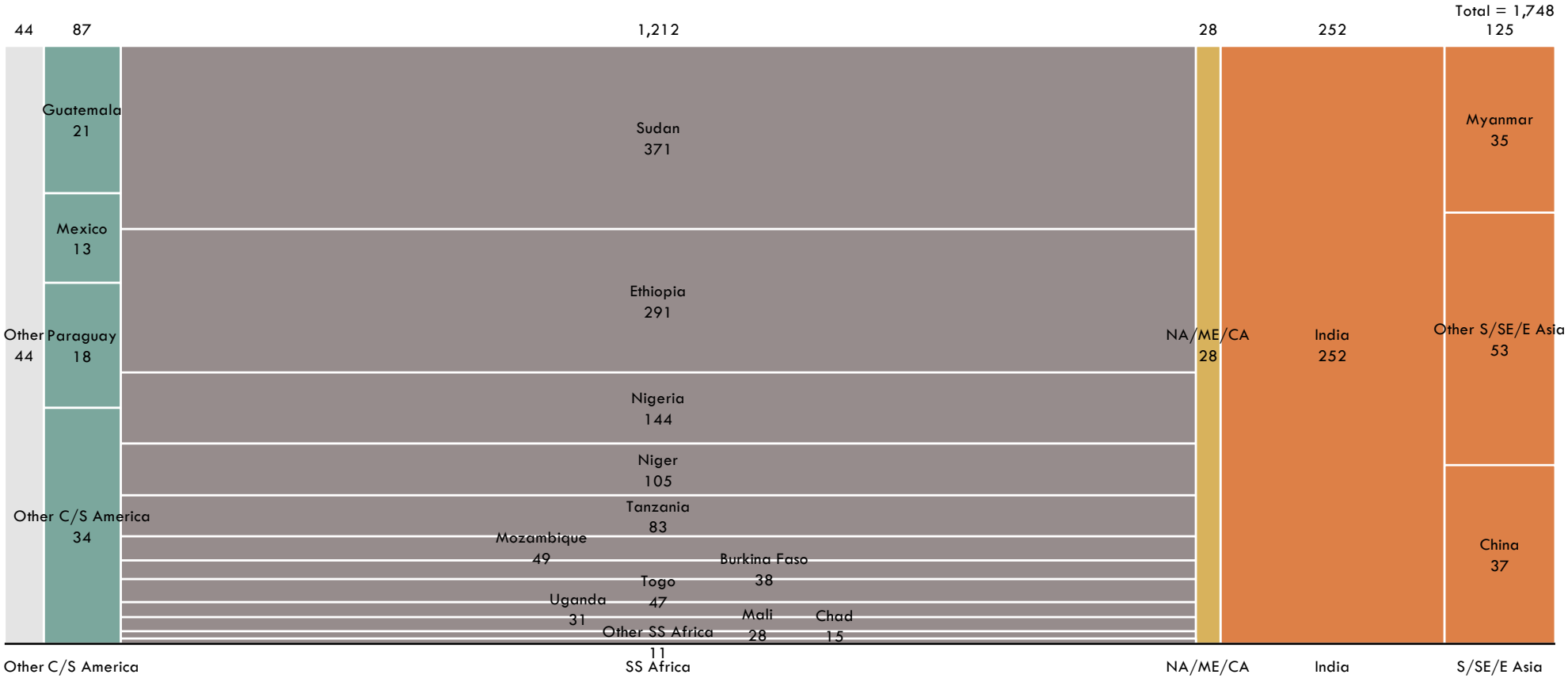
SESAME OIL EXPORTS

- Growth in the global sesame seed oil trade has come from E/SE Asia and Mexico
- Average sesame oil prices vary across exporters, with Japan standing out as achieving higher prices than average

Global demand for sesame seeds is primarily supplied by the drier parts of Africa and India

TOTAL GLOBAL SESAME SEED EXPORT VOLUME BY COUNTRY/REGION

Tonnes; 000; 2017

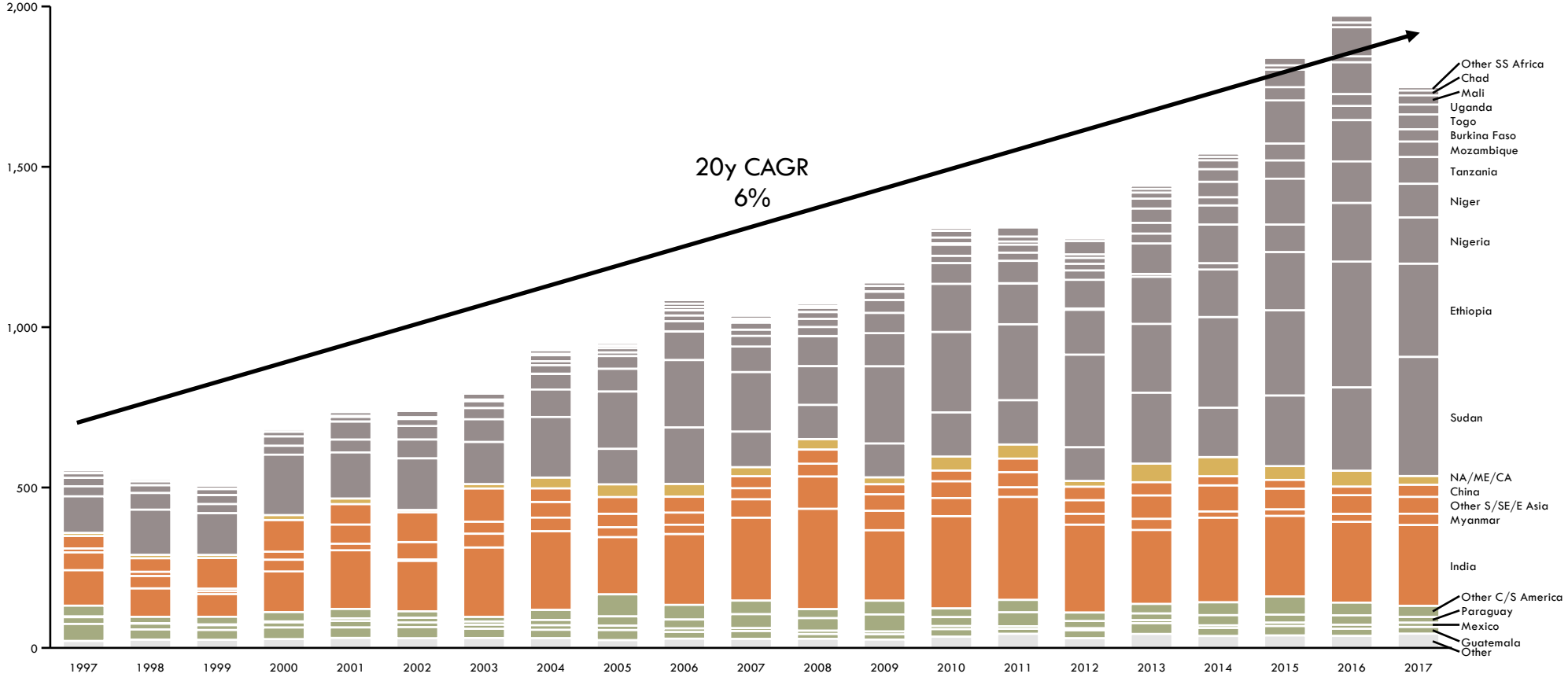


Source: UN Comtrade; Coriolis classifications and analysis

Effectively all growth in global trade in sesame seeds in the past fifteen years has come from the drier parts of Africa

TOTAL GLOBAL SESAME SEED EXPORT VOLUME BY COUNTRY/REGION

Tonnes; 000; 1997-2017

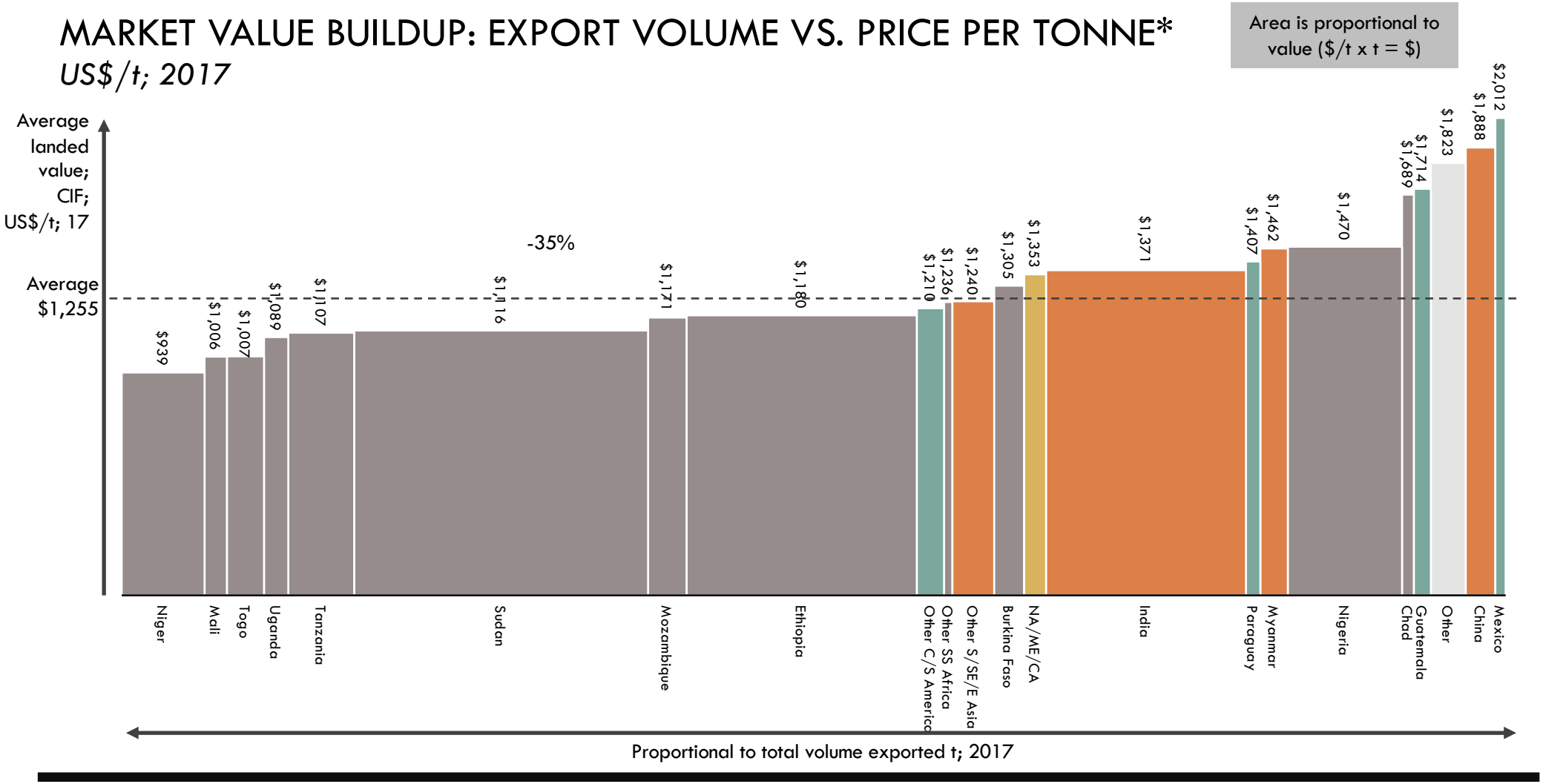


Source: UN Comtrade; Coriolis classifications and analysis

The average global landed price for sesame seeds was $1,255/t in 2017; the African countries generally have the lowest prices

MARKET VALUE BUILDUP: EXPORT VOLUME VS. PRICE PER TONNE*

US$/t; 2017

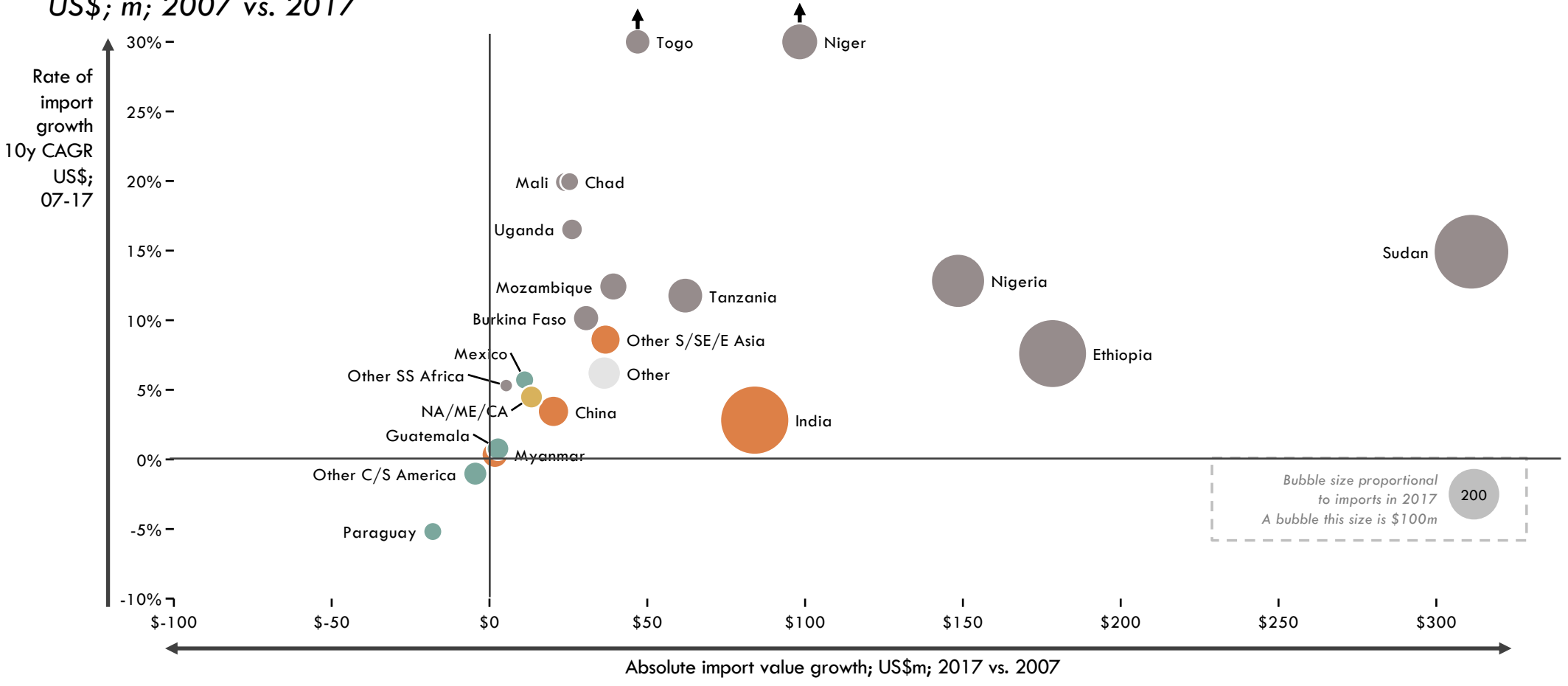


** landed price as reported receiver. Source: UN Comtrade; Coriolis classifications and analysis*

Sudan, Ethiopia, Nigeria, Niger, Tanzania and a range of other African countries are growing exports to meet global demand

GROWTH MATRIX: ABSOLUTE VALUE GROWTH VS. RATE OF GROWTH

US$; m; 2007 vs. 2017

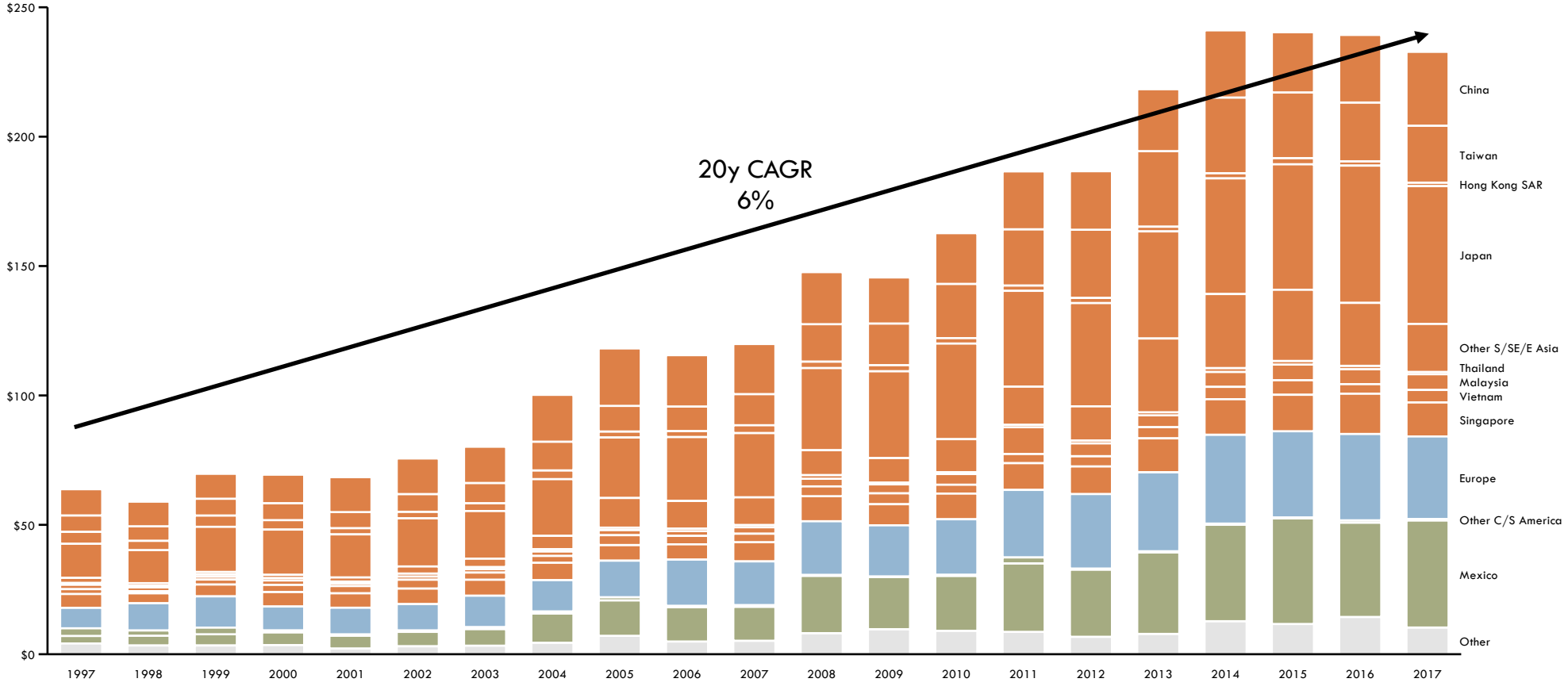


Source: UN Comtrade; Coriolis classifications and analysis

Growth in the global sesame seed oil trade has come from E/SE Asia and Mexico

TOTAL GLOBAL SESAME OIL EXPORT VALUE BY COUNTRY/REGION

US$; m; 1997-2017



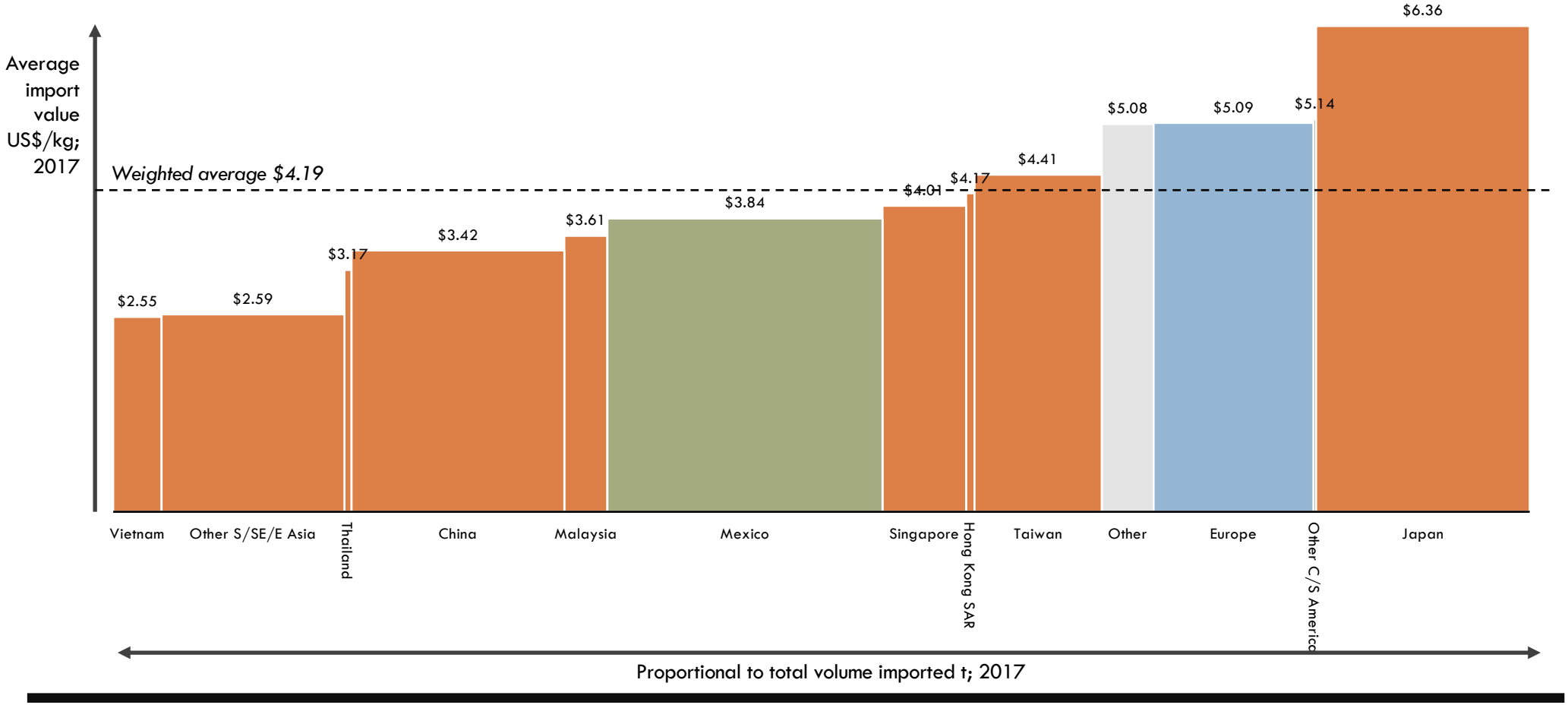
Source: UN Comtrade; Coriolis classifications and analysis

Average sesame oil prices vary across exporters, with Japan standing out as achieving higher prices than average

MARKET VALUE BUILDUP: EXPORT VOLUME VS. PRICE PER TONNE

US$/kg; 2017

Area is proportional to value ($/t x t = $)



Source: UN Comtrade; Coriolis classifications and analysis

THE $250M OPPORTUNITY

03

+ Domestic Australian market
+ Sesame seed exports
+ Sesame oil exports

Sesame has the potential to be a $250m industry for NW Queensland; exporting bulk sesame seeds is the main "prize"

POTENTIAL AUSTRALIAN SESAME EXPORT VOLUME BASED ON ACHIEVED SHARE

Model; volume; exported; uses 2017 global trade volume

	RANGE OF POTENTIAL OUTCOMES	***STAGE 1*** *DOMESTIC MARKET*	***STAGE 2*** *SESAME SEED EXPORTS*	***STAGE 3*** *SESAME OIL EXPORTS*	***TOTAL POTENTIAL VALUE***
Market value	Low	A$4m	A$14m	A$1	A$20m
	High	A$18m	A$225m	A$7m	A$250m
Tonnes	Low	1,400t	9,000t	100t	10,500t
	High	6,700t	122,000t	1,100t	130,000t
Area required	Low	1,330ha	9,000ha	100ha	10,000ha
	High	3,100ha	55,500ha	500ha	60,000ha

Note: Low uses yields of 1 t/ha, high uses yields of 2.2 t/ha used; global average yield of 0.6 t/ha in 2016; details provided elsewhere in the document; many numbers are rounded. Source: UN FAOSTAT; Coriolis analysis and estimates

STAGE 1: NW Queensland can produce 1,400-6,700t of sesame seeds, at a value of A$4 to 18m, for the local market

- The domestic Australian market for sesame (both seeds and oil) is attractive
  - Australians consume a wide range of products containing sesame
  - The average Australian consumes about half a kilogram of sesame per year, or A$1.17 per person at the border
  - While per capita consumption is flat overall, there is a clear long term shift to more consumption of sesame oil and less of seed; peers suggest Australia has some moderate consumption growth upside
  - Overall Australia is the 22nd largest import market globally for sesame (seeds and oil) and pays above average

- The Australian sesame market (oil & seed) is worth US$20m (A$28m), with seeds US$10m (A$14.2m) and oil US$10.3m (A$14.6m); the market is growing value long term (20y CAGR 4.5%)

- The estimated potential domestic sales of Australian produced sesame seeds and oils ranges from ~A$4m ($3m seeds + $1m oil) to A$18m ($11m seeds + $7m oils); supplying just the Australian domestic market could require 1,400-6,700t from 1,330-3,100ha of sesame

- Domestic production would need to price off world prices with a very limited "buy Australian" premium
  - Australia's sesame seed imports currently come primarily from India at an average landed price of A$2,260/t; average landed prices into Australia for sesame seeds are trending upward
  - Australia's sesame oil imports come primarily from E/SE Asia at an average landed price of A$7.77/kg; average landed prices into Australia for sesame oil is trending up

Australians consume a wide range of products containing sesame

EXAMPLE PRODUCTS CONTAINING SESAME IN AUSTRALIA

Selected; late 2018

Source: Woolworths; Coriolis analysis. Photo credit: fair use/fair dealing; low resolution; complete product/brand for illustrative purposes

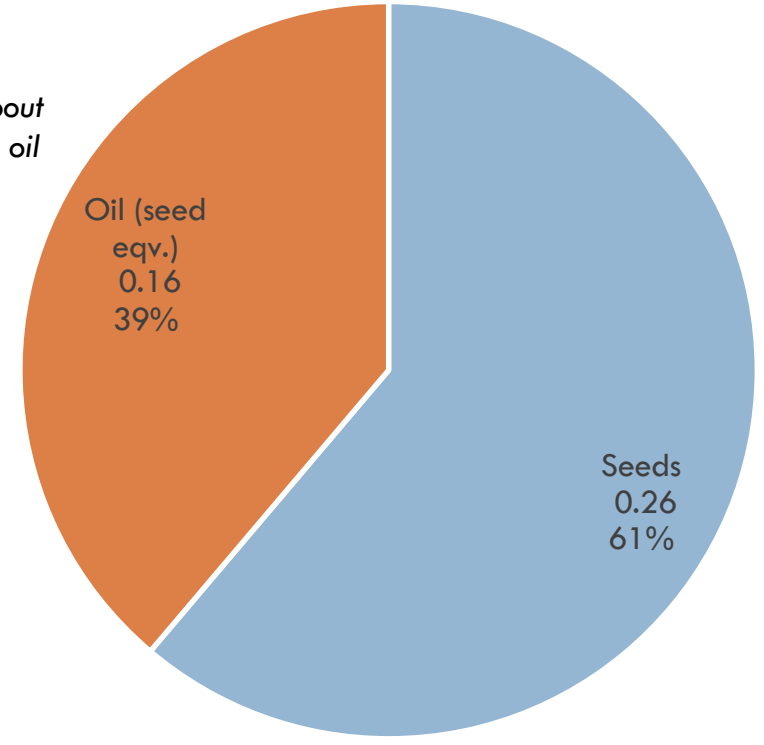
The average Australian consumes about half a kilogram of sesame per year, or US$0.83/person (A$1.17) at the border

SESAME IMPORTS AUSTRALIA PER CAPITA

Kilograms; seed equivalent; US$; actual; CIF; 2017

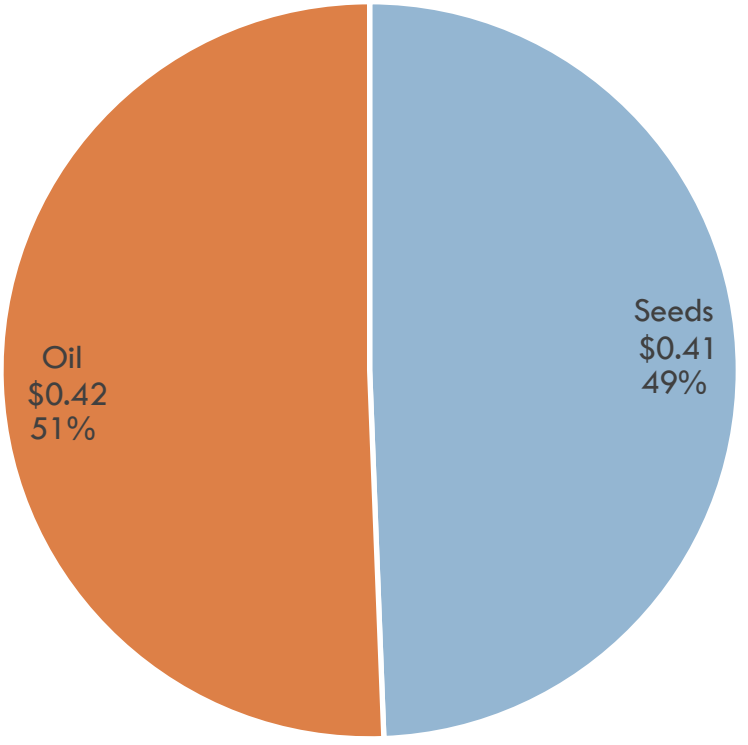
KILOGRAMS

… or about 80ml of oil



Total = 0.42kg/person

IMPORT VALUE AT BORDER



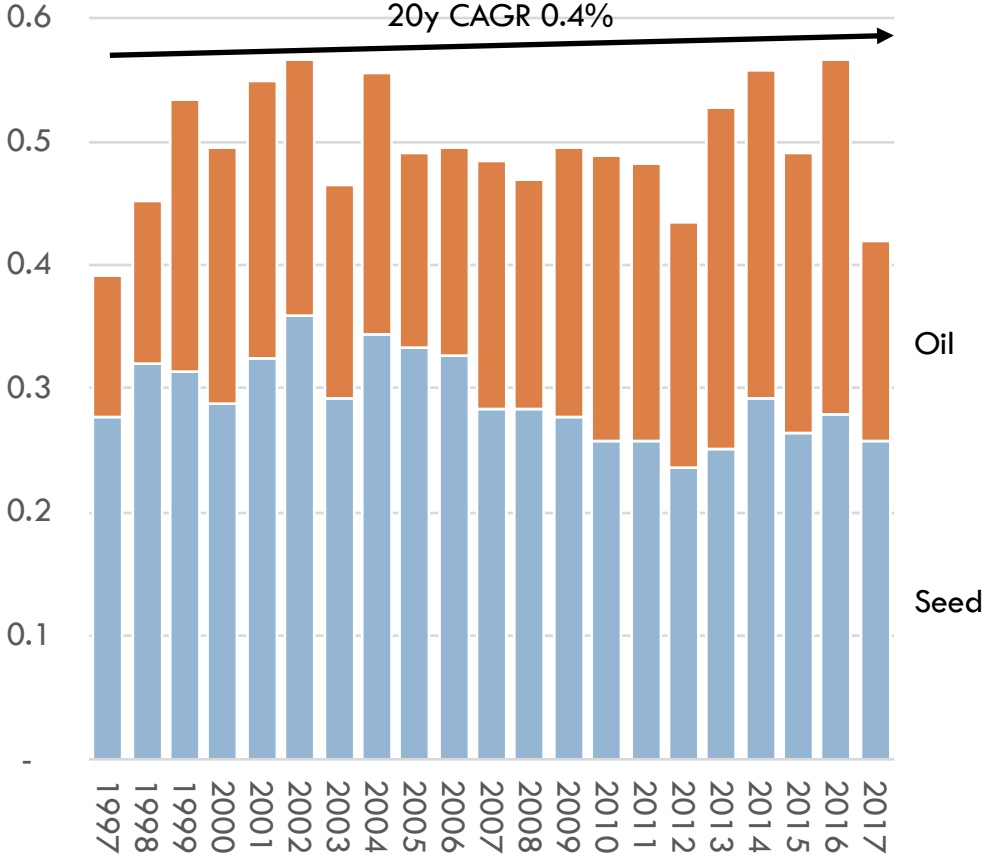
Total = US$0.83/person

* *At Oct 2018 exchange rates. Source: UN Comtrade; Coriolis classification and analysis*

While per capita consumption is flat overall, there is a clear long term shift to more consumption of sesame oil and less of seed

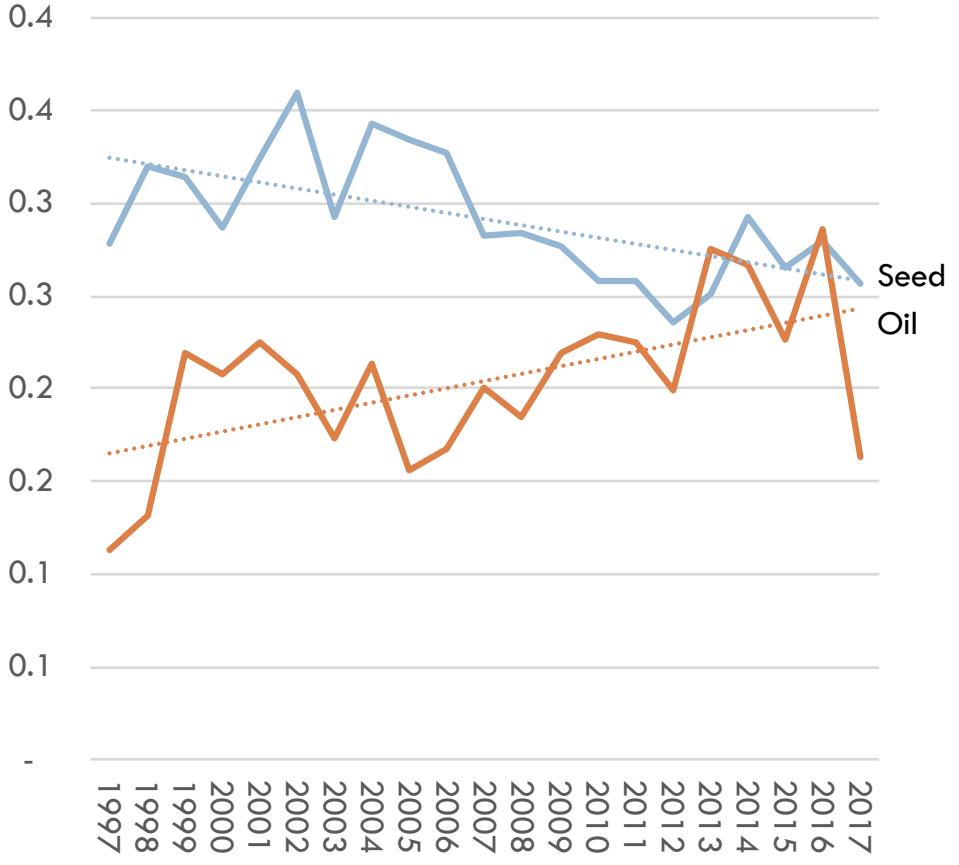
SESAME IMPORTS AUSTRALIA PER CAPITA

Kilograms; seed equivalent; 1997-2017



SESAME IMPORTS AUSTRALIA PER CAPITA

Kilograms; seed equivalent; 1997-2017

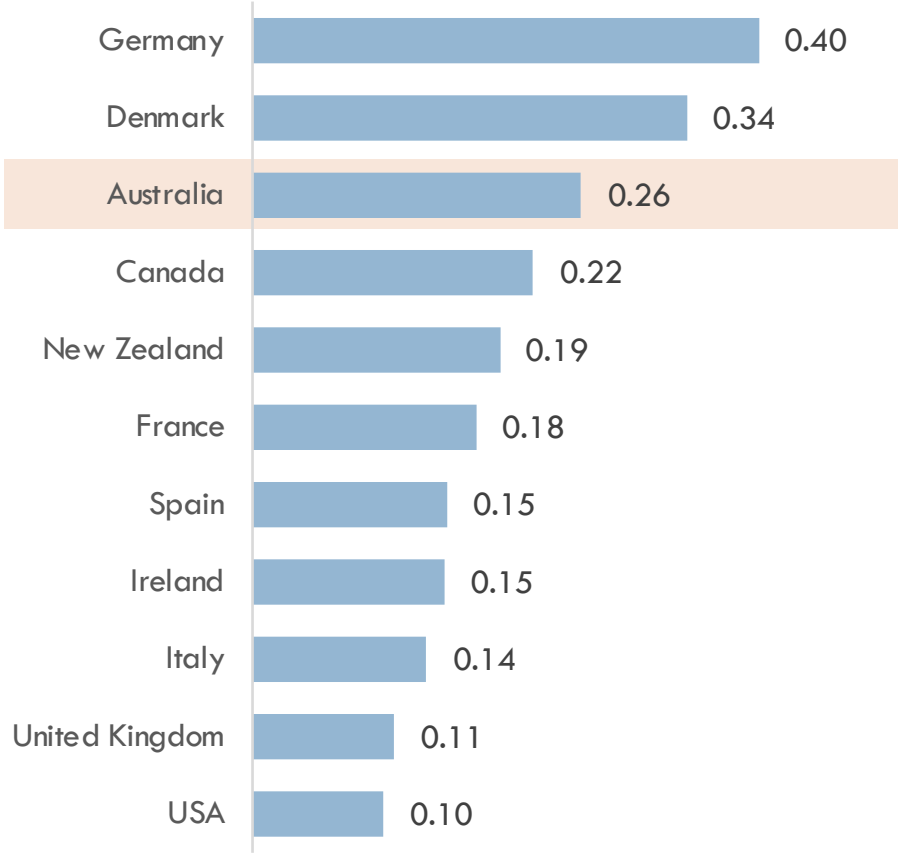


Source: UN Comtrade; Coriolis classification and analysis

Peers suggest Australia has moderate consumption growth upside

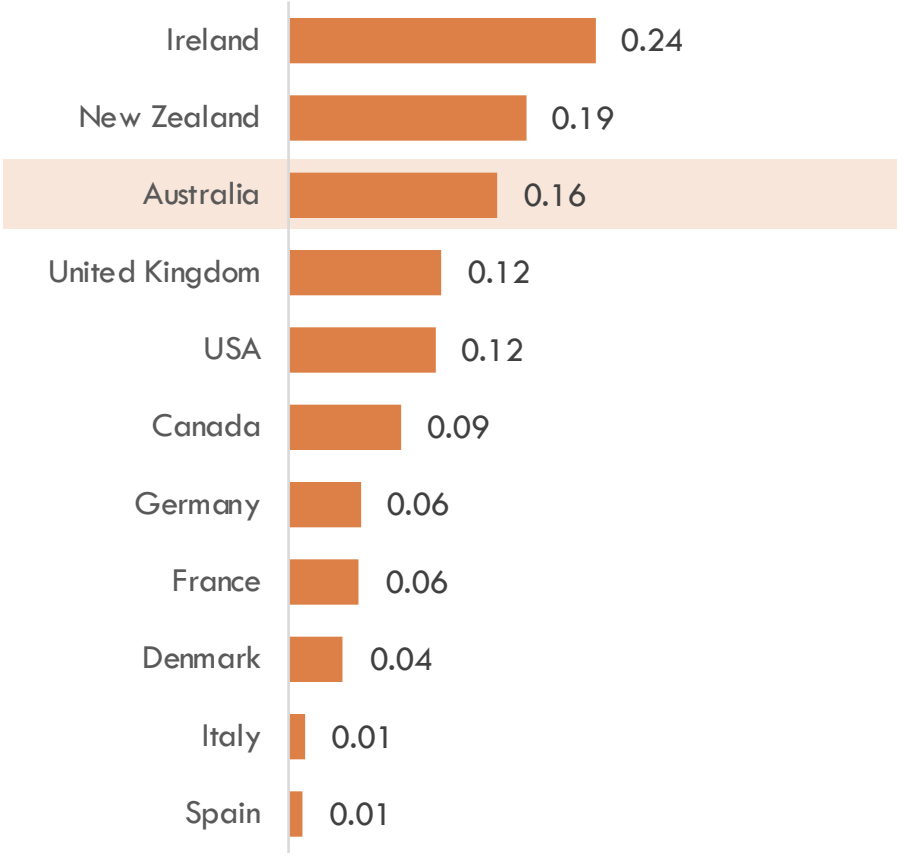
CONSUMPTION/CAPITA: SESAME SEEDS

Kg/capita; 2017



CONSUMPTION/CAPITA: SESAME OIL

Kg/capita; 2017

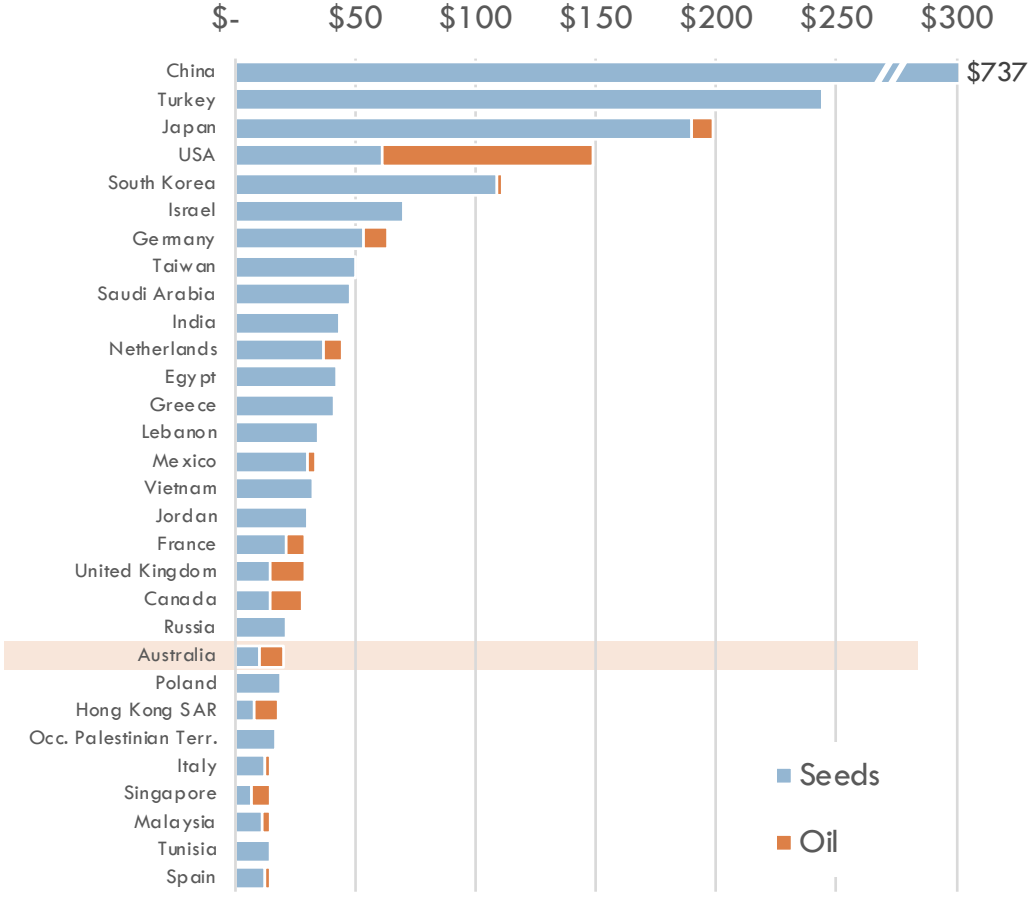


Source: UN Comtrade; UN PopStat; Coriolis classification and analysis

Australia is the 22nd largest import market globally for sesame (seeds and oil) and pays above average prices

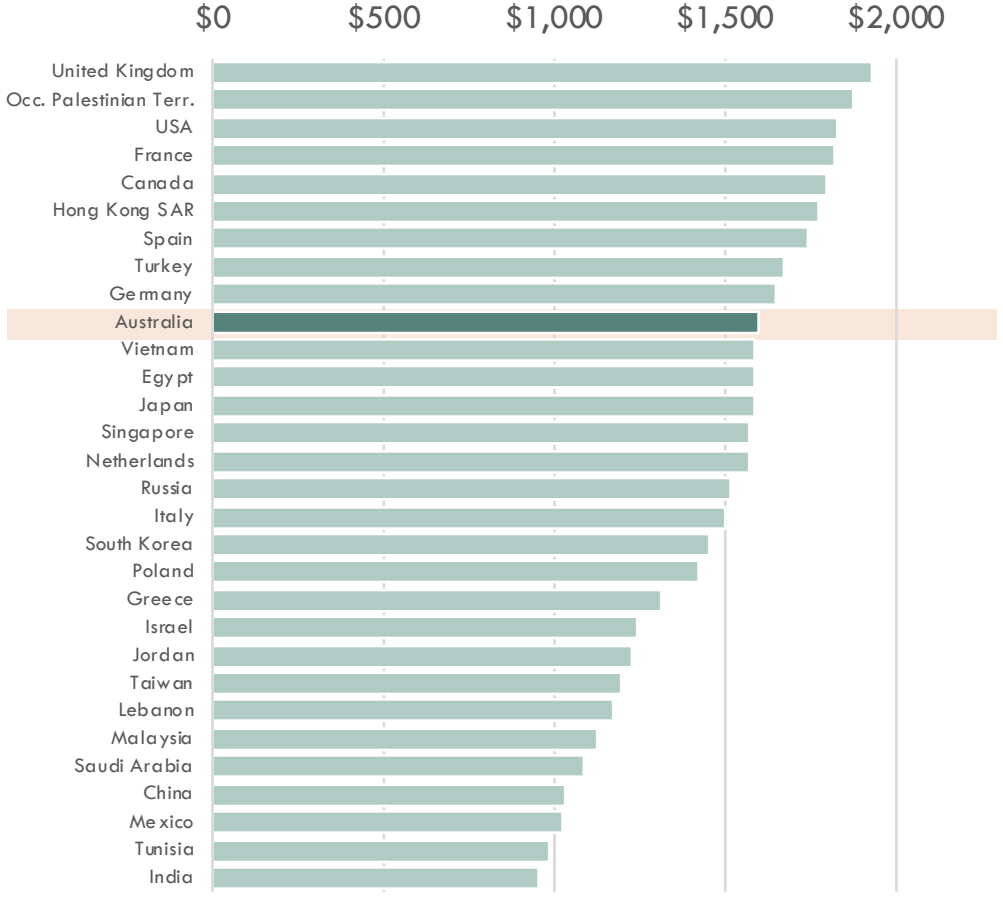
TOAL SESAME IMPORT VALUE

US$; m; CIF; top 30 markets by value; 2017



AVERAGE LANDED SESAME SEED $/T

US$/t; CIF actual; top 30 markets; 2017

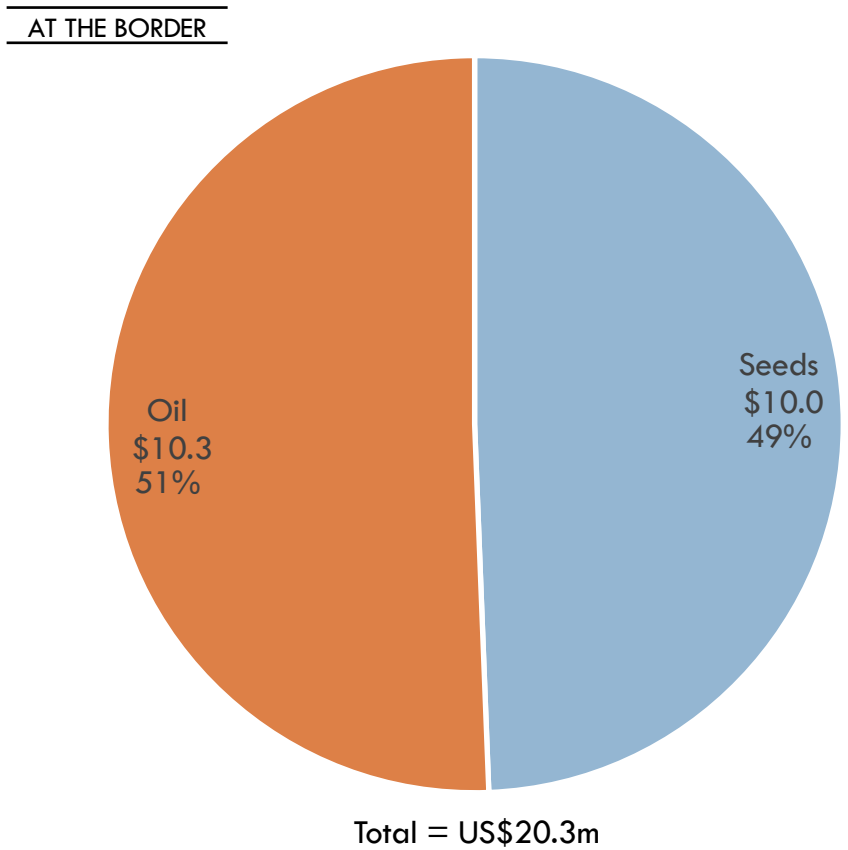


* *At Oct 2018 exchange rates. Source: UN Comtrade; Coriolis classification and analysis*

The Australian sesame market (oil & seed) is worth US$20m (A$28m); the market is growing value long term *(20y CAGR 4.5%)*

TOTAL AUSTRALIA SESAME IMPORT VALUE

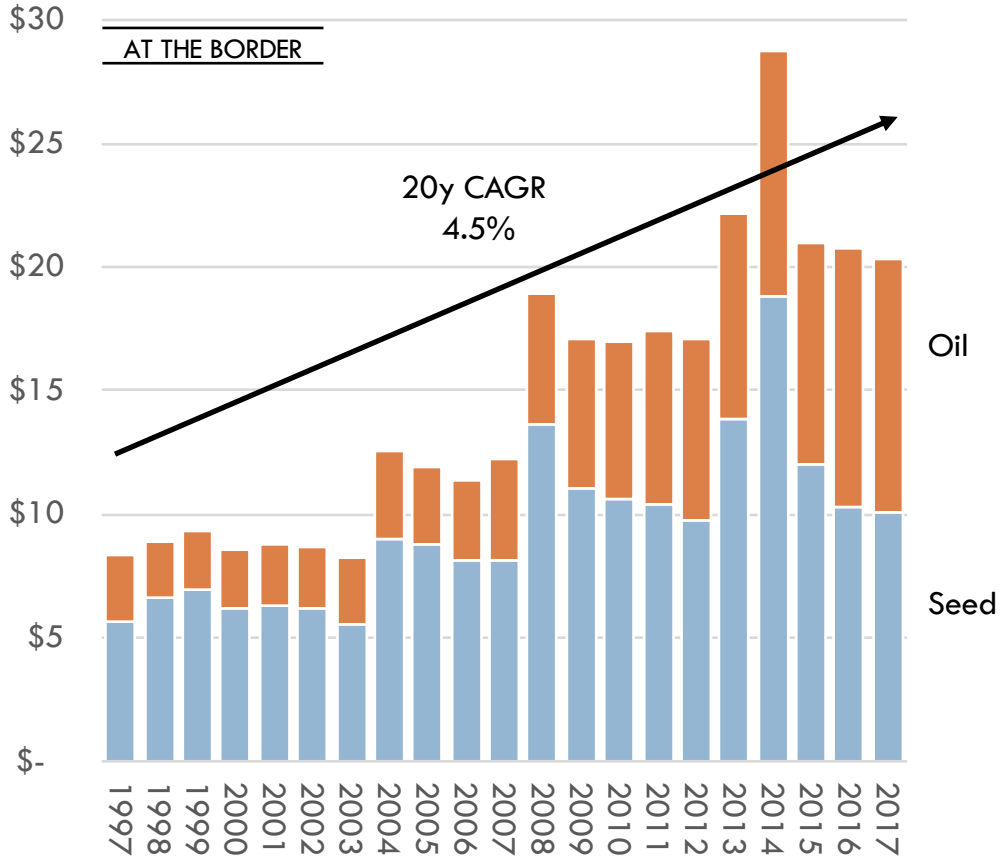
US$; m; CIF; 2017



Total = US$20.3m

TOTAL AUSTRALIA SESAME IMPORT VALUE

US$/kg; m; CIF; 1997-2017



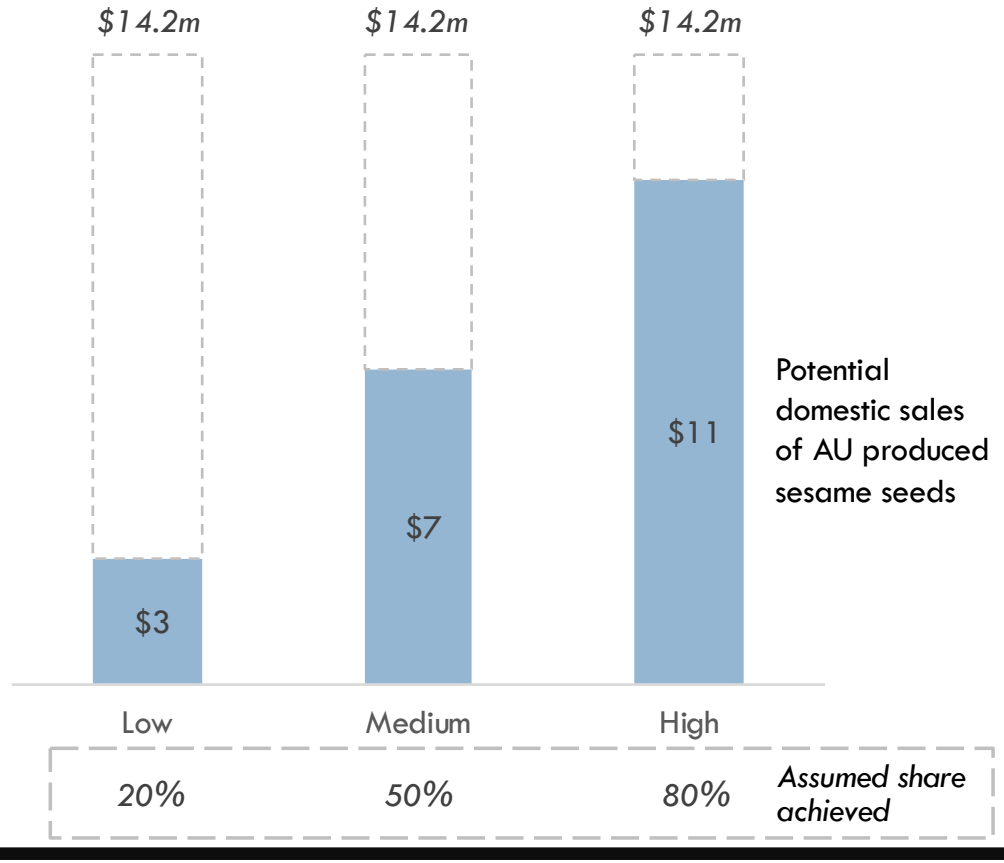
* *At Oct 2018 exchange rates. Source: UN Comtrade; Coriolis classification and analysis*

The estimated potential domestic sales of AU produced sesame seeds and oils ranges from A$4m ($3m+$1m) to A$18m ($11m+$7m)

MODEL: POTENTIAL LOCAL SEED SALES

A$; m; current market value

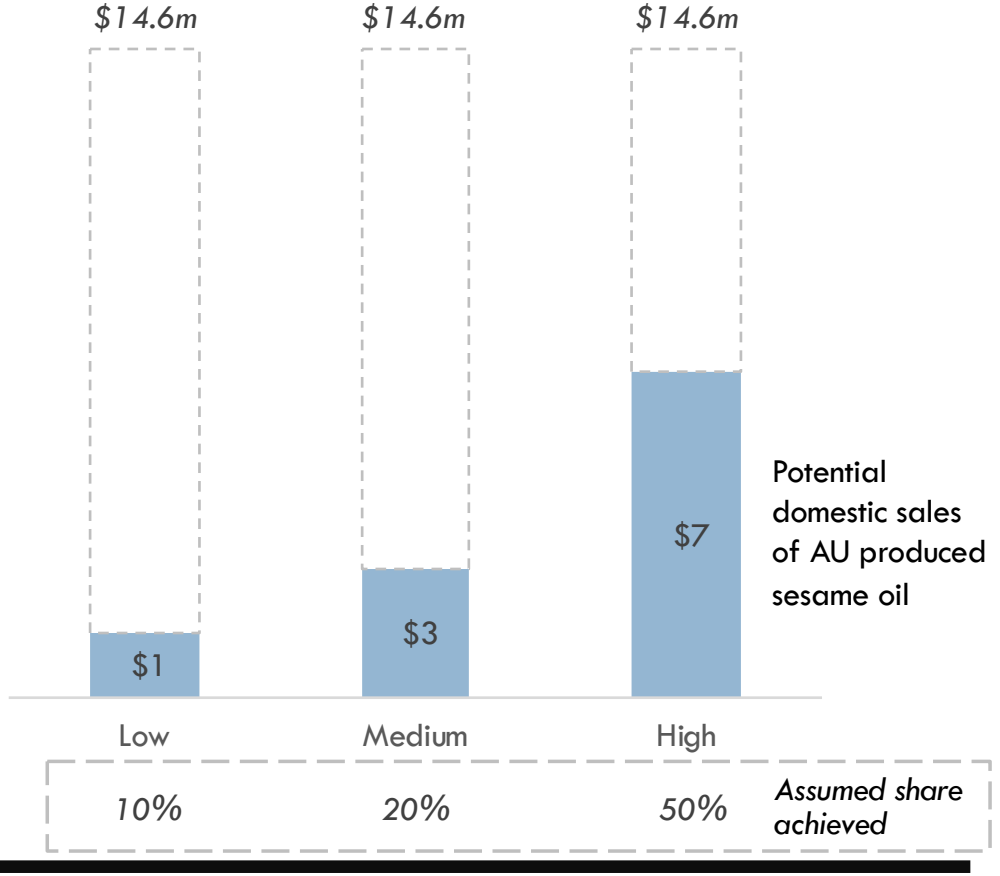
INDICATIVE/DIRECTIONAL



MODEL: POTENTIAL LOCAL OIL SALES

A$; m; current market value

INDICATIVE/DIRECTIONAL



Source: Coriolis modeling, estimates and analysis

Supplying just the Australian domestic market could require ~1,400t to ~6,700t from ~1,330ha to ~3,100ha of sesame

"TOY MODEL" OF AREA & VOLUME OF SESAME REQUIRED TO SUPPLY LOCAL MARKET

Variables as given; undefined future date using current market size

INDICATIVE/DIRECTIONAL

	SESAME SEEDS Area ha	Assumed Yield	Tonnes	Assumed Seed Price A$	Assumed Buy AU premium	Modelled Farmgate Value
Low	1,000	1.0	1,000	$ 2,710	20%	$3m
Medium	1,900	1.5	2,800	$ 2,490	10%	$7m
High	2,200	2.2	4,800	$ 2,370	5%	$11m

	SESAME OIL Area ha	Assumed Yield	Tonnes	Assumed Seed Price A$	Assumed Buy AU premium	Modelled Farmgate Value
Low	330	1.0	330	$ 2,710	20%	$1m
Medium	500	1.5	730	$ 2,490	10%	$2m
High	900	2.2	1,900	$ 2,370	5%	$5m

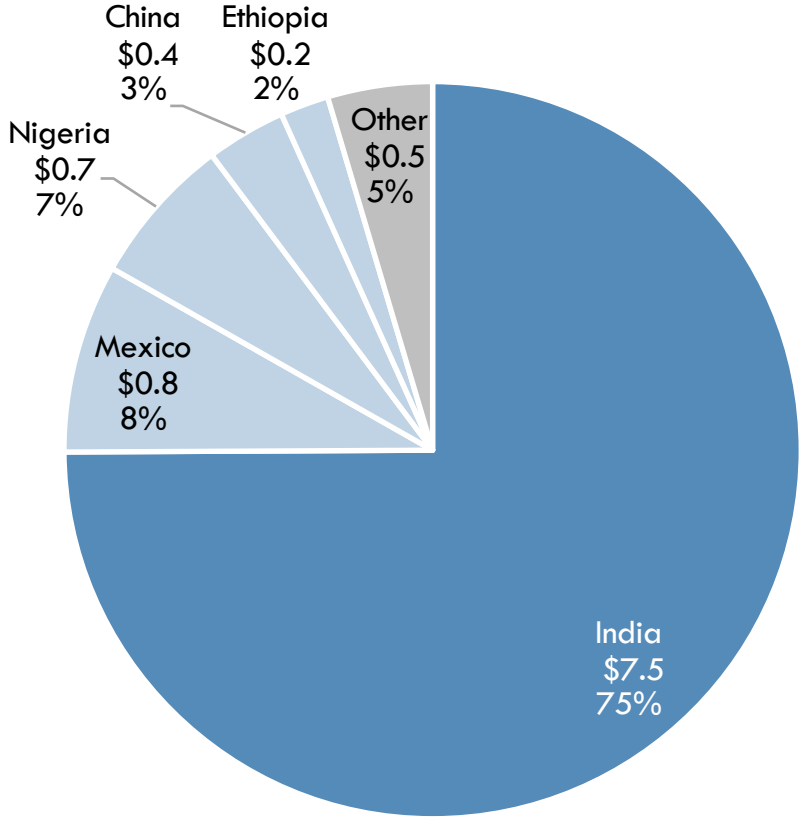
	TOTAL SESAME Area ha	Assumed Yield	Tonnes	Assumed Seed Price A$	Assumed Buy AU premium	Modelled Farmgate Value
Low	1,330	1.0	1,400	$ 2,710	20%	$4m
Medium	2,400	1.5	3,530	$ 2,490	10%	$9m
High	3,100	2.2	6,700	$ 2,370	5%	$16m

Note: global average yield of 0.6 t/ha in 2016. Source: UN FAOSTAT; Coriolis modelling, analysis and estimates

Australia's sesame seed imports currently come primarily from India at an average landed price of US$1,597/t (A$2,260/t)

SESAME SEED IMPORTS AUSTRALIA

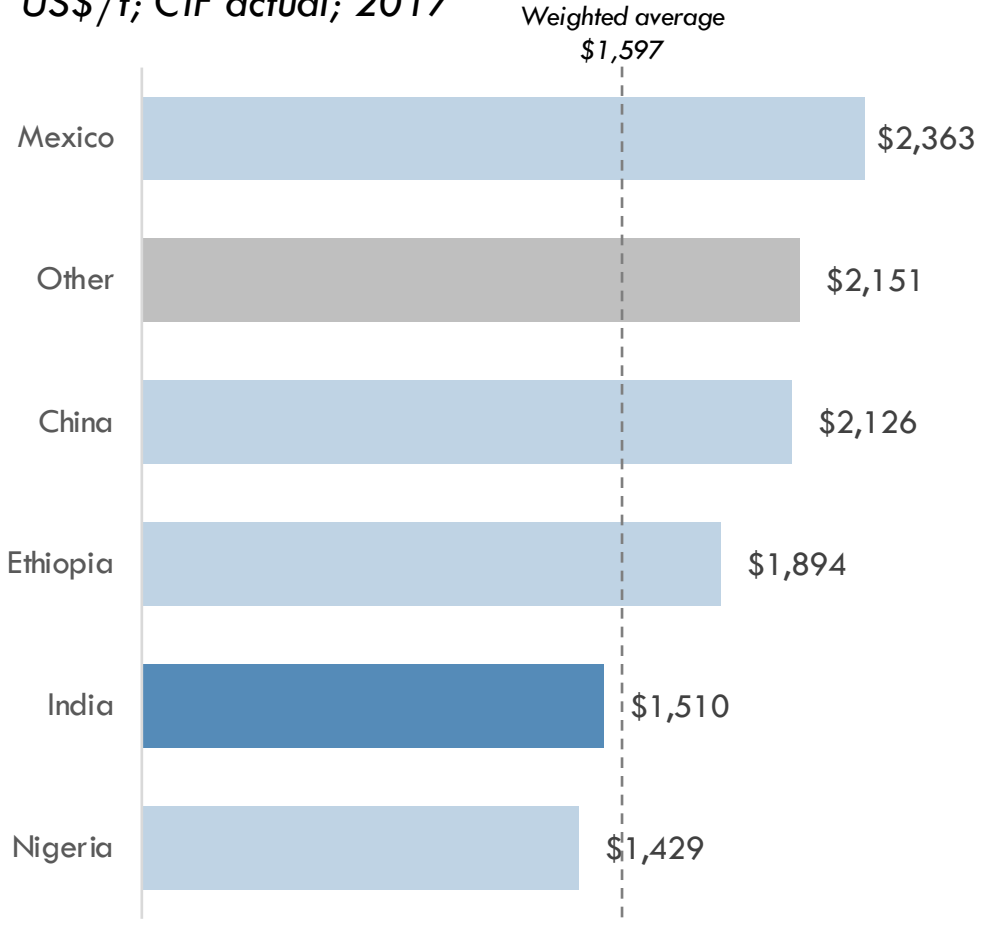
US$; CIF; m; 2017



Total = US$10.0m

SESAME SEED $/T AUSTRALIA

US$/t; CIF actual; 2017

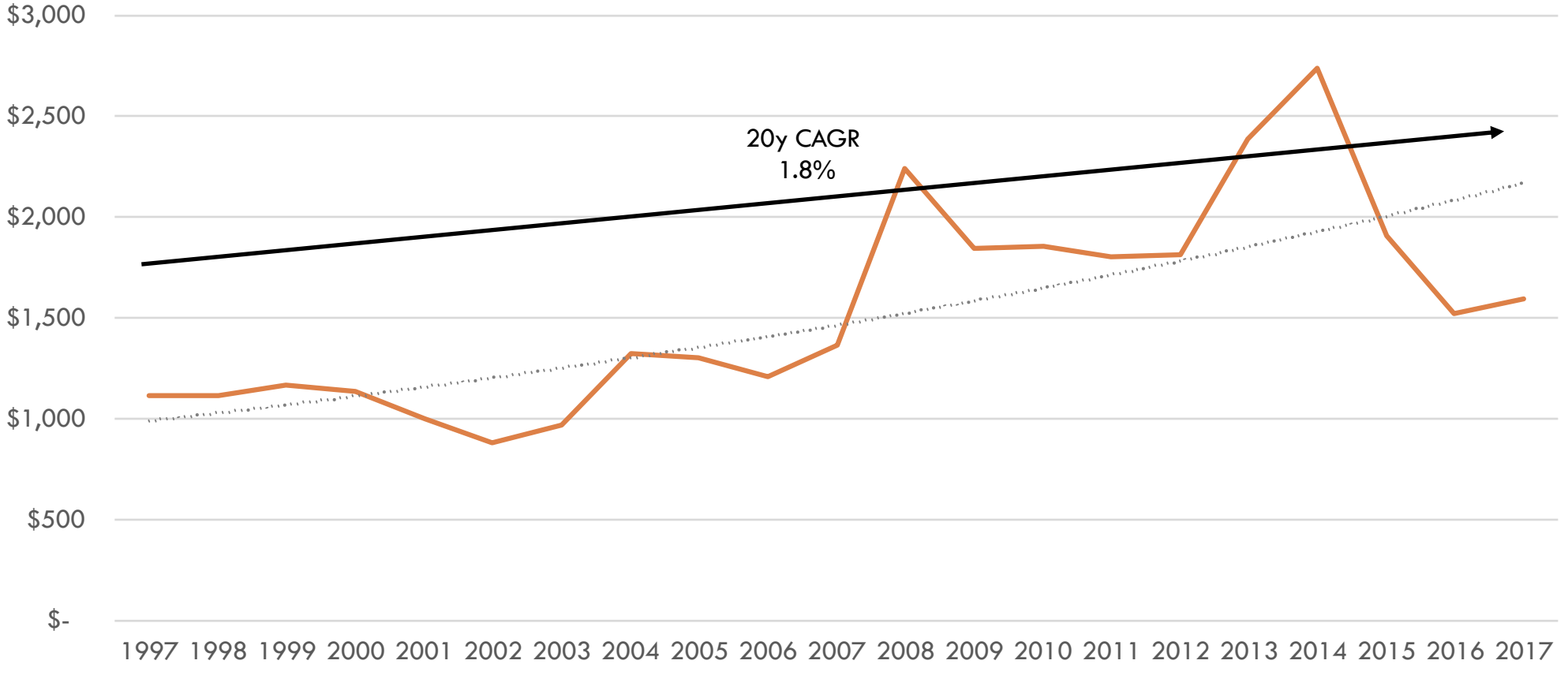


* *At Oct 2018 exchange rates. Source: UN Comtrade; Coriolis classification and analysis*

Average landed prices into Australia for sesame seeds are trending upward (20y CAGR 1.8%)

AVERAGE LANDED PRICE PAID PER TONNE FOR SESAME SEEDS INTO AUSTRALIA

US$/t; CIF actual; 1997-2017

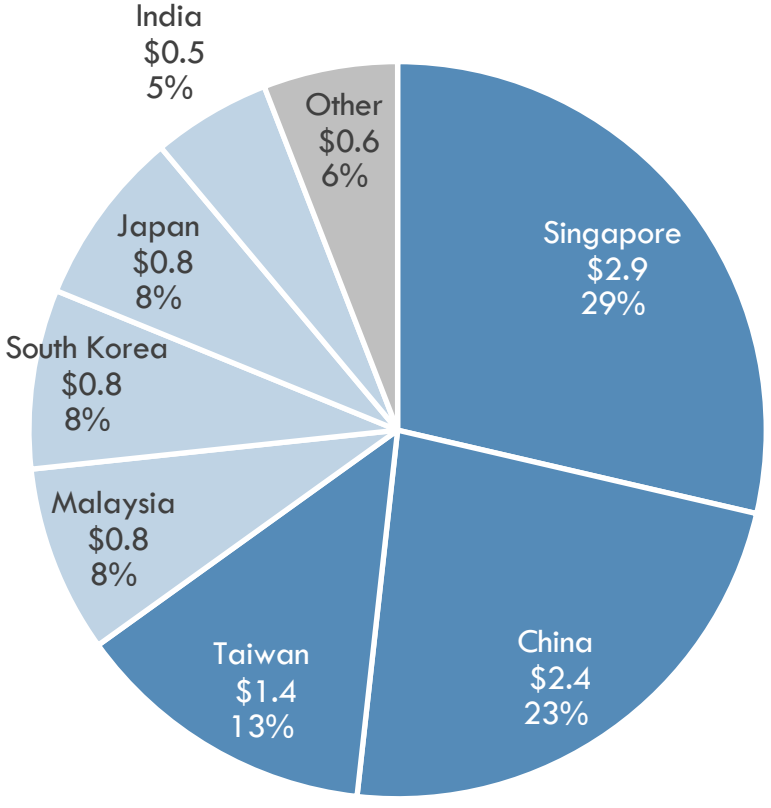


Source: UN Comtrade; Coriolis classification and analysis

Australia's sesame oil imports come primarily from E/SE Asia at an average landed price of US$5.49/kg (A$7.77/kg)

SESAME OIL IMPORTS AUSTRALIA

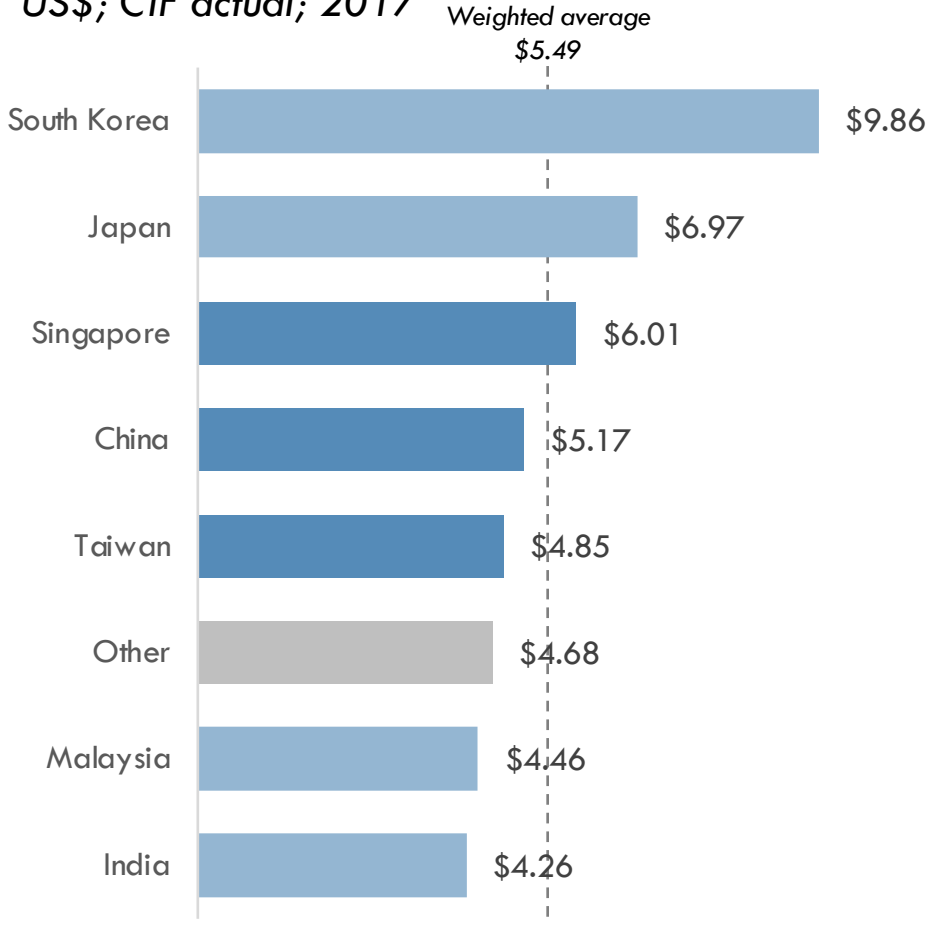
US$; CIF; m; 2017



Total = US$10.3m

SESAME OIL $/KG AUSTRALIA

US$; CIF actual; 2017

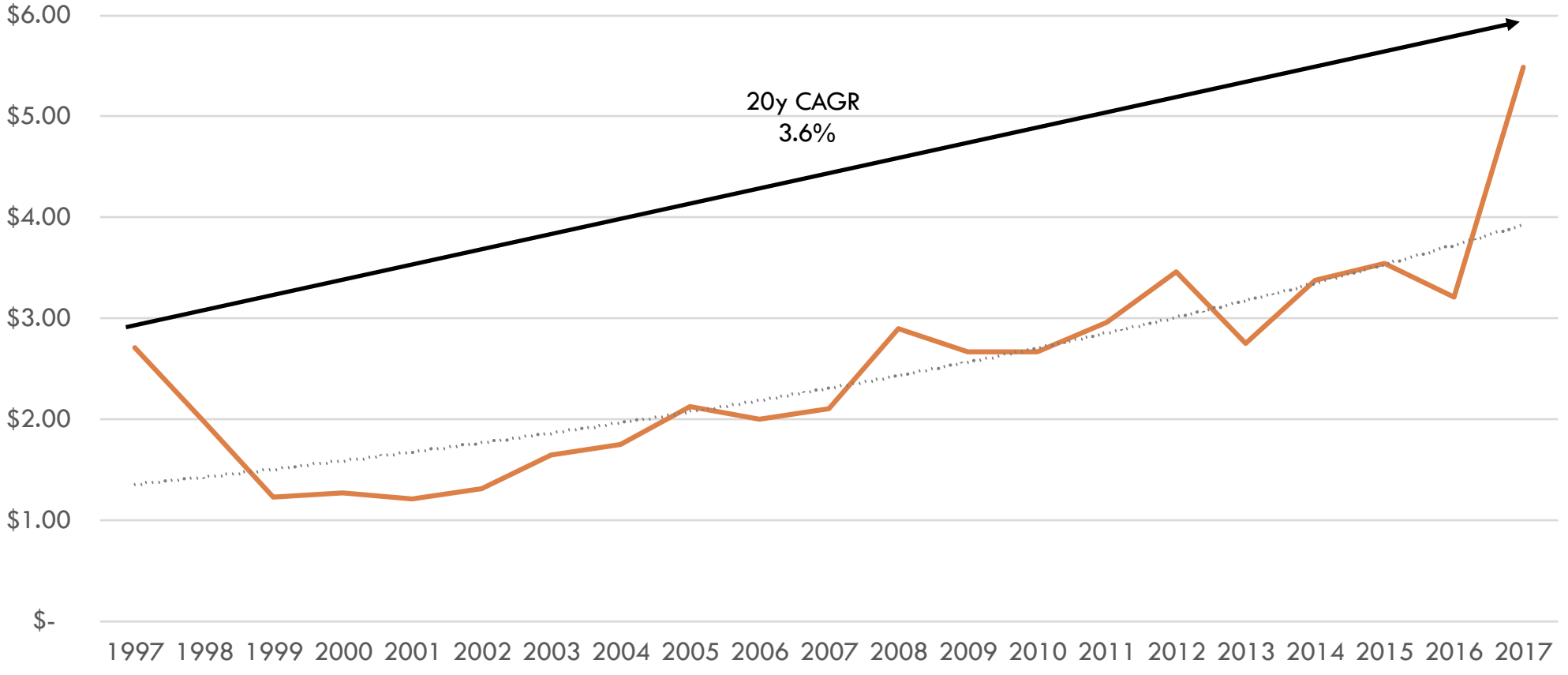


* *At Oct 2018 exchange rates. Source: UN Comtrade; Coriolis classification and analysis*

Average landed prices into Australia for sesame oil is trending upward (20y CAGR 3.6%)

AVERAGE LANDED PRICE PAID PER KG FOR SESAME OIL INTO AUSTRALIA

US$/kg; CIF actual; 1997-2017



Source: UN Comtrade; Coriolis classification and analysis

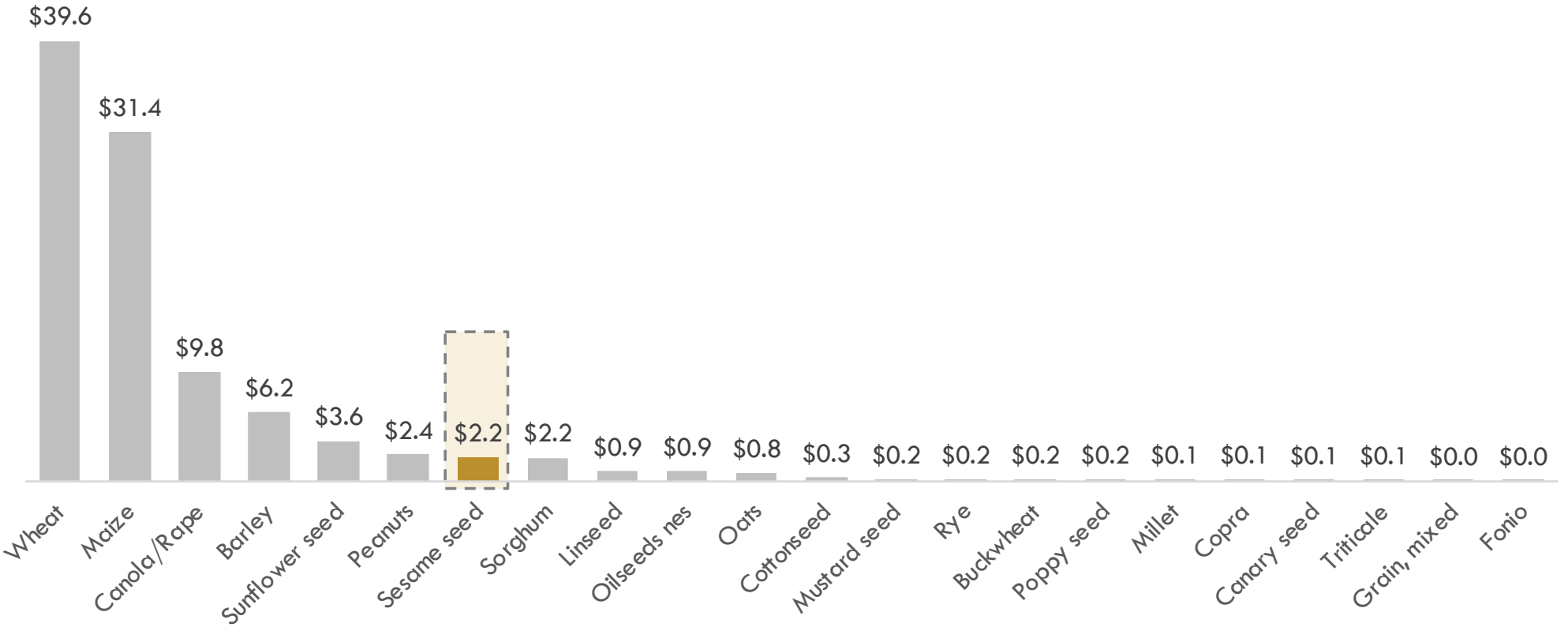
STAGE 2: NW Queensland can produce 9,000t to 122,000t of sesame seeds, worth A$14 to 225m, for export markets

- Sesame seeds are the seventh largest globally traded cereal crop by value, accounting for US$2.2b in cross-border trade in 2017
- Australia is a major arable crop exporter and typically achieves a share of 5-25% where and when it achieves success
- Estimated potential export volumes for Australian sesame seeds range from 9,000t to 122,000t depending on share achieved
  - Supplying these volumes would require ~9,000ha to 55,500ha in Queensland depending on yields at scale
- Australian arable crop exports typically trade within a narrow band to world prices with a limited "Australian" premium
- Assuming a limited Australian premium, these volumes would create an opportunity worth A$14m to A$225m

Sesame seeds are the seventh largest globally traded cereal crop by value, accounting for US$2.2b in cross-border trade in 2017

TOTAL GLOBAL CROSS BORDER TRADE VALUE OF MAJOR CEREAL CROPS

US$; b; 2016 or 2017

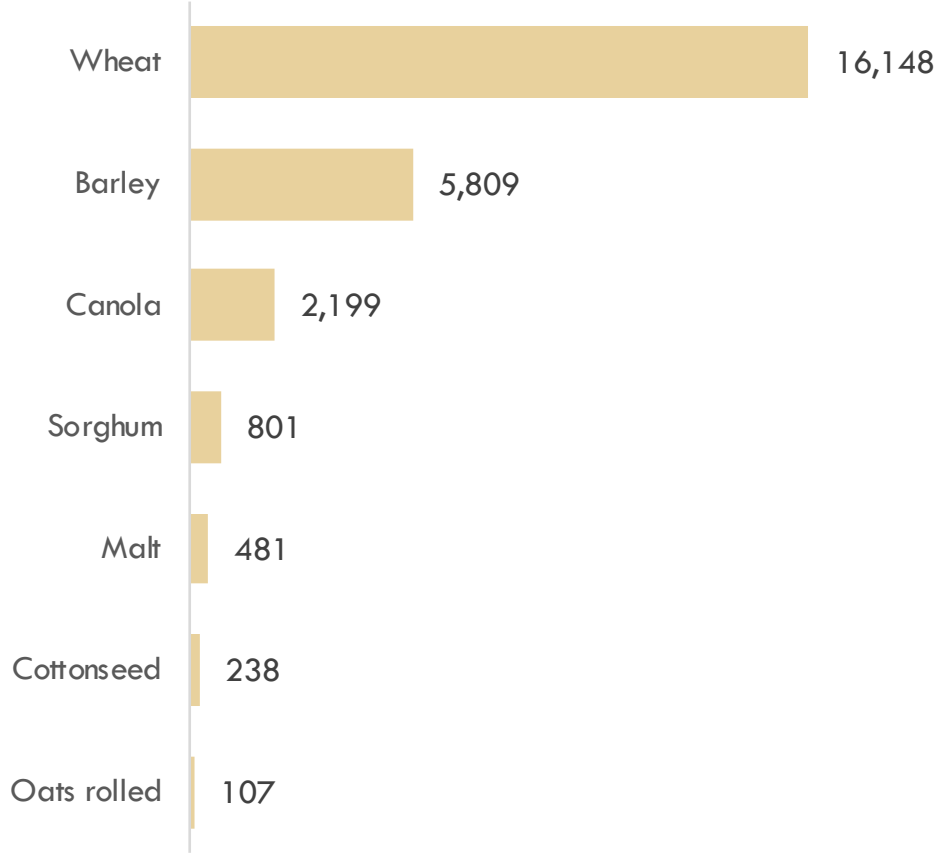


"nes" = not elsewhere specified. Source: UN FAOSTAT; UN Comtrade; Coriolis analysis

Australia is a major arable crop exporter and typically achieves a share of 5-25% where and when it achieves success

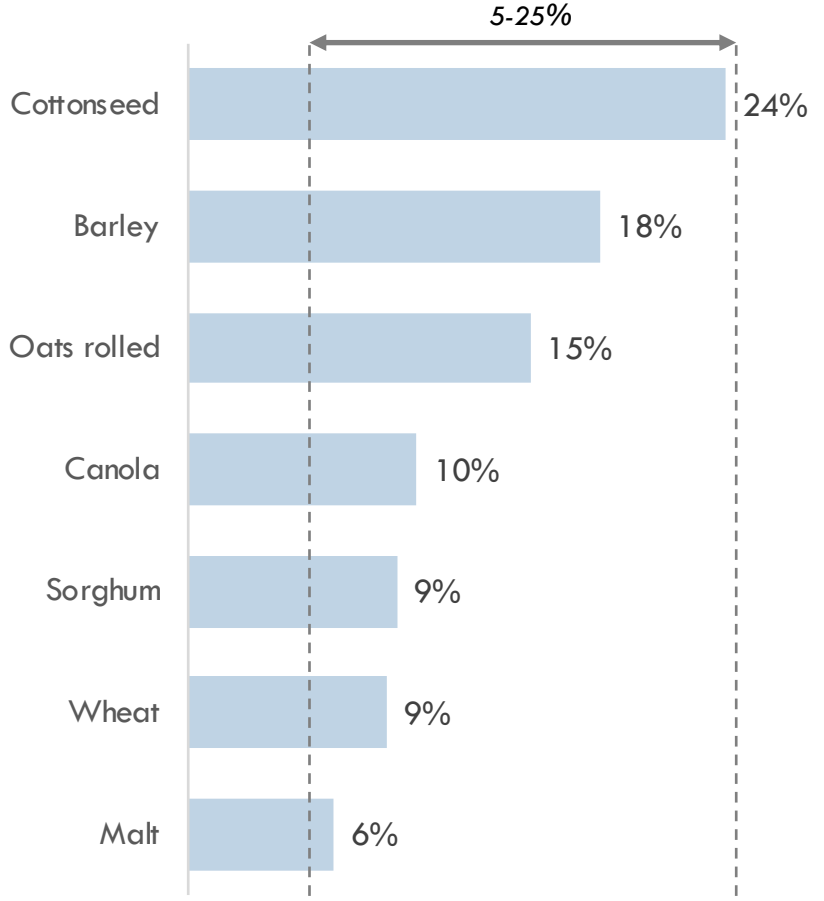
AU EXPORT VOLUME

Tonnes; 000; 2016



AU SHARE OF WORLD TRADE

% of tonnes; 2016

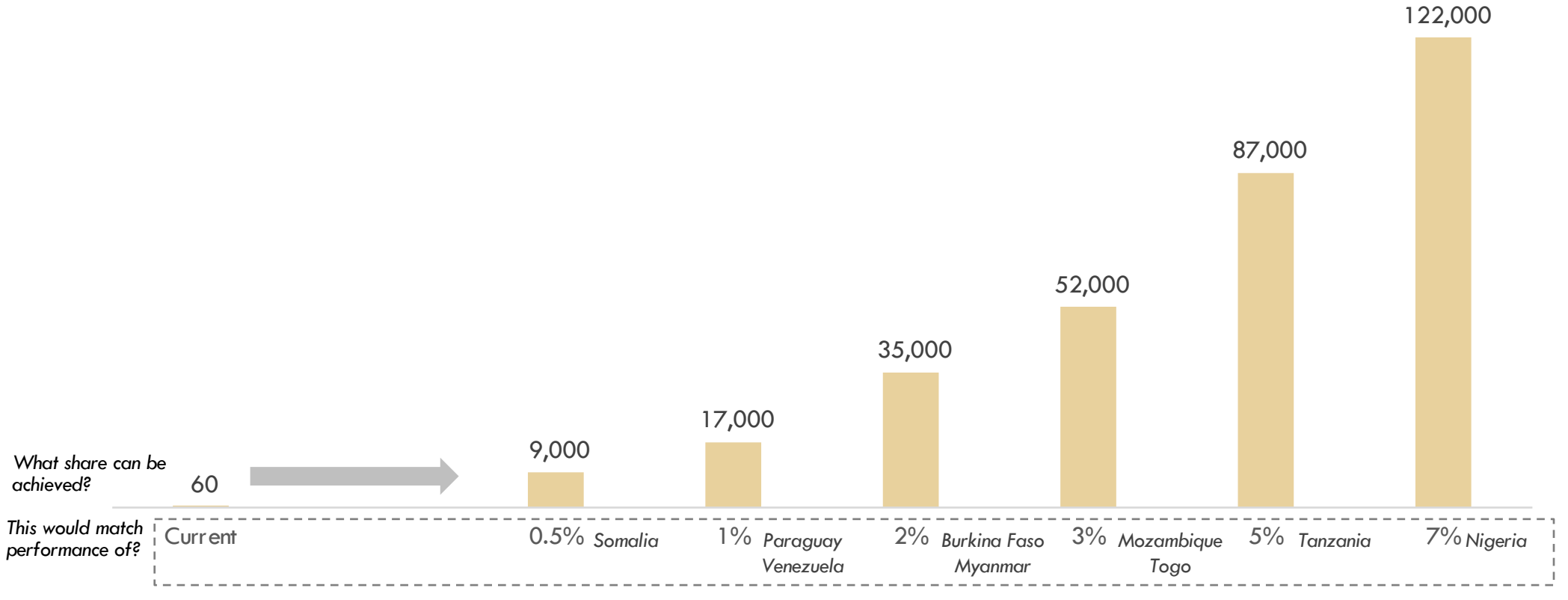


Source: UN FAOSTAT; Coriolis analysis

Estimated potential export volumes for Australian sesame seeds range from 9,000t to 122,000t depending on share achieved

POTENTIAL AUSTRALIAN SESAME SEED EXPORT VOLUME BASED ON ACHIEVED SHARE

Toy model; tonnes exported; uses 2017 global trade volume



Source: UN FAOSTAT; Coriolis modelling, estimates and analysis

Supplying these volumes would require ~9,000ha to 55,500ha in Queensland depending on yields at scale

POTENTIAL AREA REQUIRED TO SUPPLY EXPORT VOLUME BASED ON ACHIEVED SHARE

Toy model; tonnes exported; hectares; uses 2017 global trade volume

		WHAT GLOBAL SESAME TRADE SHARE IS ACHIEVED?					
	TRADE SHARE	0.5%	1.0%	2.0%	3.0%	5.0%	7.0%
	TONNES SUPPLIED	9,000	17,000	35,000	52,000	87,000	122,000
WHAT YIELD IS ACHIEVED? t/ha	1t/ha	9,000	17,000	35,000	52,000	87,000	122,000
	1.5t/ha	6,000	11,300	23,300	34,700	58,000	81,300
	2.2t/ha	4,100	7,700	15,900	23,600	39,500	55,500

AREA REQUIRED

"So far we are very pleased, the crops are particularly drought tolerant and look to have produced a crop even though there has only been 120mm of growing season rainfall…
Previous small scale trials had seen yields vary anywhere from 0.5 to 4.5 tonnes a hectare… We'd be particularly happy if the commercial trial went 2t/ha."

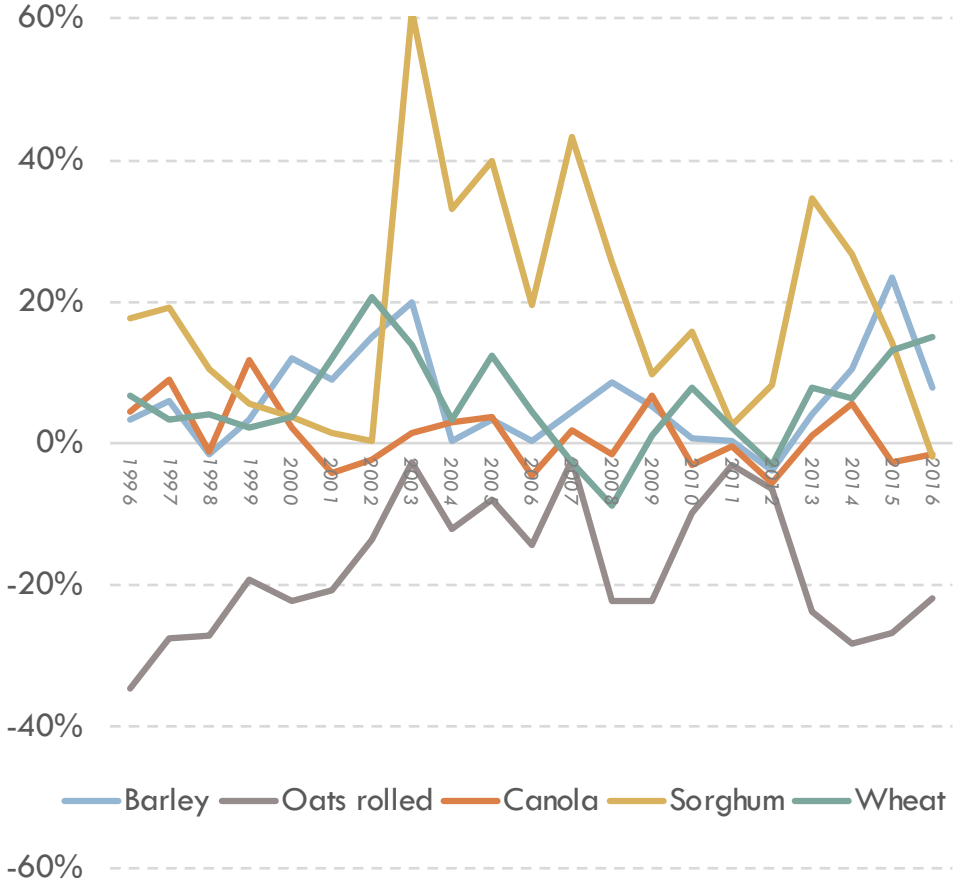
Surya Bhattarai, Research fellow, Institute of Future Farming, CQUniversity, 25 May 2018; speaking about black sesame trial (12 varieties) with AgriVentis Technologies

Source: UN FAOSTAT; Farmonline National article; Coriolis modelling, estimates and analysis

Australian arable crop exports typically trade within a narrow band to world prices with a limited "Australian" premium

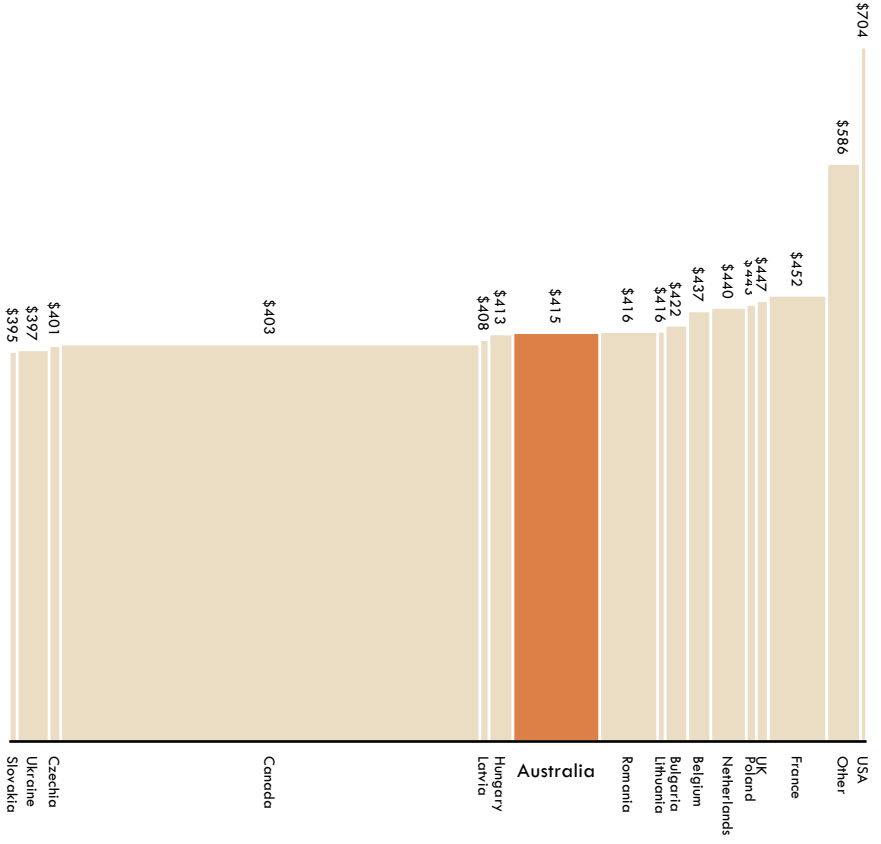
AVERAGE AU EXPORT PRICE VS. WORLD

% of US$/kg; 1996-2016



EXAMPLE: CANOLA EXPORT COST CURVE

Tonnes vs. US$/t; 2016



Source: UN FAOSTAT; Coriolis analysis

Assuming a limited Australian premium, these volumes would create an opportunity worth A$14m to A$225m

POTENTIAL EXPORT VALUE BASED ON ACHIEVED SHARE & EXPORT PRICES

Toy model; tonnes exported; $/ha; $m; uses 2017 global trade volume and average $/t

WHAT GLOBAL SESAME TRADE SHARE IS ACHIEVED?							
TRADE SHARE	0.5%	1.0%	2.0%	3.0%	5.0%	7.0%	
TONNES	9,000	17,000	35,000	52,000	87,000	122,000	
AU PREMIUM	+10%	+9%	+8%	+7%	+6%	+5%	Assumes AU premium falls with time with growing volume
ASSUMED EXPORT PRICE	$1,381	$1,368	$1,356	$1,343	$1,331	$1,318	Assumes current landed world price of $1,255/t
TOTAL CROP VALUE AT EXPORT	US$10m A$14m	US$20m A$28m	US$50m A$70m	US$70m A$100m	US$120m A$170m	US$160m A$225m	Farmgate value would be lower (less supply chain costs)

Source: UN FAOSTAT; Coriolis modelling, estimates and analysis

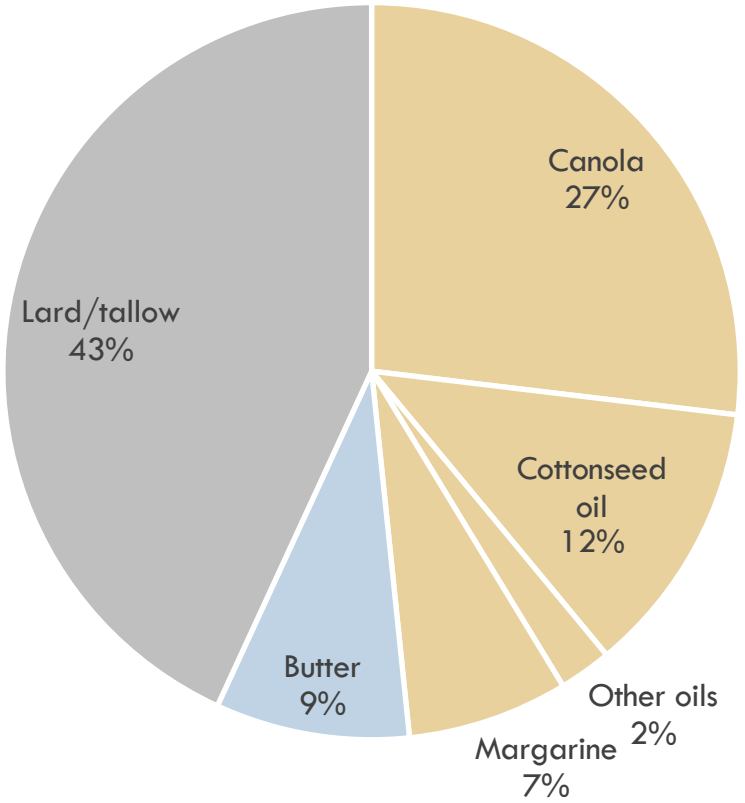
STAGE 3: NW Queensland could in the future develop local sesame oil production, though the market is not relatively large

- Australia is a major producer and exporter of oils and fats; global export share varies by products
- Australia has succeeded in transforming growing canola production into growing canola oil exports
- Potential export volumes for Australian sesame oil range from 100t to 1,100t valued at A$0.6 to A$7m depending on share

Australia is a major producer and exporter of oils and fats; global export share varies by products

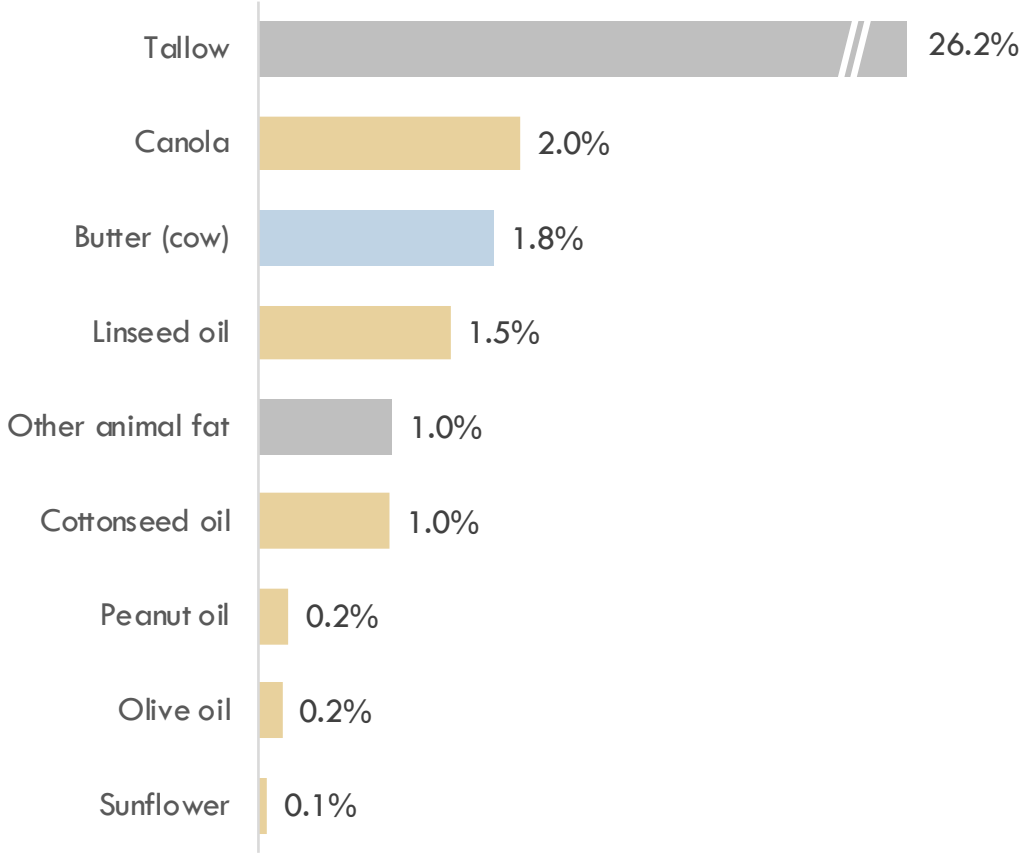
AU OIL & FAT PRODUCTION

Tonnes; 000; 2014



AU SHARE OF GLOBAL TRADE

% of cross-border export volume; 2016

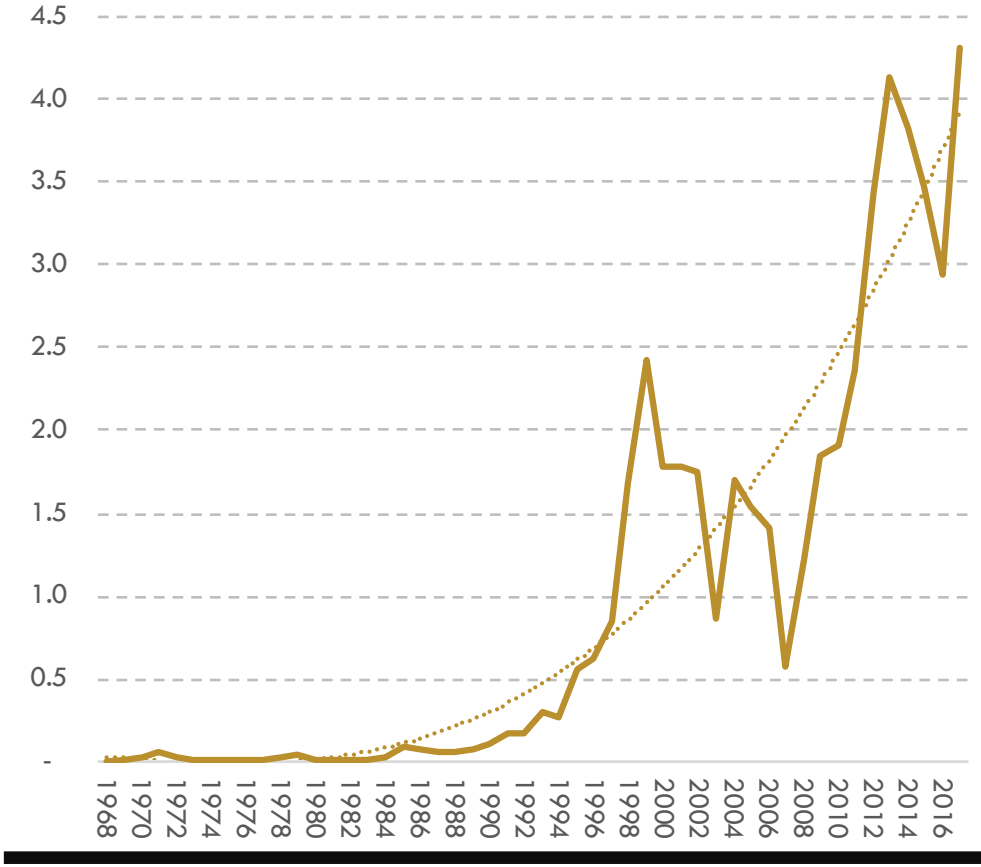


Source: UN Comtrade; UN FAOSTAT; Coriolis analysis

Australia has succeeded in transforming growing canola production into growing canola oil exports

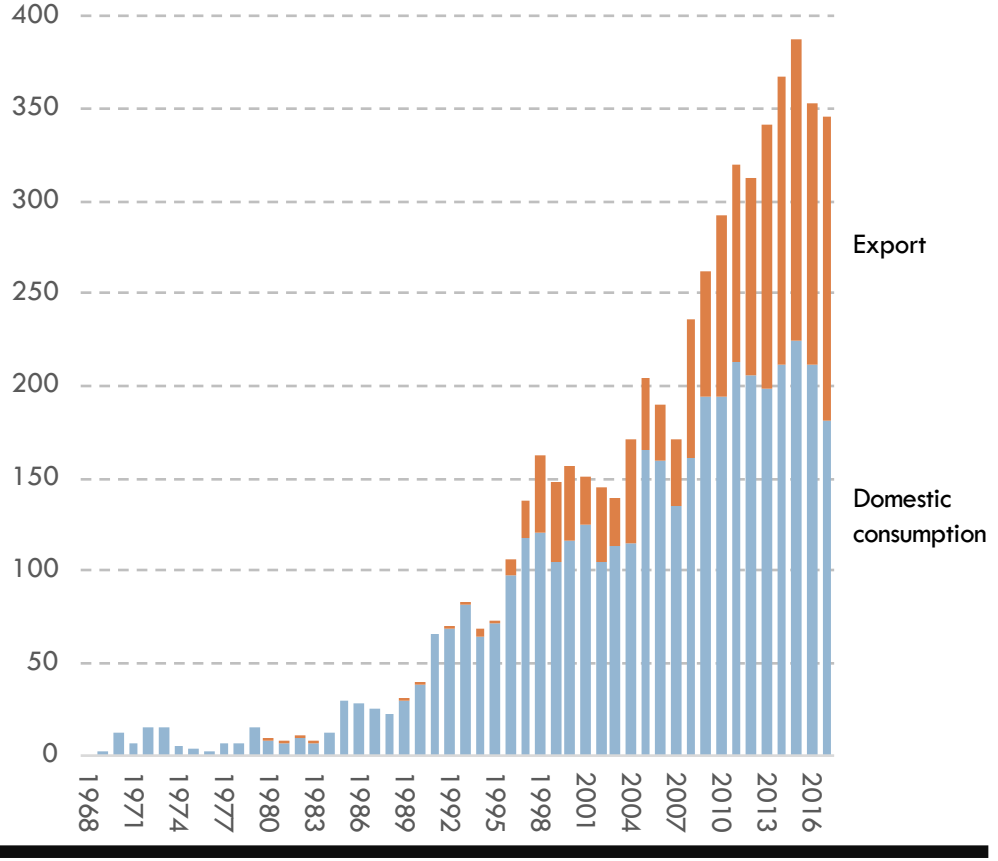
AU CANOLA PRODUCTION

Tonnes; m; 1968-2017



AU CANOLA OIL PRODUCTION

Tonnes; m; 1968-2017

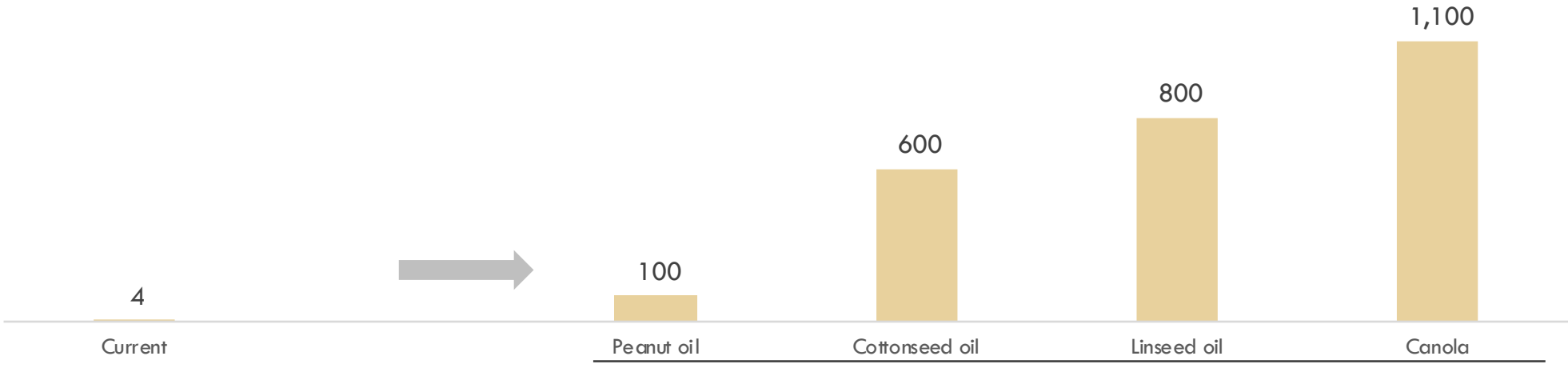


Source: UN Comtrade; ABS 7121.0; UN Comtrade; UN FAOSTAT; Coriolis estimates and analysis

Potential export volumes for Australian sesame oil range from 100t to 1,100t valued at A$0.6 to A$7m depending on share

POTENTIAL AUSTRALIAN SESAME OIL EXPORT VOLUME BASED ON ACHIEVED SHARE

Model; volume; exported; uses 2017 global trade volume



What share of global trade would be achieved?	*0.2%*	*1%*	*1.5%*	*2%*
What value of sesame oil exports would this translate into at the border? (Assumes matching Singaporean prices)	***A$0.6m***	***A$4m***	***A$5m***	***A$7m***

Source: UN FAOSTAT; Coriolis modelling, estimates and analysis

NORTH WEST QUEENSLAND CAN DELIVER

04

+ Poised for success

+ Clear next steps

North West Queensland is poised for success in sesame

- North West Queensland has the land, water and resources required for success in sesame
- NW Queensland combines a safe and trusted modern economy, with African climatic conditions, that is close to key markets
- North West Queensland can succeed against the competition in sesame
- Four specific next steps are required to realise the North West Queensland sesame opportunity
  1. Securing the best land in the region
  2. Securing the best available genetics
  3. Implementing production systems optimised to local conditions
  4. Targeted at high value markets
- Large scale sesame production could be started in North West Queensland relatively quickly

North West Queensland has the land, water and resources required for success in sesame

- Large total area 375,486 km^2
- Over 28m hectares of agricultural holdings in the region
- Diverse climatic conditions
- Low cost land currently underutilised
- Fertile soils suitable for agriculture

- Plentiful seasonal rainfall
- Multiple existing dams in the region
- Numerous additional dams proposed or in progress
- Proposed dams will be transformative to regional agriculture

- World class supply chains
- Easy access to Port of Townsville and Cairns Airhub
- Ongoing investment in infrastructure
- Skilled and educated regional population
- Readily available equipment, genetics, systems and support services

Photo credit: CC BY-SA 3.0 (Ravenspear82); purchased

NW Queensland combines a safe and trusted modern economy, with African climatic conditions, that is close to key markets

Efficient, world class, modern production system

- Very large, highly efficient farms
- World class agriculture production systems and proven capability
- Modern distribution infrastructure
- Well funded science and research
- Highly skilled at producing arable crops at scale in an arid climate
- Skilled and educated farmers
- Long history of agriculture and global trade in QLD

Crops suited to regional conditions and climate

- Warm semi arid and tropical savanna climates with some warm desert
- Long sunshine hours
- Wet and dry production possible
- Counter seasonal production
- Supplied to world market by climatic peers and produced successfully in the region

On the doorstep of East and South East Asia

- Strong demand from high value markets
- Excellent proximity to high demand markets in East & South-East Asia
- Short transport times and distances
- In the same (or similar) time zones
- Free Trade Agreements with most key trading partners

Modern, efficient economy with strong rule of law

- Protected by Australia's island location and strong biosecurity
- Strong reputation with consumers as a safe and secure food producer
- Strong investor protection, highly ranked in "ease of doing business" and rule-of-law
- AAA sovereign risk rating

Photo credit: Dollar Photo purchased by Coriolis Research

North West Queensland can succeed against the competition in sesame

STRENGTHS	WEAKNESSES
- Sesame genetics delivering results on the ground in the region - Arid tropical climate suited to many African crops - Large amounts of seasonal water relative to many climatic peers - Isolated island location with strong biosecurity; free from many diseases and pests - Proximity to fast growing Asian markets - Large area the size of Germany currently being used for large cattle stations - Low land cost relative to other Australian locations - "Brand Australia" known and trusted by global consumers - Large, high productivity farms in Queensland relative to peer group - Proven capabilities at large scale mechanised agriculture - Highly skilled, technically competent workforce - Proven track record in new crop development (e.g. almonds, avocados)	- High cost country relative to Africa and India; success requires highly efficient production through mechanisation and large farm sizes (cf. wheat) - Lack of large supply of low cost locals or "guest workers" (unlike some countries) - Low regional population; relatively high seasonal labour costs - Good roads, but relatively long transport distance to port - Low/no historical investment in large scale dams and irrigation projects in region - Strong environmental protection rules and regulation limit virgin/regrowth land clearing - Limited support services available directly in region
OPPORTUNITIES	**ISSUES/THREATS/RISKS**
- Rotational cropping of mungbeans (nitrogen-fixing) with sesame - Continued growth of the middle class in Asia - Aging global population, particularly baby boomers - Growing global interest in health giving foods - Growth of nutraceuticals and the emergence of "superfoods" - Potential to utilise waste streams - Regular, ongoing corruption, political strife, civil war, revolution, rebellion and disease outbreaks (e.g. Ebola) in Africa - Capitalise on newly developed genetics being trialled in neighbouring regions	- Disease outbreaks - Climate variability and climate change - Changing global trade flows and trade wars - Conflicting agenda and objectives of various government agencies - Changing foreign phyto-sanitary protocols and regulations and their interpretation - Politics and geopolitics, often not in support of agricultural development

Source: Coriolis analysis

Four specific next steps are required to realise the North West Queensland sesame opportunity

I. IDENTIFY THE BEST LOCATION	II. SECURE PROVEN GENETICS	III. IMPLEMENT EFFICIENT SYSTEMS	IV. TARGET HIGH VALUE MARKET
Where is the best location to produce large, consistent quantities?	*What global genetics suit the regional climate and mechanical harvesting?*	*How quickly can a proven system be developed for rapid scale-up?*	*Who are the most profitable customers as production volume grows?*
Identify Best Location	Suited to Regional Climate	Implement Low Cost Production Suited to Regional Conditions	Develop Clear "Unique Selling Proposition" (USP)
Ensure Suitable Water	Able to be Mechanically Harvested	Organise Distribution Logistics	Develop Domestic Australian Market
Identify Willing Local Owner(s)	High yielding, non-shattering varieties	Have Capable Team on the Ground	Develop High Potential Sesame Seed Export Markets

Source: Coriolis analysis

The first step is securing the best land in the region

I. IDENTIFY THE BEST LOCATION | II. SECURE PROVEN GENETICS | III. IMPLEMENT EFFICIENT SYSTEMS | IV. TARGET HIGH VALUE MARKET

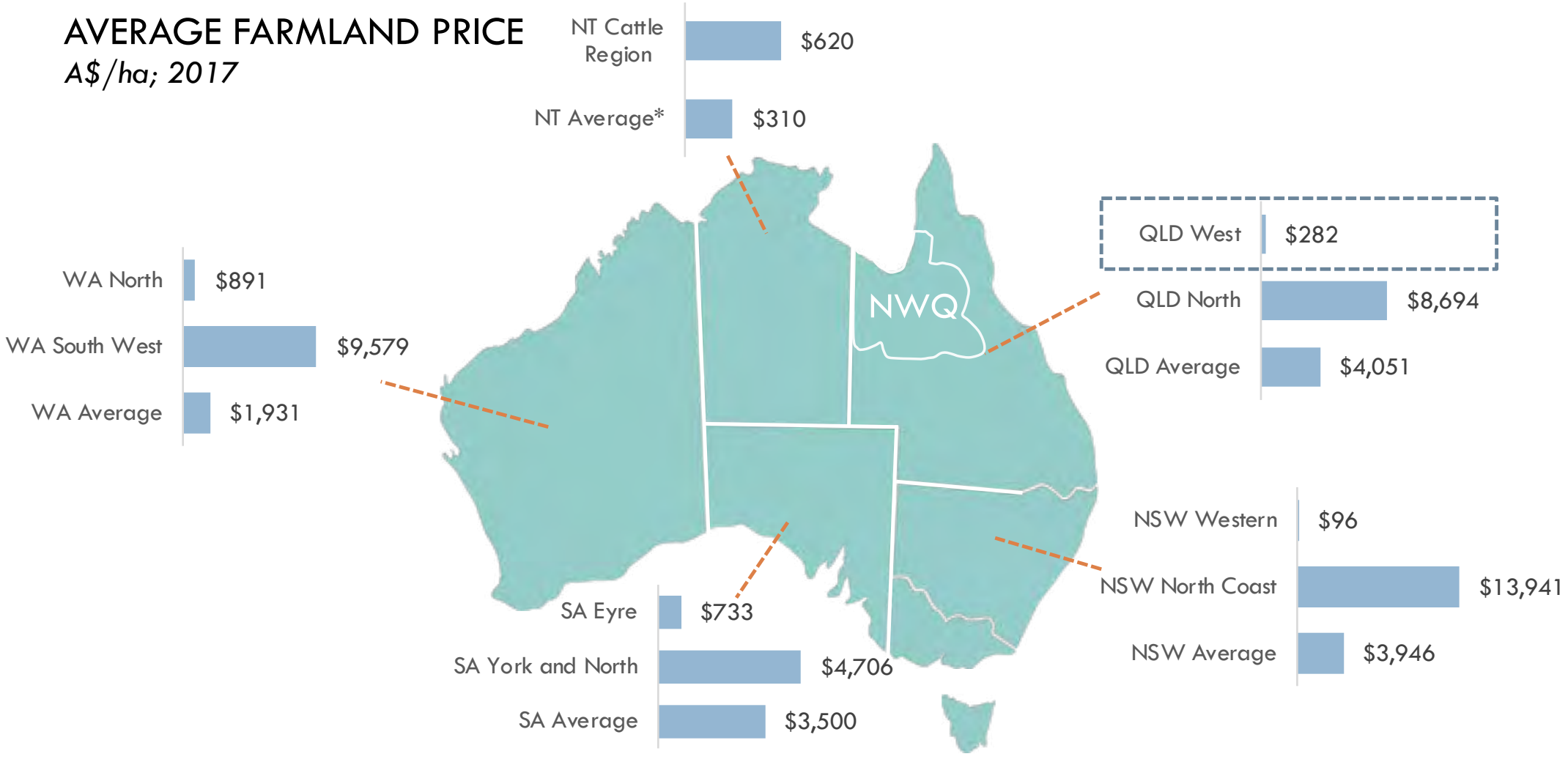
Situation creating opportunity	*Potential investment theme*	*What you would need to believe*
- NW Queensland is a large region, similar in size to Germany or Japan, with a climate suited to the crops of Africa - This area is currently used almost exclusively to graze cattle - Currently less than 1% of the land is farmed - The lack of farming is due to a range of historical reasons having little to do with the capability of the land - The government imposes limits on land clearing - By any available metric, every single other country with similar climatic conditions produces much more food	Identify Best Location	- Significant amounts of cleared land with soils highly suitable for sesame and suitable rainfall is available - Regional rainfall patterns match the demands of sesame; alternatively cost effective irrigation solutions exist - Establishment costs will deliver a competitive economic return - Sesame will grow successfully dryland and successfully in rotation with other crops
- Parts of NW Queensland receives large amounts of seasonal water - Rainfall varies by location, by region and by year - Available ground/surface water varies by location and region - Recent scientific research funded by government has highlighted additional available water in the region - Government regulates water through specific licenses tied to specific locations	Ensure Suitable Water	
- Land in NW Queensland has a wide range of owners, including large farmers, corporate farmers, government and traditional owners - Owners vary in their willingness to lease or use their land for more intensive production systems (i.e. not grazing)	Identify Willing Local Owner(s)	- Owners exist of suitable land who are willing to grow sesame (or willing lease their land to sesame growers)

Source: Coriolis analysis

Land in North West Queensland is cheap compared with other parts of Australia

AVERAGE FARMLAND PRICE

A$/ha; 2017



**NT Median Indexed; Source: Rural Bank, Australian Farmland Values; Coriolis analysis*

The second step is securing the best available genetics

I. IDENTIFY THE BEST LOCATION | **II. SECURE PROVEN GENETICS** | III. IMPLEMENT EFFICIENT SYSTEMS | IV. TARGET HIGH VALUE MARKET

Situation creating opportunity	*Potential investment theme*	*What you would need to believe*
- NW Queensland has warm semi arid and tropical savanna climates - Australia currently uses this land to breed tropical cattle - Climatic peer group countries across sub-Saharan Africa produce large amounts of sesame under these conditions - Oklahoma, Texas and other regions also produce sesame - 12 varieties of black sesame successfully trialled in Central Queensland by AgriVentis Technologies and CQU	Suited to Regional Climate	- Australia (25m people/8m km^2) needs and produces less food than Africa (1,225m people/30m km^2) - The challenge to increased food production in areas currently used for grazing cattle is a "mindset" issue - Major export crops produced in Africa (including sesame) could be produced in climatically similar regions of Queensland
- Sesame seeds are protected by a capsule which only bursts when the seeds are completely ripe (aka "dehiscence") - 99% of the sesame grown in the world is still harvested manually (highly labour intensive, up to 1,000 hours/ha) because traditional sesame capsules shatter during the drying stage before harvest; this limits mechanical harvesting due to high losses ("up to half" were historically lost in the field) - These characteristics lead to most production occurring in poor countries with low cost labour able to hand harvest - Non-dehiscent/dehiscence-resistant plants exist & have been bred to allow production under modern, mechanised farming - Sesame is grown and mechanically harvested in Oklahoma and Texas, Europe, and trials in Australia have been done	Able to be Mechanically Harvested High yielding, non-shattering varieties	- Equinom's (https://equi-nom.com/about/) 5 high yield, shatter resistant sesame varieties for different food and cosmetic applications will suit NW Queensland (trials in QLD areas with semi arid conditions have returned higher than expected yields and quality; trials in Far North QLD also very successful) - Their commercialisation agreement with Mitsui & Co (https://www.mitsui.com/jp/en/index.html) and Mitsui's interest in Northern Australia can be leveraged - Alternatively Sesaco (www.sesaco.com/about-us) and their owner Mitsubishi (www.mitsubishicorp.com/jp/en/bg/le/dfoodscom.html) would welcome a second source of counter-seasonal sesame seeds from Australia and would license their genetics - With the right genetics, Australia could match or exceed American labour efficiency in sesame production

Source: Coriolis analysis

Equinom is successfully trialing their new non-GMO "split-proof" sesame varieties across Queensland

QUEENSLAND SESAME TRIALS - EQUINOM

Comments from Equinom; 2018

PARTIES	WHAT	IDENTIFIED KEY ATTRIBUTES	NEXT STEPS FOR SESAME IN NW QLD
EQUInom QUEENSLAND GOVERNMENT Department of Agriculture and Fisheries LAND OWNERS	- Equinom, Israeli based technology seed firm - Founded in 2002 - Developed high yielding, non-splitting sesame varieties (for oil, baking and cosmetics) - Trialing in USA and Australia AUSTRALIA - 5 varieties trialed - Trials covered 800-1,000ha across multiple locations in QLD - Propose to "double area next year" (1,600-2,000ha) - Trails in Georgetown "very successful" - Achieved yields between 1.2-2.3 tonnes/ha (genetic potential for 2.5t/ha)	- High value alternative crop - Easily compete with imports on price - New non-splitting varieties are machine harvestable, allows for modern efficient farming systems - Operational efficiencies when in conjunction other grains/pulses (share the same equipment) - Short season so follows on easily in crop rotation - Complementary rotational crop (follow an irrigated crop, with little-to-no water requirement) - requires 30% less water than cotton - Drought tolerant - Low fertiliser requirements (lower cost) - Large farming operations (in the North) able to control the supply chain (higher efficiencies) - Potential for oil production with simple conventional cold-pressed seed crush machinery - 'Meal' from crush used as supplementary cattle feed (cake is 50% protein)	- Early-stage trials very successful - On-going trials required - Agronomic training required - Land development required to prepare for harvest - "There is a lot of potential in the North. You can develop the big blocks and control the whole supply chain. Even with very minimal rain, sesame will provide a yield. It performs well." *Oron Gar, Product Management, Equinom*

Source: Coriolis interview https://equi-nom.com/; Coriolis analysis

AgriVentis is in the early stages of trialing black sesame varieties in Queensland

QUEENSLAND SESAME TRIALS - AGRIVENTIS

2018

PARTIES	WHAT	IDENTIFIED KEY ATTRIBUTES	NEXT STEPS FOR SESAME IN NW QLD
LAND OWNERS	- AgriVentis Technologies is a seed development company based in Sydney, AU - Formed in 2017 - Only commercial black sesame grower in AU QLD TRIALS - Black sesame trials on 16ha in Rockhampton, QLD - 12 black sesame varieties trialed - Looking to expand trials to 100ha next year - Yields between 0.75-1 tonne/ha ("under very dry conditions") - Black sesame is valued at $1,600 per tonne - 1 tonne of seed can plant 1,000 acres - Market interest from Turkey and Korea	- High value alternative crop - Replace imports; currently 100% black sesame seed and oil seed is imported into Australia - Responds well in drought conditions - Suitable in crop rotation as low requirements for fertiliser and water - High demand for black seed on bread rolls, ice cream - High demand in niche markets in Asia - Value-added opportunities with oil - Value-added opportunities with bio-mass into India	- Expand trials geographically, intention to increase diversification of areas - Trials to focus on agronomy practices and collecting data; currently no data or experience in Australia - "There is a lot of opportunity for sesame in Northern Queensland. It performs well in the drought and there is a lot of value added opportunity in Australia and globally." *Surya Bhattarai, CQU, Nov 2018*

Source: Interview; https://www.agriventistechnologies.com.au; articles; Coriolis analysis

The third step is implementing production systems optimised to local conditions

I. IDENTIFY THE BEST LOCATION | II. SECURE PROVEN GENETICS | **III. IMPLEMENT EFFICIENT SYSTEMS** | IV. TARGET HIGH VALUE MARKET

Situation creating opportunity	***Potential investment theme***	***What you would need to believe***
- Export sesame is primarily produced in sub-Saharan Africa, India and Mexico where it is produced by low cost labour - Export sesame is also produced in Oklahoma and Texas - Australia has a global scale arable crop industry and associated support sectors (e.g. harvesting machinery) - Australia has a 30+ year history of producing relatively small amounts of sesame, primarily focused on domestic use - Australia is a developed country with high cost labour that achieves export success through efficient production of arable crops on large farms using mechanised production systems and large scale, highly efficient supply chain logistics - NW Queensland is a large, remote region currently focused on cattle grazing, large scale mining and tourism - Mount Isa (regional centre) is an 11 hour drive from major population centres and the Port of Townsville - The region has good transport infrastructure and a widespread network of regional airports - The region has rail and a reliable central electrical grid in most key areas; some large properties are more remote - However, as a relatively remote region, it lacks specialised services that need to be "brought in" from other areas - There is a limited pool of skilled producers of large scale arable crops in the region directly (but many elsewhere)	Implement Low Cost Production Suited to Regional Conditions	- Existing Australian farming systems for sesame (and other arable crops) can be adapted for NW Queensland - Improvements can be made to existing Australian sesame seed production systems (e.g. lessons from Texas, Oklahoma) - Successful lessons from Georgetown trials will be extended to other areas - A low cost production system for sesame seed production adapted to local conditions can be developed relatively quickly - Production will be competitive with global competitors - Able to utilise existing planting and harvesting equipment
	Organise Distribution & Supply Chain Logistics	- Sesame can be stored in the same storage infrastructure used for grains and canola in Australia (as is the case in the US) - Cost competitive grain/oilseed storage infrastructure can be put in place relatively quickly - Production regions will be situated close to either triple road train highways, rail or aggregation depots in order to minimise distances to port - Production regions will be closer to Port of Townsville than Mt Isa
	Implement with a Skilled & Capable Team on the Ground	- Existing regional farmers can quickly upskill in dryland sesame production - Alternatively, skilled operators from outside NW Queensland can be attracted to the region to farm sesame

Source: Coriolis analysis

Finally, the product needs to be targeted at high value markets

I. IDENTIFY THE BEST LOCATION | II. SECURE PROVEN GENETICS | III. IMPLEMENT EFFICIENT SYSTEMS | **IV. TARGET HIGH VALUE MARKET**

Situation creating opportunity	*Potential investment theme*	*What you would need to believe*
- Sesame is a premium oilseed that receives high prices - Sesame oil sells at a premium to most other oils - All major sesame seed producing countries are currently high risk, with endemic corruption, limited political or economic stability and poor infrastructure; all have bad roads - All major producers have weak "country brands"	Develop Clear "Unique Selling Proposition" (USP) for NW Queensland Sesame	- Sesame can be differentiated and is not a pure commodity - NW Queensland produced sesame will be different in some marketable way - A significant percent of buyers value soft characteristics such as "sustainable," " clean and green" and "Brand Australia" - Qld can develop a unique black seed with high health benefits
- The average Australian consumes about half a kilogram of sesame per year and there are a wide range of products containing sesame on the shelf in supermarkets - The Australian market is worth A$28m, including seeds (A$14.2m) and oil (A$14.6m), growing at 4.5% (20y CAGR) - Australia's sesame seed imports currently come primarily from India at an average landed price of US$1,597/t - Australia's sesame oil imports come primarily from E/SE Asia at an average landed price of US$5.49/kg	Develop Domestic Australian Market	- NW Queensland will be able to produce sesame at prices that are competitive with Africa or India through mechanisation - NW Queensland produced sesame will be higher quality than imported sesame from India - A significant percent of current Australian buyers of imported sesame will be willing to switch to locally produced sesame - A significant percent of current Australia buyers of sesame will be willing to pay a premium (particularly initially) for Australian seeds - NW Qld can replace current imports of black sesame
- There is a very large global market for sesame seeds, valued at US$2.2b in 2017 and growing at 8% (20y CAGR) - Asian demand for sesame seeds is growing, leading to global production volume having to triple in the last 20 years - Consumers in China and other developing E/SE Asian countries are demanding more sesame as their incomes grow	Develop High Potential Sesame Seed Export Markets	- The drivers of Australian export success in other arable crops (wheat, barley, oats, canola) will be transferrable to sesame - NW Queensland produced sesame will deliver higher quality product at competitive prices in world markets - A significant percent of global buyers of sesame will be willing to switch to buying sesame from NW Queensland

Source: Coriolis analysis

Large scale sesame production could be started in North West Queensland relatively quickly

- World class genetics are available and in trials in the region
- Dryland Sesame is less water intensive
- There are significant tracks of land well suited to sesame available now in Gilbert, Flinders, Cloncurry and elsewhere
- Sesame can be grown in crop rotation with mungbean (nitrogen-fixing legume)
- Sesame handling and logistics from the region are relatively straightforward to implement

To discuss the sesame opportunity in North West Queensland please contact

Queensland Government

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North Region Office
Townsville Regional Office
9-15 Langton Street, Garbutt QLD 4814
Australia

APPENDICES 05

+ Potential Commercial Partners
+ Glossary

OLAM GROUP

WHO ARE THEY?

CEO/MD:	Sunny George Verghese
Address:	7 Straits View, Marina One, East Tower #20-01 Singapore
Phone:	+65 6339 4100
Established:	1989
Website:	http://olamgroup.com
Revenue:	SGD$26.3b (2017)
EBITDA:	SGD$1,328m (2017)
Staff:	72,000 (Headcount)
No. of plants:	200
Production:	N/A
Ownership:	Private/ Public (SGX:O32)
Country:	Singapore
Major Shareholders:	Temasek (53.6%) Mitsubishi (17.4%) Kewalram Chanrai (7.0%) Management (6.3%) Public (15.6%)

WHAT DO THEY MAKE?

PRODUCTS

45 Agri-commodity products across:
Beverages – cocoa, coffee
Edible nuts – almonds, cashews, hazelnuts, peanuts, sesame
Spices
Tomatoes
Packaged Foods – pasta, tomato paste
Food Staples – dairy, grains, pulses, foods, rice, sugar, edible oils
Industrial Raw - cotton, rubber, wood, fertiliser

BRANDS

FreshYo, Bua, Festin, Perk, Milky Magic, King Cracker TastyTom, Enrista, Cherie, Cafe Delas, Eagle, NutriSnacks, Chic Choc Twingles, DeRica, Sunda Hejo, Colombia Timana, Dulima, Lao Naga, Laos Siho, Mexico Concordia Especial, Sulawesi Rangemario, Sumatra Crowned Garuda, Royal Feast, Royal Aroma, Mama Africa, First Choice, Royal Gold, Adeapa, Vital, deZann, Unicao, Joanes, Macao, Huysman, Britannia,

OPERATIONS

Vertically integrated value chains, farmer to manufacturer. Third largest agribusiness in the world; largest almond grower in Australia; peanut shelling and blanching facilities in Argentina, India, USA.

Australian operations: almonds, cotton

WHERE ARE THEY? ACROSS 65 COUNTRIES

Europe:	39 locations: Spain, Poland, UK, Germany Netherlands…
Americas:	130 locations: USA, Argentina Brazil…
Middle East/NA:	31 locations: Turkey
Asia:	91 locations: China, Singapore, India, Indonesia, Vietnam, Thailand, Malaysia, Central Asia…
Australasia:	Australia, New Zealand
Other:	298 locations - throughout West, East and Southern Africa

DO THEY HAVE ANY MONEY?

RECENT ACQUISITIONS & INVESTMENTS

- 2014 acquired ADM's cocoa business for US$1.3b
- 2016 acquired BUA Group (Nigeria) wheat milling and pasta assets for US$257m
- 2016 acquired Amber Foods (Nigeria) for US$275m
- 2016 acquired Brooks peanut sheller (Alabama) for US$85m
- 2016 acquired share in Acacia Investments for $25m
- 2017 acquired four second hand ships

Source: company website; company annual report; various published articles and reports; Coriolis analysis

MITSUBISHI CORPORATION

WHO ARE THEY?

CEO/MD:	Takehiko Katiuchi
Address:	3-1, Marunouchi 2-crome, Chiyoda, Tokyo 100-8086 Japan
Phone:	(512) 389 0759
Established:	1870/1954
Website:	www.mitsubishicorp.com
Revenue:	Y7,567b (2018)
Net Inc:	Y560m (2018)
Staff:	70,000
No. of plants:	100's
Production:	N/A
Ownership:	Public TYO:8085, LSE: MBC
Country:	Japan

WHAT DO THEY MAKE?

PRODUCTS

Conglomerate of companies; four main companies in: Banking, Electric, Heavy Industries and the Trading Company- Mitsubishi Corporation (Infrastructure, Finance, Logistics, Energy, Metals, Chemicals, Machinery and Living Essentials (Fresh Food, Consumer Packaged Goods, Commodities, Retail and Distribution divisions))

BRANDS

Living Essentials – Ace of Diamond, Princes, All time coffee, Tea Master, Happy, Premier coffee, Kewpie, Ichitan, Haribo, Napolina, crisp'n dry, Crosse and Blackwell, Aqua Pura, Kanro Candy, Ravi Fruit, Cote Saveurs, El Rey, Sun-Maid, …*hundreds especially across Asia via various companies*

OPERATIONS

Mitsubishi Group has 200 offices and subsidiaries in 90 countries, network of 1,300 companies.

AU operations: Agrex (grain trade), Riverina (grain procurement and feed), Cape Flattery Silica Mines.

Own Sesaco Corporation in USA, (41,000 sesame lines, including non-shatter varieties) - http://www.sesaco.com/

WHERE ARE THEY?

Europe:

Americas:

Middle East: *Global operations in 90 countries*

Asia:

Australasia:

Other:

DO THEY HAVE ANY MONEY?

RECENT ACQUISITIONS & INVESTMENTS

- 2011 MC acquired majority stake in Sesaco – accessing their sesame breeding R&D
- 2013 MC acquired Kirin Kyowa Foods (flavouring) for US$321m
- 2014 MC invests in Olam Grains AU – move into AU terminal business
- 2017 MC acquired 22% if AAQSA resources firm for $600m
- 2018 MC subsidiary Indiana Packers acquired Specialty Foods (SFG), USA, pork Company for ~US$100m
- 2018 MC acquired 80% Kewpie's Gourmet Delica (precooked foods)
- 2018 Purchased minority stake in Al Islami Foods (UAE) – frozen meat products
- 2018 Consolidate Life Sciences 3 subsidiaries to gain share in health food
- 2018 – MC and Innovation Network Corporation (INC) invest 1.7b yen in Spirulina manufacturer Tavelmout Corp
- 2019 – Invested in chicken processing in Thailand through JV partners Itoham Yonekyu Holdings and Betagro Group (6b yen)

Source: company website; company annual report; various published articles and reports; Coriolis analysis

MITSUI & CO

WHO ARE THEY?

CEO/MD:	Tatsuo Yasunaga
Address:	JA Building, 1-3-1 Ohte-machi, Tokyo, 100-8631, Japan
Phone:	+81.3.3285.1111
Established:	1876/1947
Website:	http://www.mitsui.com
Revenue:	US$44.1b (2018)
EBITDA:	US$3.6b (2018)
Staff:	42,300
No. of plants:	N/A
Production:	N/A
Ownership:	Public; TYO: 8031
Country:	Tokyo
Owner:	Mitsui Group

WHAT DO THEY MAKE?

PRODUCTS

General trading business across: Iron and Steel Products; Mineral and Metal Resources; Machinery and Infrastructure; Chemicals; Energy; Lifestyle (Food Business Unit, Food and Retail Management, Consumer Business Unit); Innovation and Corporate Development; Overseas; and Others.
Food Business Unit includes: Protein Materials, foodstuffs, fats and staples, carbohydrates, value materials

BRANDS

Spoon, Nittoh Black Tea, Oriens, Pacific Premium, Gift of Nature, Gift of the Sea, Nobility, Nice, Mitsui, Heartful Farm, Calm, Mitchan, Waso Honpo, Empress, Marie's

OPERATIONS

Key Food Business Operations: United Grain Corp in USA; Pri Foods broiler chicken processing, Kumphawapi Sugar operations, Mitsui Norin Tea ingredients and manufacturing, Mitsui Alimentos Brazil coffee company, Agricola Xingu Brazil grain production

WHERE ARE THEY?

Europe:

Americas:

Middle East: *Global operations*

Asia:

Australasia:

Other:

DO THEY HAVE ANY MONEY?

RECENT ACQUISITIONS & INVESTMENTS

- 2015 acquired 23% stake in Chile-based salmon prodcer Salmex for US$100.7m
- 2015 acquired 50% stake in Bluegrass Farms of Ohio Inc (non-GMO soybean company) for US$15m
- 2016 invested C$58m funding for precision Ag firm, Farmers Edge
- 2016 partnered with Eastern Colorado Seeds
- 2017 acquired ETG for US$265m – aim to enter African market
- 2017 acquired Top Seeds 2010 global vegetable seed company
- 2017 invested $40m in fish and livestock feed developer Calysta Inc (USA)
- 2017 invested US$8m for 80% stake in FDR Japan, water recirculation products for fish farming
- 2018 invested $7.6m in halal production drive

Source: company website; company annual report; various published articles and reports; Coriolis analysis

ETC GROUP LTD (ETG)

WHO ARE THEY?

CEO/MD:	Ketan V. Patel
Address:	902 East, Index Tower, DIFC, Dubai, UAE
Phone:	+971-4-386-4551
Established:	1967
Website:	www.etgworld.com
Revenue:	US$3,658m (2017)
EBITDA:	N/A
Staff:	6,600
No. of plants:	N/A
Production:	5m metric tonnes procured and distributed (2015)
Ownership:	Private
Country:	Dubai
Owner:	Mitsui 30%

WHAT DO THEY MAKE?

PRODUCTS

Business operations which include agricultural products (from origination & processing through to storage & import/export), sales of agricultural supplies (fertilizers, agrochemicals, seeds, etc.), plus manufacture and sale of foodstuffs; Leading African firm in handling pulses, sesame, fertiliser, agrochemicals

BRANDS

ETG, Kynoch, Zambia

OPERATIONS

One of Africa's largest Agricultural Conglomerates; Main operational bases in Dubai and Johannesburg; Businesses based in 330 locations across 36 countries concentrated in East Africa; JV processing in north China with ADM; Global leader in sesame trade.

In 2017 Mitsui & Co (revenue: $44.2b) invest US$265m in group with aim to expand into Africa.

WHERE ARE THEY?

Europe:

Americas:

Middle East:

Asia:

Australasia:

Other/Africa East Africa

Subsidiaries (blue 10 or more locations, yellow less than 10)

DO THEY HAVE ANY MONEY?

RECENT ACQUISITIONS & INVESTMENTS

- 2014 started operations in Australia
- 2014 opens one of the largest pulse processing plants in the world in India

Source: company website; company annual report; various published articles and reports; Coriolis analysis

Who are the potential commercial partners?

FIRM	YEAR EST.	HEAD OFFICE LOCATION OWNERSHIP	GLOBAL SALES # OF EMPLOYEES	KEY PRODUCTS	KEY REGIONS	WEBSITE NOTES
	2017	North Sydney, Australia Private	N/A	Pulse, brassicas, cruciferous, dryland native rice, summer grains, oilseeds, soybeans, legume crops	Australia	https://www.agriventistechnologies.com.au Agricultural seed technology and development company; only commercial grower of black sesame in Australia
和田萬 WADAMAN since 1883	1883	Osaka, Japan Private Wada family	¥1b N/A	Sesame seeds, paste, oil, jam, dressings, sprinkles, seasoning, confectionery	Japan	http://wadaman.com/english/about Processor and seller of sesame seeds and products; sesame restaurant; organic certification
kewpie love around the kitchen table	1919	Tokyo, Japan Public TSE:2809	¥24b 13,478	Mayonnaise, sesame dressing, salad dressings, prepared vegetables, prepared salads, egg products, ready meals, aged care meals, baby food, cosmetics	Global	https://www.kewpie.co.jp/english/about-us/history.html 9 factories in Japan; numerous subsidiaries; factories in USA, China, Thailand, Vietnam, Malaysia, Indonesia, Poland
Mondelēz International	1824	USA Public NASDAQ:MDLZ	US$25.9b 100,000	Biscuits (cookies, crackers and salted snacks), chocolate, gum and confectionery, beverages (coffee and powdered beverages), cheese, grocery	North America Global	www.mondelezinternational.com # 2 confectionery company globally; operating in 165 countries; recently exited chocolate manufacturing in NZ
CJ CHEILJEDANG	1953	South Korea Public KRX:001040	US$10b (2013)	Food and Food service, Biotech & Pharmaceuticals, home shopping, logistics, entertainment and media	South Korea	http://eng.cjcheiljedang.com/ Farm in Ayr, interested in sesame growing in QLD

Source: company website; company annual report; various published articles and reports; Coriolis analysis

GLOSSARY OF TERMS

A$/AUD	Australian dollar
ABS	Absolute change
ANZSIC	AU/NZ Standard Industry Classification
AU	Australia
Australasia	Australia and New Zealand
b	Billion
CAGR	Compound Annual Growth Rate
CIF	Cost plus Insurance and Freight
CN	China
C/S America	Central & South America (Latin America)
CSIRO	Crown Scientific Institute Research Organisation
CY	Calendar year
E Asia	East Asia
EBITDA	Earnings before interest, tax, depreciation and amortization
FAO	Food and Agriculture Organisation of the United Nations
FOB	Free on Board
FY	Financial year (of firm in question)
GBP	British pounds
HS Code	Harmonized Commodity Description and Coding System
HK	Hong Kong
IQF	Individually quick frozen
JV	Joint venture
m	Million
n/a	Not available/not applicable
NA/ME/CA	North Africa / Middle East / Central Asia
N. America	North America (USA, Canada)
Nec/nes	Not elsewhere classified/not elsewhere specified
N/C	Not calculable
N.H	Northern Hemisphere
R&D	Research and Development
S Asia	South Asia (Indian Subcontinent)
SE Asia	South East Asia
S.H	Southern Hemisphere
SS Africa	Sub-Saharan Africa
T	Tonne
US/USA	United States of America
US$/USD	United States dollar


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