



RURAL INDUSTRIES RESEARCH
& DEVELOPMENT CORPORATION



Market Alternatives for Japanese Green Tea

A report for the Rural Industries Research
and Development Corporation

by Angela Monks

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Foreword

There is increasing interest world wide in the use of green tea in beverages, cosmetics, nutraceuticals, medicinals and as flavours and fragrances. The medical research industry is increasing its focus on potential disease cures and preventatives.

There is also increasing production of the ready to drink beverages (RTD). The RTD market contains green tea either as a single flavoured drink or as an ingredient in a mixture of flavours, which are aimed at the health market.

The report covers several aspects that are not considered mainstream marketing information of Japanese Green Tea. These subjects have been included since they are not covered in other documents which are concerned with value added products and marketing.

This project was funded from RIRDC Core Funds which are provided by the Federal Government. This report, a new addition to RIRDC's diverse range of over 600 research publications, forms part of our New Plant Products R&D program, which aims to facilitate the development of new industries based on plants or plant products that have commercial potential for Australia

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Peter Core
Managing Director
Rural Industries Research and Development Corporation

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Executive Summary

A desktop investigation was initiated to explore the potential use of green tea grown in Australia for alternative products. Traditionally processed Japanese green tea requires a large capital investment for processing equipment, there is a very large market for both processed teas as well as value added products which by-pass the processing line.

This report, funded by RIRDC to examine the potential for value added products made from green tea. There are many forms of products that can be made from either extracted polyphenols from green tea or from powdered green tea leaves.

The report covers several aspects that are not considered mainstream marketing information. These subjects have been included since they are not covered in other documents which are concerned with value added products and marketing.

There is increasing interest world wide in the use of green tea in beverages, cosmetics, nutraceuticals, medicinals and as flavours and fragrances. The medical research industry is increasing its focus on potential disease cures and preventatives.

Green tea is used by the cosmetic industry for a variety of reasons. The activity of green tea as an antioxidant both within the product itself (as a preservative) and on the skin surface helps to reduce sun damage to the skin with perceived benefits such as anti aging and reduced wrinkling of the skin itself. Green tea is used as an alternative preservative in some products, which are aimed at the consumer that might want natural products rather than synthetic preservatives. Cosmetic products that use green tea are sunscreens, moisturisers, foundations, toothpaste and haircare products.

Green tea has had a strong traditional use in Japan as flavouring for cake, sweets and biscuits. The products that use flavours derived from green tea are becoming available slowly in western countries.

There is increasing production of the ready to drink beverages (RTD). The RTD market contains green tea either as a single flavoured drink or as an ingredient in a mixture of flavours, which are aimed at the health market. These products can be packaged in a variety of containers including cans, bottles and tetrapacs they are also either carbonated or still. The product destiny plays some part in the type of packaging with vending machines in many cases being a factor in the selection of packaging.

The health care market (both nutraceutical and medicinal) is increasing its use of green tea in tablets, capsules and health drinks. The tea used in the nutritional supplements is either in an extract form or as a powdered leaf. Reports (contained in the appendix) of the benefits of green tea in the treatment of bacterial and viral infections and the treatment of certain types of cancer are increasing. Reports of the use of green tea in the medical industry are receiving increased attention from the media and are becoming more available via the World Wide Web.

Extensive expertise already exists in Australia for the establishment and expansion of the extractives industry. Established industries in this area include poppy, essential oils, cold pressed oil, and hops. The green tea industry would benefit from the strong linkages already in place in the extractives industry.

Information has been sourced from several areas and includes the use of the World Wide Web, The Australian Bureau of Statistics, supermarkets and healthfood shops, cosmetic retailers and cosmetic manufacturers and researchers.

Where it is possible web pages, web addresses and statistical information has been included in the appendix at the end of the report.

1. Introduction

1.1 Current trends

World wide there is increasing focus on the health benefits of green tea. Consumer demand has led to the range of products available within Australia, which contain green tea as an ingredient to rapidly expand (ABS information).

Tea used in the production of different types of value added products may only receive minimal processing such as the initial steaming to prevent fermentation of the tea enzymes which cause blackening of the leaf material. After steaming the green tea can be further processed for the traditional green tea or it can be dried for use in other products. Products that are available which contain green tea range from sweets, cakes and biscuits to ready to drink canned tea, nutritional supplements and a wide range of cosmetic products.

The publication of media and scientific reports, which detail the benefits of green tea, reflect the consumer interest in alternative health foods.

1.2 Project description

The Rural Industries Research and Development Corporation (RIRDC) have funded this preliminary desktop project investigating the alternative potential markets and products.

This report seeks to examine the product and market alternatives for Australian grown green tea. The project emphasis to date has been on the production of a Japanese style green tea. The examination of economic and agricultural parameters has shown that production of good quality Japanese green tea is possible in Australia.

The main objective of this project is to identify areas that green tea may be value added without using all of the processing stages required for traditionally processed green tea thus reducing the initial and ongoing capital requirement for the crop. The technology and expertise is present in Australia for the establishment and expansion of a high quality extractives industry. Crops already established in Australia that rely on the extractive process include hops, pyrethrum, essential oil, cold pressed oils (citrus) and the poppy industries.

Markets for the Japanese style green tea produced in Australia have been previously examined with the use of an international marketing firm 'Tea Craft'

Previous work carried out by the DPIWE has shown that there is also potential for the production of a range of products other than traditionally processed Japanese style green tea and access to markets other than those previously investigated and attempted.

1.3 Project outline

The four main components of the project are covered in this report:

- Literature search of green tea and products which contain green tea as an ingredient.
- Statistics for Tea importations in Australia.
- World markets for green tea.
- Product survey of value added products or products that use green tea in manufacturing process.

The Literature search provides introductory information of green tea with respect to its use in value added products. Aspects included in the review are the types of tea used, pharmaceutical use, the chemistry of the active components of green tea and their extraction from tea, information readily available on the World Wide Web and storage of the products.

The section dealing with statistics reviews the imports of different teas into Australia, the country of origin and the production of tea within Australia.

An overview of world markets has been reviewed and includes summaries of the markets in America, Europe, Australia and Japan.

The product survey examines a selection of products available in Australia and overseas and use green tea as a component in their production.

1.4 Previous work

Together the DPIWE with RIRDC have produced or commissioned several projects culminating in extensive documents and final reports. The reports are listed in the bibliography within this report. Most of the reports are available from the DPIWE or alternatively from the funding bodies RIRDC and Horticulture Research and Development Corporation (HRDC).

The reports contain information on crop establishment, agronomy, quality assessment and processing of green tea and its commercial potential. There are also sections dealing with the economics of growing green tea commercially.

1.5 Projects in other states of Australia

In Victoria commercial production of green has begun. The initiative has been driven by a combination of stakeholders including private individuals, Japanese companies, Local Government, State Government and the Commonwealth Supermarkets to Asia Program. Trial plants were originally supplied by the DPIWE from Tasmanian produced stock and with several successful imports of new stock plants from Japan the trials in the Murrindindi Shire are showing promise. There has been strong interest shown by foreign investors in Victoria. The oldest trial sites are 3 to 4 years with the largest plantings amassing several acres now.

The Western Australian government is examining green tea as a new opportunity for farmers in the South of the state. DPIWE Tasmania has assisted WA in the provision of established mother plants for propagation and expert advice to enable private growers to commence the industry in that state.

Japanese investors have also expressed interest in Western Australia with several visits and high level meetings but to date they have not committed to the enterprise.

New South Wales have also obtained mother plants for production of stock plants from Tasmania. One group of plants has been obtained for a Japanese company under the supervision of the University of New South Wales to produce stock plants for private production.

A second group of plants has been sent to a commercial propagator in NSW to produce plants for other investors.

2. Recommendations

Several aspects have become clear from the production of this preliminary desktop report.

- Continue to investigate the production of alternative products for green tea. Increase the emphasis on production of quality extracts for different products with the product destiny clearly in mind.
- Establish market relationships with national and foreign buyers of green tea extracts.
- Foster the relationships formed between the primary producers, the extractives industry and market buyers.
- Establish a pilot scale production of green tea extracts utilising existing extraction facilities and expertise, to be compared with commercially available green tea extracts using gas chromatograph and mass spectrometry and olfactory analysis
- Source samples from the ready to drink product range. There are a wide variety of products available both in the alternative and health RTD range.
- Form linkages with Cosmetic manufacturers to test the green tea and green tea extract for its suitability for use in cosmetics.
- Investigate the ready to drink range of products both in Asia and Australia as a potential value adding opportunity for Australian grown green tea.

There is increasing interests in the biological activity of green tea both as a health product and as a replacement for traditional antioxidants in product stabilisation. There are many opportunities in Australia for import replacement not only of processed teas but also for green tea, which is used in the preparation of value, added products such as cosmetics and hair care products.

The RTD market is rapidly expanding both overseas and will become increasingly more visible in Australia as demand for alternatives in the beverage industry increases.

The health care industry both in areas such as professional medicines and nutraceuticals is increasing. Demand for alternative drug sources and methods of treatment are also increasing in Australia and there is likely to be increased demand for tea products, which can combine health tonics with convenience such as the nutritional supplement products and the RTD markets.

3. Background

3.1 Project history

There have been a variety of methods used to investigate the viability of green tea in Australia and have included the use of economic analysis, agronomic investigation, market analysis, collaboration with other states and the use of most forms of printed and electronic media.

The Department of Primary Industry Water and Environment (DPIWE) began investigating the introduction of Japanese Green Tea in 1991. Work on the crop has been ongoing since that year and has progressed toward a national green tea crop.

The initial project began with the importation of 6000 plants from Japan into Australian quarantine. After a 60% reduction in total numbers after disinfestation procedures, the remaining plants were used to propagate enough plants for trial purposes.

Site selection has been found to be a critical factor in crop establishment. The plants have been found sensitive to three main factors, wind and soil salt deposition, frost and wind chill during critical stages of growth and to mechanical damage of the young foliage.

During the course of the various projects undertaken by the DPIWE it has been found that while Australia can produce Japanese style green tea, there are markets available for alternative products which do not necessarily utilise the expensive Japanese traditional processing machinery.

3.2 Tea production

Japanese green tea is produced from the new growth formed on plants of *Camellia sinensis* var *sinensis*. After the flush of new growth is harvested the shoots are collected and processed.

There are many different types of green tea consumed throughout Asia and each area has various traditional ways of processing the tea. Among the many ways of processing some forms include pan-fried, semi fermented and variations of hand rolling.

Harvesting can be carried out by a variety of methods including hand harvesting and mechanical harvesting.

Processing begins with the steaming of the fresh shoots to denature the enzymes which ferment the tea and turn it black (black tea is encouraged to undergo enzymatic breakdown prior to processing). The tea is then transferred to a succession of machines, which mimic the traditional Japanese method of hand processing. Each machine breaks up the internal structure of the plant material and introduces twisting and rolling to the shoots. Several of the machines remove some of the moisture from the tea until primary processing is finished and the tea is placed in a final drier to remove all but around 5% of the total moisture content.

3.3 Costs of production

The processing methods require extensive use of specialised machinery which mimics the traditional hand rolling methods used prior to mechanisation in Japan. The inclusion of the valuable machinery in the economic analysis (detailed in a previous project report published by the RIRDC publication number 00/59) elevates the total cost of production approximately 66% of the capital costs are due to the processing equipment. If the machinery is excluded from the economic analysis then the costs of producing green tea and processing the green leaf to the first stage of steaming is reduced. The crop then

falls within economic reach of farmers who might grow the crop but don't proceed with it due to the capital investment needed for traditional processing.

An economic analysis as is shown in the report titled 'To continue the investigation into Japanese green tea'. The cost of the machinery as part of the capital investments can be very high. To date there have been no firm quotes available on the cost of a processing plant for a green tea enterprise. Estimates for 10 to 50 hectares of tea vary from 1 to 4 million dollars AUD.

As an example the importation and installation of the green tea pilot plant at the DPIWE laboratories was around AUD\$120 000. The pilot plant can process a total of 2kg per batch every 2.5 hours. Depending on the time of year, quality of material and the amount harvested the processing from a trial plot of 300 plants can take up to 2 days.

3.4 Cultivar description and extract production

The Japanese producers favour the cultivar Yabukita that constitutes around 80% of the total plantings in Japan. Often Yabukita is used as a synonym for one of the quality levels found within the grading and quality assessment of the processed tea.

Three cultivars were imported to Australia for trial use, Sayamakaori, Yabukita and Okuhikaori. Of the three varieties Yabukita is the preferred variety in the Japanese markets. Under Tasmanian conditions Yabukita is less vigorous and propagates at a slower rate than Sayamakaori.

Sayamakaori is the most vigorous under Tasmanian conditions and Okuhikaori is intermediate between the other two varieties present in Tasmania with regard to its vigour it is slower to propagate than the other two varieties.

Yabukita is often the cultivar required for production of polyphenols for the extractives market. The cultivar has a recognised higher level of polyphenols (Proceedings of the International Symposium of Tea Science). Preliminary testing of Tasmanian samples by the University of Tasmania Agriculture School has shown that the cultivar Yabukita has higher levels of polyphenols than other varieties. The polyphenols were extracted from the samples they were from the third harvest of tea which is recognised by Japanese experts to have lower levels of polyphenols than the first harvest. Yabukita yielded more polyphenols than Okuhikaori and Sayamakaori respectively. The polyphenol yields were well below 1 gram per Kilogram of wet leaf level, although it would be reasonable to expect a yield of polyphenol would increase if the first good quality harvest were to be used. From dry material several reports relate that material from the first harvest contains between 15 to 30% of polyphenols, (from the Proceedings of the International Symposium on Tea Science).

4. Literature Search

4.1 Introduction

Material gleaned from the World Wide Web is presented in the appendix section and the information is summarised here.

4.2 Historical

Tea was introduced to Japan from China and subsequently to the rest of the world after the Portuguese began trading with Asia. Around 1650 tea was commonly used in Europe and available from food shops. Previously tea had only been available to the wealthy due to its high cost. Tea was introduced to the Americas by the Dutch settlers who appeared to consume more tea than did England at the same time. The introduction of tea to England was the slowest since there were internal politic problems at the time.

The international trade in tea gave rise to the East India Company. The company had a virtual monopoly in trade with China and India and was able to inflate prices to artificial levels. The monopoly later led to several wars being fought around the world.

Tea was discovered around 5000 years ago in china where the majority of the *Camellia* species can be found. The first tea seeds were transported to Japan by a buddhist priest around 800 AD and from that beginning there has been extensive breeding of the two species of *Camellia* that make up the genetic foundation for tea. *Camellia sinensis* var *assamica* is the subspecies bred for producing black tea. It has a larger leaf size, different agronomic characteristics such as flushing periodicity and chemical composition suitable for black tea. *Camellia sinensis* var *sinensis* is used for the production of green tea, Japan has devoted hundreds of years to the breeding and selection of cultivars for green tea. Government and private companies continue to investigate breeding tea with many new varieties becoming available in Japan each year to suit the various climates found in Japan and to create further opportunities for widening the harvest window. Green tea has a smaller leaf and is characterised by three or rarely 4 flushes of new growth per year.

The typical hedge shape of tea plantations is artificially induced by the need for crop management and the harvesting of the new flush of growth to process into tea. The crop requires specialised and devoted equipment. Tea harvesters range from around AUD\$2500 upward. The processing equipment may only be used 3 times a year and is valued at around AUD\$120 000 for a pilot plant up to between 1 and 4 million dollars for a basic plant which would be suitable for around 50 ha of tea plants.

The capital costs involved in establishing a tea plantation can be prohibitive for a small operator. The emphasis is then on finding alternative products and markets for the tea produced rather than the traditional Japanese style of tea and that market place.

Alternative products for green tea include semi-processed teas and leaf material, extracted polyphenols (or catechins) for the use in the cosmetic and pharmaceutical industries.

The steamed and dried leaf material may be used in products without further treatment or it may undergo an extractive process. Extraction of the catechins can be achieved by a similar method to the extraction of most essential oils. The term essential oil was attributed to a 16th century physician and was the total flavour and odour of a vegetable or plant. The value of essential oils relates to their ease of extraction and concentration from the plant.

4.3 A natural elixir

Tea contains large amounts of vitamin C, vitamin B, riboflavin, niacin, folic acid and pantothenic acid. Tea also contains trace elements such as manganese, magnesium, potassium and fluoride. The naturally occurring polyphenols contained in tea have been linked to the lowering of blood pressure, prevention of many types of cancer and as an aid in liver function.

4.4 Catechin chemistry

Tea contains polyphenols or tea flavenoids, which are often referred to as catechins. There are 4 main types of catechins:

- epicatechin (EC)
- epigallocatechin (EGC)
- epicatechin gallate (ECg)
- epigallocatechin gallate (EGCg)

Catechins are a form of bioflavonoids with several phenol groups and are characterised by their ring like structure. They control both taste and biological activity. The strongest catechin activity is found in EGCg, which is used as an antioxidant in food production health studies and cosmetic production.

4.5 Semi processed tea

Tea processing can be continued to varying extents after the initial steaming which is required to prevent the polyphenols within the green leaf from oxidising and causing the tea to turn black. The blackening effect caused by the oxidative process is the distinguishing feature between black and green tea. Green tea can be taken to a number of stages along the traditional Japanese style processing, or it can be diverted around the traditional processing to a final drying stage and used for a range of products other than Japanese style green tea. These can be in the form of other types of tea such as the Indonesian style gunpowder tea, for tea bags or it can be used as an ingredient in other products such as pharmaceuticals or cosmetics.

Tea is produced in a wide range of types and grades for world market. The DPIWE has produced a report for the Horticultural Research and Development Corporation detailing the different types and of green tea produced. The report covers aspects of taste aroma and phenology.

4.6 Extraction technology

There are a variety of possible ways to extract the polyphenols from green tea. There is a wide range of information on the processes involved in the extractives industry and are summarised here. There is more information in Appendix 3, which contains the WWW information.

4.7 Steam extraction of polyphenols from tea

Steam extraction (or distillation) of essential oils is an extensively used process for the food and flavour industry as well as the cosmetic and the pharmaceutical industries.

Steam distillation is often favoured by many industries since it does not contain non-renewable solvents or potentially toxic solvent contaminants, with associated solvent flammability and solvent recovery problems.

Fresh or dried vegetable matter is placed into a heatproof vessel and steam is circulated through the chamber. The steam acts as the solvent for the oils contained within the plant and dissolves them allowing them to be carried out of the chamber in the water vapour. The vapour is then passed through a condenser, which is jacketed in circulating cold water. The steam containing the extracted oils condenses on the inside of the condenser and runs into a collection vessel.

The extracted oil has a lower specific gravity than water and floats on top of the condensate and is separated from the water. The remaining water contains water-soluble components of the extracted oils and can be used as a product in itself often referred to as floral water or hydrosol, or it can be refined further.

4.8 Steam extraction with solvent processing

The plant material is steam extracted and a solvent 'scrubber' is placed at the end of the processing procedure to remove the last traces of the oils from the water condensate.

4.9 Solvent extraction

Solvent extraction yields a higher content of oil than other more conventional processes but has associated problems. This type of extraction has a higher capital cost than other processes.

Solvent such as hexane is used to saturate the plant material and dissolve the oils within the material. The solvent is then removed using vacuum distillation. The subsequent concrete is then dissolved in alcohol, which evaporates, and the essential oil is left.

Problems that are associated with this process can be undesirable residues of solvent may be left in the extracted oil, recovering the extractive solvent might be a difficult process or there are concerns with the use of some solvents and their toxicity.

There is increasing concern with the use of solvents derived from non-renewable resources and their use in the production of products destined for wholistic therapies. Increasing interest in traditional medicines and ecological therapies conflict with the use in part of the production of environmentally unfriendly processes.

4.10 Supercritical fluid extraction

These process use carbon dioxide pumped as a gas into a pressure chamber containing the plant material. The pressure builds up in the vessel and causes the carbon dioxide to condense into a liquid. The liquid CO₂ then acts as a solvent and extracts the required oils from the plant material. When the pressure is released from the CO₂ it reverts to its gaseous state and leaves the extract behind without any residues.

Carbon dioxide extraction has been shown to have a higher purity and potency than many other types of extraction and is favoured by the pharmaceutical industry. The processing method uses lower temperatures, makes some extracted materials like gums and resins easier to handle and has a higher yield with fewer residues than other extraction methods.

4.11 Cold pressing

This procedure is used when dealing with fruit oils such as citrus. It will be mentioned here as it may be used when dealing with tea seed oil extraction.

Fruit, which contains oil in the skin, is rolled over a rough surface to scarify the skin. The whole fruit is then crushed to release the fruit juice and the skin oils and the juice is then separated from the oil in a later process.

4.12 Use in food

There is increasing use of green tea in the flavour and fragrance industry. There is a strong industry in Japan in the production of Ready to Drink beverages (RTD). Canned RTD teas are sold from vending machines, supermarkets and shops in a similar way to western styles of canned beverages (for example Coke® and Pepsi®). The RTD industry in Japan has been detailed in a report prepared by Tea Craft for the DPIWE.

4.13 Pharmaceutical usage

Extract of green tea has been used in research for treatment of different types of cancer worldwide. Green tea extract has been implicated as an inhibitor of several types of cancer including mammary gland cancer in rats, skin cancer in mice and oesophageal cancer in humans.

Green tea extract has also been used in attempts to control and reduce cholesterol in a number of experiments worldwide.

As a bactericide green tea extract has been used in clinical studies on *Bordatella sp.*, *Staphylococcus sp.*, *Vibrio cholerae* and *Streptococcus sp.* It appears that the activity of green tea may be selective since there was no reported affect on the growth of *Salmonella enteritidis*, *Pseudomonas spp.*, *Aeromonas sobria* or *Vibrio fluvialis*.

Other trials have included green tea as an agent in the control of neurological seizures, as a radioprotectant and life extender after exposure to radiation, also as a blood platelet aggregation inhibitor with activity similar to aspirin.

Experiments have investigated the possible activity of green tea in the control of mycoplasmas such as *Mycoplasma pneumoniae*.

4.14 Health supplements

Green tea is provided as a nutritional supplement as either a stand-alone treatment or in a combination with other plant remedies. The tea appears to be encapsulated as a powder of either semi or fully processed green tea. There is no active ingredient listing on the product labels The label indicates that the product contains a specified amount of *Camellia sinensis*.

Products can be obtained which have a standardised rate of catechin content. Some products list the content of catechin on the label, as an equivalent to the active amount of the catechin.

4.15 Use in cosmetics

There is increasing use of green tea in cosmetics. The ranges of products, which contain green tea as an extract, or as a powdered form are increasing continually. Hair care products include shampoos and conditioners, ultraviolet screens and colour protectants. Cosmetics, which contain green tea, include moisturiser's perfumes, sunscreens and foundations.

4.16 Catechin analysis

Catechins are normally analysed for their concentration by High Performance Liquid Chromatography (HPLC). Testing is carried out by comparison of the test sample against a known reference sample.

4.17 Storage

There is little information available on the storage of green tea extract other than methods which are used for the storage of processed drinking green tea. Long term storage after processing for Japanese style green tea includes the product being stored in foil bags and flooding with carbon dioxide then heat sealed and stored in freezers.

Storage of the extract might depend on the methodology of the extraction process, the product destiny and time span involved for the usage of the product.

5. Statistics of Australian Tea Imports

5.1 Australian Bureau of Statistics (ABS)

The imports of the various grades, types and amounts of tea imported into Australia are detailed in the appendix section. The direct breakdown of the imported material is unavailable. The information contained in the appendix combines tea imported for different end use destinations like drinking tea, food flavourings or the extractive and cosmetic industries. The appendix containing the ABS statistics shows the country of origin, the final destination, amount in kg and the import value of green tea over several years. As an example in the 'under 3 kg' section over the period 96-97 AUD\$ 951,190 of green tea was imported into Australia from various countries. The under 3 kg packaging term is used to aid in the determination of tea quality, Bulk teas are imported in larger packages and re-packed on arrival. Generally the statistics imply that the consumption of green tea is increasing slowly in Australia.

5.2 Other source Statistics

The statistics section also includes some world production figures from countries, which produce tea. Tea is an expanding industry in several countries including Kenya, India, Indonesia, China, Sri Lanka and Zimbabwe. Factors which affect the competitiveness of these countries in the world market include capital costs, labour costs and availability (hand picked teas sell at premium prices) and the amount of quality arable land devoted to the production of the crop.

Several companies producing different types of products that include green tea in their ingredient lists were contacted. These companies included cosmetic and nutritional supplement companies.

The nutritional companies were unable to supply any information so the information gained from the cosmetic companies will be used here.

5.3 Imports of catechins

Sufficient information was unavailable to determine if there are any imports of green tea extract specifically the essential oil of green tea.

6. World Markets

6.1 Introduction

Transport of live plants or plant material both interstate and overseas must meet legislated requirements of the state or country that it leaves and the country that it enters. After processing, the plant material or derivative product may also need to meet certain requirements set out by the quarantine department of the target state or country. If the destination of the product has an industry, which may be threatened financially or by disease, then often the government will place obstacles to prevent the threat being realised.

Green tea is a prospering industry in many countries around the world including developed and non-developed countries.

Importing or exporting tea products to different countries requires some understanding of import / export restrictions and an understanding of quarantine regulations.

6.2 Trade restrictions

Tariff and non-tariff restrictions apply to international trade, they are applied to both importing and exporting countries for a variety of purposes. Tariffs, safety regulations and technical standards are the most common restrictions imposed on international trade of products.

6.3 Non-tariff restrictions

The Convention of International Trade in Endangered Species is an example of a non-tariff trade restriction. It is used to cover trade in some spices, which are rare, and /or have not undergone extensive breeding programs for agricultural pursuits.

Health and safety regulations are continually under review by most countries. Regulations are increasingly reviewing botanical products particularly in the areas of pesticide residues, minimum requirements for active ingredient levels and product purity.

Phyto-sanitary requirements restrict the entry into a country of microbial contaminants, insects, amphibians or mammal pests. Contamination by foreign matter such as sand or dirt is also monitored.

Post harvest processing, packaging and disinfestation regulations apply to many products, which are traded internationally. The fumigation disinfestation requirements are variable between different countries and some products can be contaminated by the fumigation procedure required.

Quality and technical standards require appropriate identification of the botanical materials, medicinal qualities, characteristics and storage. These aspects are well defined in most importing country's pharmacopoeias.

Most major markets have stringent legislation governing the importation of edible plant products. Some of the requirements include purity, cleanliness and freedom from contamination of pesticide residues.

International Organisation for Standardisation (ISO) provides guidelines and minimum requirements for many products traded internationally. The ISO standards allow a measurable quality expectation for products, which are to be imported or exported.

6.4 Tariffs

Tariffs are designed to protect domestic markets for locally produced goods by decreasing the competitiveness of the imported goods. Import tariffs also raise revenue for the government and are often accompanied by a consumption tax.

Export tariffs act mainly to raise revenue for the government from the products being exported out of the country and are mainly found in developing countries.

6.5 European market

The European market is emerging rapidly as a consumer of nutraceuticals and cosmetics with green tea used as part of the ingredient list. As yet there is no readily available information of market details.

6.6 American market

The South American market was investigated by Tea Craft for the DPIWE and a report titled 'Tea in South America' was written in 1993.

6.7 Asian market

Tea Craft was funded to submit a report detailing the production and marketing of tea in Indonesia, Korea, Thailand, Vietnam, Hong Kong and Singapore. The report titled 'Green Tea – Production and marketing in South East Asia' was written in 1995 for the DPIWE.

6.8 Japanese Market

Teacraft, a consultancy company, which produced a desktop study for the DPIWE, titled, has detailed the Japanese market 'Green Tea: Production and marketing in Japan'. The consultancy examined the trade in tea in Japan and also briefly looked at some value added products such as the ready to drink market.

7. Product survey

A brief survey was carried out in supermarkets, department stores and specialist cosmetic or health food shops to assess the range of products which might use green tea in their formulation. This survey is not intended as a complete catalogue of the products available and is only intended to give an introductory assessment of the variety of uses that green tea might be suitable for.

7.1 Ready to drink tea

There is an increasing worldwide market for canned and bottled ready to drink green tea. The WWW search in the appendix section shows the wide variety of flavoured ready to drink green tea which can be carbonated or not with added herbal remedies in the drink. Packaging of ready to drink teas can range from canned, bottled and tetra-pac and the product destiny determine the type of packaging, ie cans to be sold in vending machines.

7.1.1 Liptons

An iced tea range, which includes a green tea and honey, flavoured drink in bottles.

7.1.2 Tribal Tonic

A range of premium herbal enhanced green tea drinks, which contain added herbal ingredients such as ginseng, parsley and ginkgo biloba. The products are sold in glass containers.

7.1.3 So Be Essentials

Green tea drinks which have fruit juices added to enhance the flavours. The ranges of products are bottled.

7.2 Jurlique

The web home page is included in the appendices section and the direct Web address is:

<http://www.jurlique.com.au/>

7.2.1 Face wash cream

A paste type product to be used to clarify the skin on the face and neck.

7.2.2 Foaming facial cleanser

A mild cleanser for suitable for all skin types, to be used once or twice daily.

7.3 Rexona

7.3.1 Lux skin sense

Body wash, moisturiser, body bar and body mist

Ranges of products, which contain lime and green tea, extract to refresh and smooth the skin.

7.4 The Body Shop

The web home page is included in the appendices section and the direct Web address is:

<http://www.int.the-body-shop.com/index.html>

7.4.1 Green Olive Shower Gel

A soap free shower gel containing soapwort, green olive oil and green tea extract.

7.4.2 The Body Shop Colourings- Tea Zone

An anti shine product for use under foundation or as an alternative to foundation. It is designed to prevent the skins natural oils from becoming evident through the facial make-up particularly in the 'T' zone of forehead nose and chin.

7.5 Bio-Organic

Natural nutrition and bio-organics are maintained under the parent company Bullivants. The web home page is included in the appendices section and the direct Web address is:

<http://www.bullivants.com.au/>

This brand is one of several produced by Bullivants. The products are capsules of herbal remedy, which contain various amounts of powdered green tea. The products are either a combination of other plant remedies for treatment of various conditions or a pure powdered green tea specifically used for its anti oxidant properties.

7.6 Natural Nutrition

A company that produces a nutritional supplements with green tea extract as a major ingredient for its antioxidant properties. Each tablet contains a standardised amount of green tea extract equivalent to 2g of green tea.

8. Further reading

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Monks A.J. and Baxter, L.B., 1997 - To Continue the Investigation into the Commercialisation and Development of Japanese Green Tea, *Camellia Sinensis*

Tasmanian Dept. Primary Industries and Fisheries, 1996 - Quality Assessment and Market Evaluation of Tasmanian Green Tea for the South East Asian Market

Department of Primary Industries Water and Environment 1999 Continued Investigation into the commercial production and development of Japanese green tea in Tasmania.

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9. Appendix

Included in this appendix are ABS information and information gleaned from the WWW. Information is also included on the history, chemistry and uses of green tea, various extraction methods and product home pages, which have information relating to the product.

The material is held on file and can be obtained on request from RIRDC.