



Independent
Agriculture
& Horticulture
Consultant

Indigenous Herbs Feasibility Study

Prepared For MabX

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Executive Summary

MabX has requested AgFirst complete a feasibility study on three indigenous herbs for medicinal, commercial production on whenua Māori. They are, Horopito, Kawakawa and Harakeke. Obtaining commercial information regarding production and financial performance of these three herbs as crops was particularly challenging. Most companies buying raw product were not willing to share any information, and identifying current growers was also difficult. Therefore, the details in this report are based on a desktop assessment and include details of the main companies, products and selling prices for each of these herbs. Despite potential benefits to health and well-being from products produced from these herbs, a number of constraints to achieve commercial scale were also identified and include, scale, access to drying facilities and potential cultural implications.

Overview

Horopito, Kawakawa and Harakeke were identified from the Medicinal Herbal Research Report (prepared for the Rua Taranaki Medicinal Herbal Cluster) as having potential commercial value to be grown on Māori land in Taranaki, particularly for the use in medicinal compounds. There is a growing market for products that promote health and well-being. These herbs have been demonstrated to provide these benefits and this potentially creates an opportunity for growers.

These herbs have an increasing commercial value when processed into different products, but a major constraint for the producers of these products is access to a consistent volume of the raw ingredients/product from growers. A lot of growers are smaller scale which can restrict the commercial opportunities for the market. Manufacturers and retailers are trying to build a sustainable economy to support small growers and businesses. A further constraint is access to drying facilities as it is not feasible for every grower to have their own. A regional hub would help cut down costs and be mutually beneficial for the grower and producer to increase profit margins, but this does not currently exist. The cultural aspect is another important consideration especially for Harakeke which is primarily used for fibre. Weavers do not commercially grow natural fibres for weaving and therefore the commercial value is hard to ascertain. The fibres are harvested under strict Tikanga and transferring this to a commercial setting may have its challenges.

Methodology

The intention was to undertake a full feasibility study which would provide an assessment of production considerations and profitability of Horopito, Kawakawa and Harakeke. There is no publicly available information available to support this, therefore the initial research included contacting industry growers and manufacturers of the end product to obtain financial and yield details (or any indication of this). However, despite best efforts, growers and manufacturers were not able or willing to share this information for the purposes of the report. Therefore, a desktop assessment was undertaken to identify products available made from the three herbs, prices, and the associated selling medium.

Summary information of product offering of each herb

Horopito

Horopito (*Pseudowintera colorata*) is also known as the pepper tree, due to its pepper like taste. This is a New Zealand native shrub which grows up to 2.5m tall has green leaves with red, rusty coloured spots. Māori first used Horopito in traditional Māori medicine and healing to treat fungal skin infections and other skin conditions. Today it has many claimed benefits including anti-fungal, anti-bacterial, anti-viral, anti-inflammatory and antiseptic (Horopito: New Zealand's Herbal Hero, n.d.), (Horopito, 2024).

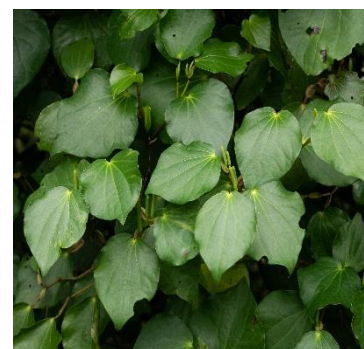


Company	Product	Amount	Price	Use	Selling Medium
Pure Nature	PlantæDerMX® Horopito Leaf Extract	100g	\$39.00	Topical treatment	Online
Kolorex	Women and men's intimate care collection, derma range and gut care products E.g. Candia Balance Gut Care	30 soft gels	\$29.90 – Kolorex \$20.40 – Pharmacy Direct	Health supplement	Online and through resellers in New Zealand (pharmacies, health shops)
Zurma Botanical Oil Studio	Horopito Extract	100ml	\$25.00	Topical treatment	Online
Forest Gourmet	Dried Horopito	100g	\$49.95	Food additive	Online
Oku	Circulate (Kawakawa and Horopito Heart Tea)	30g	\$18.98 – Oku \$19.50 – HealthPost	Health supplement	Online and through resellers in New Zealand (pharmacies, health shops)
Leena Spices	Horopito Dried	40g	\$11.00	Food additive	Online
Self Heal	Horopito Tincture 1:5	100ml	\$19.80	Topical treatment	Online
Waiheke Distilling Co	Horopito Spice Vodka	700ml	\$95.00 – Waiheke Distilling Co \$81.99 – Liquorland	Beverage	Online and in store through liquor stores
Ocho Chocolate	Horopito & Kawakawa 66%	95g	\$14.50 – The Chocolate Bar NZ \$12.65 – Otago Chocolate Company \$11.90 – Chocolate Post	Food product	Online and in store through resellers
Moana New Zealand	Horopito & Beef Ragu	300g	\$9.99 – Moana New Zealand \$9.49 – New World	Food product	Online and in store in supermarkets

Aoraki	Aoraki Smokehouse BBQ and Horopito Dry Rub Hot Smoked Salmon	180g	\$17.99 – PaknSave, New World	Food product	Online and in store in supermarkets
Purelicious	Horopito Savoury Rub	52g	\$7.99 – FreshChoice	Food additive	Online and in store in supermarkets
Silver Fern Farms	Honest Beef Burgers with a Touch of Horopito Pepper	500g	\$13.49 – New World	Food product	Online and in store in supermarkets

Kawakawa

Kawakawa (*Macropiper excelsum*) is a New Zealand native herbaceous shrub which grows up to 6m tall with knobbly joints, branching stems and dark green heart shaped leaves. The name Kawakawa refers to the bitter taste of its leaves. It can be found in the coastal and lowland forests of the North Island and the northern half of the South Island. Kawakawa was used in traditional Māori medicine for herbal remedies or concoctions such as teas. Today it has many claimed benefits including anti-inflammatory, antioxidant, anti-bacterial and analgesic effects (Kawakawa- Everything You Need To Know About This Amazing Native Plant, 2022), (Kawakawa, 2024).

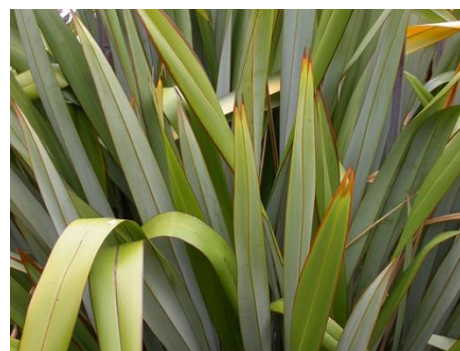


Company	Product	Amount	Price	Use	Selling Medium
Waiheke Distilling Co	Kawakawa Summer Vodka	700ml	\$95.00 – Waiheke Distilling Co \$94.99 – Liquorland	Beverage	Online and in store through liquor stores
Kara Kawa	Kawakawa Soap	65g	\$7.00	Topical treatment	Online
	Kawakawa Healing Balm	25g	\$17.00	Topical treatment	Online
Oku	Kawakawa Healing Balm	40g	\$17.98 – Oku \$15.00 – HealthPost \$17.50 – Pharmacy Direct	Topical treatment	Online and through resellers in New Zealand (pharmacies, health shops)
KawaCure	Kawakawa Traditional Balm	100ml	\$28.00	Topical treatment	Online
Aotea	Kawakawa Balm	30ml	\$22.00	Topical treatment	Online and in store through resellers in New Zealand
Koa Organics	Kawakawa Balm	65g	\$35.50	Topical treatment	Online and in store through resellers in New Zealand
	Kawakawa Lip Balm		\$13.50	Cosmetics	Online
Simply Kawakawa	Natural Healing Balm	30ml	\$13.00	Topical treatment	Online
Honest Skincare	Kawakawa Balm	80ml	\$35.00	Topical treatment	Online
Oosh	Kawakawa Lavendar & Magnesium Balm	100ml	\$38.00	Topical treatment	Online
Forest Gourmet	Kawakawa Flakes	50g	\$24.95	Food additive	Online
Ocho Chocolate	Horopito & Kawakawa 66%	95g	\$14.50 – The Chocolate Bar NZ \$12.65 – Otago Chocolate Company \$11.90 – Chocolate Post	Food product	Online and in store through resellers

Six Barrel Soda/Zealandia	Kiwifruit & Kawakawa Syrup	500ml	\$19.50 – Six Barrel Soda, Zealandia, The Warehouse	Beverage additive	Online and in store through retailers
Wildly	Wild Delicious Matakana Peppermint Lime & Kawakawa Sparkling Probiotic Water Kefir	750ml	\$30.00 – Wildly \$14.99 – New World	Beverage	Online and in store in supermarkets
The Bond Store	Kawakawa Gin	700ml	\$54.00	Beverage	Online
Planta Mate	Planta Yerba Mate Sparkling Lime and Kawakawa	330ml	\$5.50	Beverage	Online through resellers
Purelicious	Kawakawa Savoury Rub	52g	\$7.99 – FreshChoice	Food additive	Online and in store in supermarkets
Moana New Zealand	Kawakawa, Tomato & Chicken Tagine	300g	\$9.99 – Moana New Zealand \$10.49 – FreshChoice	Food product	Online and in store in supermarkets
Ti Ora	Herbal Infusion Peppermint with Spearmint & New Zealand Kawakawa Tea	15 pack	\$6.29 – PaknSave \$7.00 – Countdown \$6.79 – New World	Health supplement	Online and in store in supermarkets
Silver Fern Farms	Honest Lamb Burgers with a Pinch of Kawakawa Herb	500g	\$13.49 – New World \$14.49 – PaknSave	Food product	Online and in store in supermarkets
Good Buzz	'A' Series Hawkes Bay Peach & Kawakawa Kombucha	6 pack 1l	\$99.99 – Good Buzz \$15.99 – New World	Beverage	Online and in store in supermarkets
Taha	Sparkling Tonic Water	4 pack	\$12.00 – Countdown	Beverage	Online and in store in supermarkets
Atutahi	Kawakawa Lemon & Lime	15 pack 12 pack	\$60.00 – Atutahi \$54.00 – Nelson Marker	Beverage	Online, farmers markets and in store

Harakeke

Harakeke (*Phormium tenax*) or common flax is a New Zealand native with long, upright, and stiff leaves which can be up to 4m in length. It is found throughout New Zealand from sea level to 1300m asl, specifically in wet areas. Traditionally Harakeke fibres are used in Māori craft for weaving into kete (baskets), whariki (floormats), cloaks and robes. It is also used for medicinal purposes (Harakeke, n.d.), (How Harakeke Was Traditionally Used By Māori, 2022).



Company	Product	Amount	Price	Use	Selling Medium
Pure Nature	PlantæDerMX® Harakeke Leaf Extract	100g	\$39.00	Topical treatment	Online
Go Native	Harakeke hydroethanolic extract	100ml	\$55.00	Topical treatment	Online
Real World NZ	Harakeke & Blood Orange Handwash	100ml	\$39.00	Topical treatment	Online and in store
Aotea	Harakeke Seed Oil Night Cream	60ml	\$55.00	Topical treatment	Online and in store
Tigerlilly's	Harakeke (NZ Flax) Seed Oil	50ml	\$16.00	Topical treatment	Online
Antipodes	Baptise H ₂ O Ultra-Hydrating Water Gel	60ml	\$52.00 – Antipodes \$41.00 – Bargain Chemist \$41.99 – Pharmacy Direct \$43.90- HealthPost	Topical treatment	Online and through resellers in New Zealand (pharmacies, health shops)
Living Nature	Hydrating Toning Gel	120ml	\$47.00 – Living Nature \$35.50 – Pharmacy Direct \$40.75 – HealthPost	Topical treatment	Online and through resellers in New Zealand (pharmacies, health shops)
Kara Kawa	Kawakawa & Harakeke Soap	65g	\$8.00	Topical treatment	Online
Ecostore	Dishwash Liquid Jasmine & Harakeke	1l	\$8.49 – Countdown, New World, Ecostore	Cleaning product	Online
The Wildside	Harakeke Lip Balm	10g	\$8.00	Cosmetics	Online
Frances Nation	Kete waikawa with handles		\$125.00	Consumer products	Online
Kura Gallery	Flax woven Kete		\$375.00	Consumer products	Online and in store
Flaxworx NZ	Large Kete Whakairo – Green and Natural		\$249.00	Consumer products	Online

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Feasibility Study on **Astragalus Membranaceus**

Astragalus Membranaceus is a perennial herbaceous plant in the Fabaceae family that is native to China. It is one of the most widely used herbs in traditional Chinese medicine. The use of Astragali Radix dates back to more than 2000 years ago, where it has been utilised as a top grade medicine, often taken for its many benefits and limited adverse side effects even when used over a long period of time.

It is predominantly grown in the northern Chinese provinces of Shanxi, Jilin, Hebei as well as inner Mongolia. It usually grows between 80 - 150cm tall with leaves made up of 5 - 14 pairs of leaflets and distinct yellow flowers. It prefers cool and dry conditions.

Astragalus Membranaceus has not been cultivated on a large scale in New Zealand. Yet given the mild climate and fertile soil of Taranaki, there are opportunities for New Zealand producers to grow Astragalus Membranaceus. The primary focus of this report centres around the production of raw, unprocessed Astragalus Membranaceus products.



1. Soils

Astragalus Membranaceus is a deep-rooted plant and therefore best grown in dry, sandy and fertile soil that is well drained, with plenty of sunlight.

The ideal soil for growing Astragalus Membranaceus is sandy loam. Slightly low acidic to neutral pH level soil is preferred, with the ideal pH level being 7. Astragalus Membranaceus is resilient to drought, however excessive water is harmful to the crops. Therefore, low lying land is not preferred as water can accumulate easily.

The root of Astragalus Membranaceus can grow up to 90cm and therefore the soil must be cultivated to a minimum depth of 40cm to maximise production. The ideal soil depth should be equal to or greater than 40cm with no impeding layer within 1m of the surface.

Astragalus Membranaceus is predominantly found in its wild state in dry and sunny grasslands, forest edges, and areas with dark brown loam soil. These habitats are commonly located in mountainous or semi-mountainous regions with altitudes ranging from 800 to 1300 meters. However, when considering the practicality of utilising machinery for cultivation, flat land is preferred for farming Astragalus Membranaceus to facilitate the efficient use of machinery.

2. Climate

Temperature

Astragalus Membranaceus is resilient to severe cold. The plant can survive in temperatures as low as -40°C, and up to 38°C. The ideal annual average temperature range is -3 to 9°C.

For reference, Chifeng (a city in inner Mongolia) that produces top quality wild astragalus, has an annual average temperature of 0 to 7°C. The average annual precipitation is 380mm, with nearby areas averaging between 350 to 450mm. The number of sunshine hours in various parts of the city ranges from 2800 to 3100 hours. For some context, the winter season is characterised by its long duration, cold temperatures, and

relatively less snowfall but strong winds. Spring arrives swiftly, bringing dry and windy conditions. Summers are short, with concentrated rainfall. In autumn, temperatures drop sharply, leading to the onset of frost, while sunshine remains abundant. These climatic conditions contribute to the success of *Astragalus Membranaceus* cultivation in Chifeng. It belongs to the temperate semi-arid continental monsoon climate zone.

Annual average temperature: 7.2°C

Average temperature in summer: 23°C

Maximum temperature: 39°C

Average temperature in winter: -11°C

Minimum temperature: -30°C

In comparison, Taranaki is one of the sunniest and windiest regions in New Zealand, with a mild climate. Summer temperature ranges from 19 to 21°C, and rarely exceeds 30°C. Meanwhile winter averages between 7 to 8°C and can reach as low as 3°C in mountainous areas. The annual average temperature is around 13.5°C. Furthermore, Taranaki receives over 2,000 hours of sunshine annually, contributing to favourable conditions for growing *Astragalus Membranaceus*.

It's worth noting that while Chifeng's climate provides optimal conditions for wild *Astragalus Membranaceus* growth, commercial cultivation in different regions may require adaptations based on local climate and environmental factors.

Water requirements

Astragalus Membranaceus likes cool and dry conditions and is resilient to drought. The topography of the land determines if drainage facilities need to be provided. If the terrain is low, drainage facilities are necessary to prevent water accumulation during heavy rain events.

The annual rainfall of most areas that grow *Astragalus Membranaceus* in China rarely exceeds 1500mm. Often, the areas that produce *Astragalus Membranaceus* successfully suffer from severe droughts, with annual rainfall no more than 600mm which is considered low. If the rainfall ranges within 1000mm annually and is not too concentrated; it is considered a low rainfall area, and should not require drainage to be built specifically for *Astragalus Membranaceus*.

In Taranaki, the average annual rainfall ranges widely, from an average of 1500mm, to an excess of 2000mm per year. Therefore the choice of location for the planting of Astragalus must be carefully considered. It is strongly recommended that Astragalus Membranaceus be planted in areas where annual rainfall is less than 1500mm.

3. Planting techniques and requirements

Cultivation

Plow the land about 40cm deep and for each hectare, apply 1500kg of sulfate-based NPK compound fertilizer or organic fertilizers and animal husbandry fertilizers treated with high temperature bacteria, ideally in autumn.

Planting

Astragalus Membranaceus can be planted during either spring or autumn, although spring is preferable. It can be grown by either direct seeding or transplanting. An effective method for stratifying Astragalus seeds involves soaking in warm water for approximately 24 hours.

1) Direct seeding: seeds are planted into trenches with spacing of 25 - 30cm and at a depth of 2cm, and then covered with a layer of soil up to 1.5cm. This will usually lead to germination in 7 days.

2) Transplanting: dig out the seedlings during the second year, and transplant to another field. Dig a 10cm deep trench, and place the seedlings head to tail with their buds facing upwards; burying them in the soil at an angle. Stamp firmly into the soil, and water. Cut off the stems, leaves and hairy roots, leaving only the buds. Seedlings are planted into trenches with a spacing of 10cm between rows and 25 to 30cm within each row. It can be planted for about three years after transplanting.

More manual labour is used for transplanting. This method ensures easier harvesting of the roots in the future as it grows closer to the soil surface, yielding thicker roots that are highly valued in the market. This method is suitable for large-scale production. Although it is labor-intensive, it has many advantages and is high-yield, high-quality. Notably, China commonly employs this method in its cultivation of *Astragalus Membranaceus*.

Field Management

1) Fertilising

Use NPK compound fertiliser or Monopotassium phosphate on the leaves or roots during summer.

2) Weeding

Weeds grow rapidly during the seedling stage; hand weeding or inter-row hoeing is required. Weeding required 3 - 4 times annually.

3) Pest management

Mainly to combat insect pests; pyrethroid insecticides are normally used in China. There are basically no other viral fungal diseases.

4) Irrigation

Sprinkler irrigation is usually used.

4. Fertiliser requirement

Fertiliser

Cultivation is required prior to planting. It is suggested to do a basic soil test, which will provide a nutrition profile of the soil to confirm suitable fertiliser to be used. In China, 1500kg of standard NPK based fertiliser or 22,500kg of organic fertiliser processed under high temperature is normally applied per hectare.

Herbicide

During cultivation, it is common to spray out a field with a herbicide such as glyphosate to kill weeds.

Insecticide

In China, pyrethroid insecticides are generally sprayed to combat insect pests. There are basically no other viral fungal diseases. This would be applied by tractor mounted sprayer or helicopter/sprayer. It is important to note that insecticide requirements depend on the specific pests and environmental factors present in each location. New Zealand may have differing pest pressures and environmental conditions that need to be addressed.

5. Infrastructure and investment

Equipment

Infrastructure required:

- 1) Cultivation machinery
- 2) Fertilising spreader
- 3) Sowing machinery
- 4) Insecticide sprayer
- 5) Harvesting machinery
- 6) Freezer for storage
- 7) Sprinkler irrigation system

- 1) Cultivation machinery

Soil will need to be cultivated with tractor mounted discs or rotary hoe and harrowed to create a suitable seed bed. It is advisable to consult with a contractor or agricultural expert who can provide specific guidance on the most suitable cultivation techniques and equipment for the soil conditions and crop requirements in the given area.

- 2) Fertiliser spreader

Fertiliser would normally be applied at this stage using a tractor mounted fertiliser spreader. It is recommended to consult a fertiliser expert to help ensure optimal nutrient management for the crop's growth and development.

3) Sowing machinery

A tractor mounted direct seed drill that can handle soft seeds should be used to sow the seeds directly. This would need to be discussed with the contractor to ensure the drill is suitable.

4) Insecticide sprayer

If spraying of insecticide is required it may be important to have the plants in rows that will allow the tractor wheel to pass over without crushing the plants. The same goes for weeding (if done mechanically). Not an issue with hand labour.

5) Harvesting machinery

Harvesting would be best done mechanically on a large plantation. A potato harvester or carrot harvester might be suitable for this. The contractor should also be able to give some advice prior to planting to ensure rows are suitable for mechanical harvesting.

6) Storage

A freezer is required to store the dried products. The size depends on the quantity of products.

In China, sowing and harvesting machinery are specifically customised for planting *Astragalus Membranaceus*, taking into account the size of land and the spacing of rows between the plants. They vary in width, from 1 to 2m. Generally, pesticides and weed spraying are applied manually (via knapsack sprayers) allowing for targeted application. For small-scale land, weeding is normally done by hand. At the same time, sprinkler irrigation can be used to distribute pesticides.

Drainage

Rainfall and drainage must be carefully considered when growing *Astragalus Membranaceus*. Firstly, the contours of the land will need to be taken into account. If the terrain is low, drainage ditches should be constructed to prevent water accumulation during heavy rain events. Higher and steeper terrain will not require doing so. Sandy loam soil is preferable as it is well draining. However, if the location receives over 1500mm of annual rainfall, then drainage ditches must be implemented regardless of soil condition or contour of the land.

The ideal amount of rainfall for a location that grows *Astragalus Membranaceus* should fall within 1,000mm annually. Additionally, if the soil is sandy loam which is highly permeable, it should help alleviate water accumulation. Therefore, if the above conditions are met, then it should be highly suitable for growing *Astragalus Membranaceus* without requiring any drainage to be constructed.

Skills and labour

The manager of this operation would ideally have experience in growing *Astragalus Membranaceus* or similar plants used in traditional Chinese herbal medicine. Alternatively, experience in cultivating root vegetables could be suitable, provided they are willing to conduct research and adapt their knowledge as the project progresses.

This experienced manager would oversee the overall operations. Contractors would be hired to complete the jobs that require operation of large scale equipment. Whereas jobs such as hand weeding, spot spraying, and general maintenance can be completed by either the manager or low skilled labourers.

Depending on the size of the land, the manager may undertake most if not all of the tasks. For larger scale allotments, seasonal and/or additional workers may be required.

The role of the manager includes but is not limited to:

- Soil nutrition management
- Fertiliser application
- Weed control
- Pest and disease control
- Sowing of seeds and/or transplanting
- Irrigation monitoring and maintenance
- Harvest management
- Liaison with contractors and ensuring work is completed accurately
- Management of seasonal/additional workers

6. Processing requirements

Harvest

Harvest approximately 2 or more years after sowing if plants are direct seeded, or 1 - 3 years after transplanting. As time goes by, the roots will become thicker and longer, and the medicinal content will be higher. Generally, it takes no more than four years to reach the best state in terms of yield, medicinal properties and products.

Dig out roots in spring or autumn; preferably in autumn.

Processing

Cut off rootstocks and shake off any residue sand and soil. Dry roots under the sun to remove 80% of moisture. Tie into bundles of 2.5kg and then repeat sun-dry process until all moisture is removed.

Dried Astragalus roots are often sold in slices in Chinese communities. To cut the roots into slices requires a customised slicing machine. The slicing machine is made with a whetstone and an electric motor, and a skilled technician operating the machine is required. (A slicing machine will cost RMB 10,000 approximately.) Given that it will be a small-scale cultivation, slicing machine with a technician is not recommended to acquire at this stage. The freezer would help maintain the quality and shelf life of the dried Astragalus roots, ensuring that they remain fresh and retain their medicinal properties until they are sold.

7. Markets

Global consumption

Astragalus Membranaceus has been widely used in Chinese medicines, health products, foods, teas, drinks, wines and cosmetics. Demand has spiked since COVID-19 in 2019. The annual consumption of Astragalus Membranaceus in China during 2021 and 2022 were 35 million kg per year, with global demand also steadily increasing.

Astragalus Membranaceus has high export value in China. 4 million kg is exported from China annually, of which 90% is consumed within Asia. Destinations include Hong Kong, Korea, Japan, Taiwan and Malaysia.

The global market for Astragalus Membranaceus root extract is projected to grow from US\$ 358 million in 2023 to US\$ 525 million by 2033.

Global production

China dominates the Astragalus Membranaceus production globally. Astragalus Membranaceus is mainly produced in Northern parts of China. The annual production of Astragalus Membranaceus in 2021 and 2022 were 40 million kg per year.

Domestic market

Astragalus Membranaceus has high demand in both global and domestic markets. In New Zealand, the conservative estimate for demand of Astragalus Membranaceus root extract is approximately 800kg per year, which is currently imported from China. At this moment, retailers in New Zealand are largely only importing/selling Astragalus in the form of a sliced root product. The average retail price is NZ\$ 300/kg.

Considered a high value herb locally and globally, it may be positioned at a premium price point. Local traditional Chinese practitioners/stores are likely to purchase New Zealand grown Astragalus provided that the product is price-competitive and has similar or better qualities than the existing Chinese product. The fact that it will be New Zealand grown, and more easily accessible is an added bonus.

As one of the leading retailers in traditional Chinese medicine in New Zealand, Jean's Natural Herbs is always looking for opportunities to market New Zealand grown products. However most importantly, the product itself must be superior or comparable at the very least to the Chinese-grown.

Given the absence of large-scale farming of Astragalus in New Zealand and the price competitiveness of imported Astragalus, it is reasonable to focus on high-quality production for smaller, higher-value markets. Targeting consumers who are willing to pay more for New Zealand-grown products would be a strategic approach.

By targeting smaller, higher-value markets, exploring organic cultivation, and potentially adopting a wild or semi-wild approach, New Zealand can differentiate its Astragalus products, positioning them as premium offerings with superior quality and unique characteristics.

8. Financial Indications

Investment in infrastructure will be impacted by the anticipated returns over future years, as well as available budget and existing assets that can be readily utilised.

Typical infrastructure may include a tractor, mounted tractor equipments, harvesting machinery, drainage trenching, irrigation, sprayers for weeding/pesticides and miscellaneous equipment.

As mentioned above, the size of the plot of land will influence the type of machinery and/or infrastructure that will be used. For example, the cost of a tractor can vary widely, anywhere between \$20,000 to \$150,000. Whereas a (potato) harvester can cost between \$3,000 to \$20,000 depending on its size.

For reference, some of the infrastructure used by small-scale Astragalus farmers in China (around 20 hectares) cost the following:

- Customised tractor-mounted direct seeding (\$1,200)
- Customised Astragalus harvester (\$3500)

The capital cost of starting up an Astragalus farming operation in New Zealand, where there is no current infrastructure or model may be quite expensive. It may be wiser to look at more affordable options in the short term. There are two proposed options:

Option 1: Hire existing farm equipment from similar operations, along with contractors to carry out the work to be overseen by a farm manager. This requires much less financial investment towards machinery in the short term.

Option 2: Purchase specific customised machinery/equipment from China as outlined above, which have been adapted to suit Astragalus farming and maximise efficiency. And potentially hire a contractor from China who is currently farming Astragalus to oversee the work, and advise local NZ workers on the process throughout. Factoring the additional shipping costs and/or fees, it may still be viable, as the efficiency may outweigh the costs.

Development work (drainage, land preparation, irrigation, spraying) will also vary widely depending on the size and contour of the land. The development assumes drainage and irrigation are required. A drainage trench will cost approximately \$12,000 per 100m. A sprinkler irrigation system will cost roughly \$6,000 - \$9,000 per hectare.

As *Astragalus Membranaceus* is a perennial plant, the cost of upkeep and field management (labour/fertiliser/weeding) from the second year onwards will be half (50%) of the first year.

More investigation will be required in this area for individuals to budget for specific machine harvesting equipment.

The following table is a rough breakdown of income as well as associated costs of growing one hectare of *Astragalus*. The data are collected from consultants/working farmers from China. The yield and expenses are calculated based off a per hectare rate in China. These details should be considered as a preliminary indication.

Due to the numerous variables, we are unable to outline a precise breakdown of all the associated costs and therefore cannot provide a gross margin. The table provides a rough outline of the development and infrastructure costs, worked out to a per hectare rate. There are many variables and costs that we have not included in the table, such as: farm manager salary, freight, maintenance & repair of machinery, fuel & electricity, water, overtime and/or miscellaneous costs. Further research should be conducted to ensure an accurate representation of the expenses for growing the very same herbs in New Zealand.

Astragalus	Unit	Price per hectare
Income		
Yield	4,500 kg (over 3 years)	
	\$150/kg (assumed wholesale price) (retail price - \$300/kg)	
Total income		\$675,000
Expenses		
Seed	75 kg	\$800
Fertiliser	1,500 kg	\$2250
Weed and Pest	Site dependent (variable)	TBD
Planting	150 hours (low skilled worker - assumed min. wage)	\$3405
Weeding	150 hours (low skilled worker - assumed min. wage)	\$3405
Machinery operating - Harvesting	150 hours (skilled contractor)	\$7500
Machinery operating - Processing	75 hours (skilled contractor)	\$3750
Tractor		\$20,000 - \$150,000
- Mounted discs for ground preparation		TBD
- Mounted fertiliser spreader		TBD
- Mounted direct seed drill		TBD
Insecticide sprayer		TBD
Harvester (Potato)		\$3,000 - \$20,000
Storage		TBD
Drainage trench		\$12,000 / 100m
Irrigation		\$6,000 - \$9,000
Total expenses		TBD

9. Challenges

Climate

Excessive rainfall or high humidity levels can pose challenges to the crop's growth and development. Therefore, careful consideration should be given to selecting an optimal location for *Astragalus Membranaceus* cultivation as well as implementing proper drainage systems to mitigate water accumulation to maintain ideal growing conditions for the crops.

Varying soil conditions

It is important to note that without detailed information on the specific soil conditions and the correlation of insecticide/fertiliser requirements between New Zealand and China, it is challenging to make direct comparisons or draw definitive conclusions, specifically pertaining to the potential development/cultivation costs. Soil conditions can vary significantly between regions (let alone countries), impacting plant growth and nutrient availability. Conducting thorough research and analysis specific to the target region in Taranaki is necessary to determine suitable soil conditions and insecticide/fertiliser needs for successful *Astragalus Membranaceus* cultivation.

Two worlds apart

There is limited research and local knowledge on *Astragalus* cultivation specific to New Zealand, highlighting the need to address knowledge gaps and conduct region-specific research tailored to New Zealand's conditions is essential. *Astragalus Membranaceus* has a long history of cultivation in China, with Chinese farmers having gathered valuable data and insights through years of trial-and-error, resulting in efficient cultivation practices. To bridge this knowledge gap between the two countries, one potential option could be to engage a contractor from China who can directly advise their New Zealand counterparts, leveraging their expertise and experience in *Astragalus* cultivation. This collaboration could facilitate knowledge transfer and help adapt successful Chinese cultivation practices to the specific conditions and requirements of *Astragalus* cultivation in New Zealand.

Market competition

As mentioned earlier, the market for Astragalus can be competitive, with imported products often available at lower prices. Establishing a niche market for New Zealand-grown Astragalus and competing with imported products can be a challenge.

10. Opportunities

Niche market

New Zealand-grown Astragalus can target niche markets that value high-quality, locally sourced herbal products. There is a growing demand for natural and organic health products, and Astragalus, with its traditional medicinal use, can cater to this market segment.

Unique selling proposition

New Zealand's clean and green image, coupled with its strict food safety regulations, can be leveraged as a unique selling proposition for New Zealand-grown Astragalus. Consumers increasingly value products with traceable and sustainable origins, and New Zealand's reputation for quality and responsible environmental approach can be considered a competitive advantage.

Organic or wild

To further emphasise a point of difference, there may be an opportunity to also grow this plant organically, or in the wild, provided that it is commercially viable to do so. For domestic markets, consumers may pay more for a fresh local product. Building upon this, there is potential to explore organic cultivation methods or wild/semi-wild grown Astragalus in New Zealand. Global and domestic consumers are constantly seeking natural and sustainably produced herbal products. By adopting organic cultivation techniques, the superior quality and purity of New Zealand-grown Astragalus can be emphasised, catering to a niche market segment that is willing to pay more for organic credentials.

Diversification of agricultural activities

Growing Astragalus can provide an opportunity for farmers to diversify their agricultural activities, reducing reliance on traditional crops and potentially increasing their income. Astragalus cultivation can be integrated into existing farming systems, offering a new revenue stream for farmers.

Astragalus-derived products

There is an opportunity to capitalise on the global trend of utilising Astragalus in manufacturing of various value-added products. These products can include but are not limited to: capsules, extracts, herbal teas, flavoured honeys, beverages, wines, cosmetics, skincare and more.

Feasibility Study on **Panax Quinquefolius** (American Ginseng)



Panax Quinquefolius (American Ginseng) is a perennial herbaceous plant in the Araliaceae family, native to United States and Canada. It was introduced and is now successfully planted in many provinces in China. It usually grows between 15 - 60 cm tall with 3 - 5 leaves, each with 3 - 5 leaflets and produces small red berries.

Naturally grown wild American Ginseng is considered the most valuable product. However, due to years of severe over-harvesting, it now accounts for less than one per cent of the global ginseng market with the majority of ginseng being cultivated.

American Ginseng has been grown on a large scale in New Zealand, with three commercial growers of ginseng scattered throughout the North and South Islands. The largest scale production of wild products is grown on 100 hectares of pine forests in the Central North Island. Given the mild climate, abundant amount of rainfall, and fertile soil of Taranaki, there are opportunities for New Zealand producers to grow American Ginseng. The primary focus of this report centres around the production of raw, dried American Ginseng.

1. Soils

American Ginseng is a deep-rooted plant. The soil requirements for growing American Ginseng are strict. It is best grown in loose topsoil with deep moist humus soil that is well-drained and fertile.

The soil core and surface should have good permeability. Slightly acidic soil is preferred, with the ideal pH level being 5.5 - 6.0. Ginseng is more vulnerable to diseases and tends to exhibit poor health when the soil pH is below 5.5. It is recommended to maintain a soil moisture content between 40% and 55%.

The root of American Ginseng can grow for several years and therefore the soil must be cultivated to a minimum depth of 25 - 30cm to maximise production.

Slopes are generally more conducive to ginseng production than flat areas since flat areas are often poorly drained. Gentle slopes are preferred over very steep slopes for a couple of reasons. Steep slopes tend to shed water more quickly, and it is difficult to plant and maintain ginseng plots on steep slopes. It is advised to grow American Ginseng on slightly sloped land with a gradient of 20 degrees or less.

American Ginseng is well-suited for cultivation in mountainous broad-leaved forests, normally at altitudes of around 1,000m. To optimise growth conditions, planting bases are often situated in deep mountain forests. These forests are selected for their appropriate shading structures that can effectively regulate light, as well as providing suitable temperature and humidity levels for the ginseng to thrive.

2. Climate

Temperature

American Ginseng is a shade plant that thrives in cool and humid climates and is resilient to the cold. It cannot tolerate strong or direct light and prefers the shade.

The most suitable temperatures for growing ranges from 10°C to 21°C. In spring, when the temperature reaches above 10°C, seedlings will emerge. The optimal temperature for growth is 20 - 25°C. The growth period of American ginseng lasts for 130 to 150 days a year.

For reference, Marathon county in Wisconsin that produces 95% of commercially grown ginseng in the U.S, has a humid continental climate. This is characterised by hot, humid summers and cold, snowy winters with an average annual temperature of 7°C. The temperature typically varies from -13°C to 26°C and is rarely below -25°C or above 31°C over the course of the year. The annual rainfall

is 800mm and the average snow per year is 1370mm. There are approximately 188 sunny days per year in Marathon County.

Changbai Mountain, an area that produces top quality American Ginseng in China, has a temperate continental mountain climate. Typically, it experiences cold and long winters, as well as warm and humid summers. The annual average temperature is between -3°C and 11°C. The average annual precipitation is around 1,200 mm.

American ginseng is a long-day plant, meaning it requires longer periods of daylight for optimal growth and development. However, it cannot tolerate intense or direct sunlight as it will burn the plant leaves, causing the plant to wither. It thrives in shaded environments, where there are gentle and dispersed light, rather than harsh and concentrated rays. Artificial cultivation generally requires construction of a shed to provide shading, whereas cultivation in the wild or open forest area require some form of natural shading that restricts light transmittance. Generally, light transmittance should be around 20%.

In the United States, American Ginseng is usually grown on North and East-facing slopes, as these orientations generally provide more shade and moisture. Eastern slopes only receive sunlight in the morning, which is much less intense than mid-day and or the afternoon, while Northern-oriented sites receive the least sunlight compared to all the other orientations. The steepness of a slope also affects the amount of light that is received on a site. Generally speaking, the lower 1/3 portion of a slope is considered more suitable for ginseng production, as the soil content is more moist and less likely to receive direct, intense sunlight. These lower sloped positions are often well shaded and have deeper soil with higher moisture content than slopes on higher altitudes which tend to be more exposed. At the same time, it is important to avoid low-lying land that have poor drainage or a history of flooding.

In comparison, Taranaki is one of the sunniest and windiest regions in New Zealand, with a mild climate. Summer temperature ranges from 19 to 21°C, and rarely exceeds 30°C. Meanwhile winter averages between 7 to 8°C and can reach as low as 3°C in mountainous areas. The annual average temperature is around 13.5°C. Taranaki receives an abundance of sunshine, with an annual average of more than 2,000 hours. While the favourable climate and geographical conditions in Taranaki may be suitable for various crops, the significant amount of sunlight could potentially pose challenges for growing American Ginseng. Therefore, despite the favourable conditions, the high level of sunshine in Taranaki may need to be addressed or mitigated when cultivating American Ginseng in the region.

Water requirements

The ideal annual rainfall for American Ginseng cultivation is typically between 800 and 1100mm, accompanied by a relative air humidity of 75% - 85%.

It's worth noting that both Marathon County and Changbai Mountain have average annual rainfall that exceeds the minimum requirement of 800mm, confirming the suitability of these regions for growing American Ginseng in terms of precipitation.

American ginseng thrives in high air humidity during the growth period and does not grow well in places with drought, low humidity, or huge drops in temperature between day and night. That being said, excessive water, or water accumulation is also detrimental to its growth. Striking a balance is crucial, as American Ginseng requires adequate humidity without being subjected to excessive moisture.

In Taranaki, the average annual rainfall ranges widely, from an average of 1500mm, to an excess of 2000mm per year. The choice of location for the planting of American ginseng must be carefully considered as it requires a certain amount of water, but at the same time too much water and water accumulation in the ginseng bed is not conducive to good growth.

3. Planting techniques and requirements

Wild-simulated VS Field cultivated

Apart from the wild harvested American Ginseng, which requires over 15 years of growth before harvesting, there are two main universally adopted cultivation methods for this plant: wild-simulated and field cultivated.

The wild-simulated method seeks to mimic the natural growing conditions of wild ginseng as closely as possible. There is often limited use of fertilisers and pesticides, with minimal human interference, promoting a more natural growth process. It requires 7 or more years of growth before it should be harvested. The roots are much smaller in size and less uniform than those of field cultivated ginseng, but are more sought after and fetches a much higher price. The production of wild-simulated ginseng requires relatively low initial capital investment. However, the selection of a suitable site for cultivation is crucial to the success of growing wild-simulated ginseng. Factors such as moisture levels, shading, and accessibility must be carefully considered when choosing the site.

On the other hand, the field cultivated method involves intensive field cultivation, typically conducted in controlled environments such as shade houses or artificial shading structures. Generally, field cultivated American Ginseng can be harvested in 4 to 6 years. This method aims to maximise production and yield through careful management of growing conditions, including light, temperature, humidity, and soil nutrients. In order to provide a controlled environment for the ginseng to grow, artificial shade structures need to be constructed, requiring significant financial investment. The soil is usually heavily prepared with all debris and weeds removed, ensuring healthy and regimented growth. Although one can produce a far greater yield of ginseng roots under this system within the four year rotation, the roots are often large but carrot-like and more uniform in appearance which is considered far less valuable in the Asian market.

Production systems vary from field cultivated to wild-simulated methods. The wild-simulated approach has been adopted not only in the United States but also by commercial growers in New Zealand. Valuable information and references on wild-simulated ginseng have been gathered from an experienced grower in New Zealand. On the other hand, it is widely observed that China extensively employs the field cultivation method for growing American Ginseng. Valuable insights have been obtained from Chinese farmers (and sources) regarding their practices in ginseng cultivation.

I. Wild-simulated

i. Site selection and preparation

The best wild-simulated ginseng habitat is native forestland with a relatively open understory with tall canopies that provide 70 to 90% of natural shade, with adequate air circulation and light levels around 25% sunlight. Sites with well-drained slopes are preferred. Long-lived tree species that develop few canopy gaps make better ginseng habitat than short-lived tree species. In the United States, sugar maple, tulip poplar, and black walnut make the most productive habitat because they are long-lived, tall, and release calcium into the soil when their leaves descend in autumn.

In New Zealand, wild-simulated ginseng are often planted in commercial pine forests with trees aged 10 to 28 years. Pine is the most commonly planted forest in New Zealand for their timber, and is in no short supply. Commercial pine forests are preferred for several reasons. Firstly, these forests tend to require less site preparation compared to other land types, making them more convenient for ginseng cultivation. The uniform rows already formed by the pine trees can be converted into suitable planting beds for the ginseng, saving time and effort in creating new planting areas. Moreover, the leaves and organic matter that naturally fall onto the forest floor from the pine trees can serve as suitable mulch for the ginseng plants. This organic matter helps retain moisture, suppress weed growth, and improve soil health, creating favourable conditions for ginseng growth. Most importantly, the tall forest canopy provide much needed shading for the plants to thrive.

ii. Planting

Seeds must go through a period of cold dormancy or stratification to ensure germination occurs. It is recommended to refrigerate the seeds before planting. In autumn, after clearing away leaves and other debris, the seeds are planted by machinery in untilled soils at a depth of 1 - 2.5cm. Otherwise, seedlings can be transplanted by hand at 1 or 2 years of age. After planting, the leaves can be raked back over the area to serve as mulch.

iii. Field management

Most of the work takes place during planting and harvesting; all that is normally required in the interim is regular monitoring of ginseng patch for disease, pests, and poaching. Common pests that pose a threat to ginseng plants include slugs, worms, birds, and rabbits. Pests can be controlled with chemicals approved and certified for use on ginseng. Physical barriers can be created using netting to protect ginseng plants from bird and rabbit damage. Diseases such as blight and root rot can be minimised by regular monitoring, good site selection, proper mulching, and wide spacing between plants. Often the chemicals for weed and fungi management is applied during the site preparation stage. Poaching might also be a problem and therefore security may be required. Machinery is used to mulch the weed into the ground/ seed bed for plant to grow.

Maintenance of the field occurs largely over the first 2 to 3 years of ginseng cultivation. This primarily involves weeding and slug control. It is important to remove weeds to reduce competition for resources and ensure the healthy growth of ginseng plants. In terms of fertilisation, it is generally advised to avoid the use of fertilisers in order to promote slow root development that closely resembles the characteristics of wild ginseng roots.

II. Field cultivated

i. Site selection and preparation

The selected plot of land should avoid direct sunlight and constant heavy winds. The organic matter content in farmland soil is typically low, with poor soil quality. Therefore, before planting ginseng, care must be taken in ensuring the soil quality and fertilisation is accounted for. Ways to improve the soil include applying a large amount of organic fertilisers, such as compost, manure, peat, bean cake fertiliser, and planting early-maturing leguminous crops or planting green manure plants such as perilla. Soil testing is highly recommended.

Plow the land about 25 - 30cm deep. After multiple plowings, the soil is matured to achieve the purpose of increasing the soil organic matter content and improving the physical and chemical properties of the soil.

Level the land before sowing to form raised planting beds of 25cm high, and 150cm wide. The length of the beds can vary depending on the terrain, ranging from 20m to 60m. Working paths are formed at 60cm wide; and a slope ratio of 1:1. Create the ginseng bed soil ridge by shovelling the soil of the work path to the planting bed. Raising soil ridges in small areas can be done manually, while in large areas, machinery is often used.

ii. Planting

American Ginseng can be planted during spring or autumn, usually in autumn. It can be grown by either direct seeding or transplanting.

1) Direct seeding: seeds are planted with spacing of 7cm x 7cm or 5cm x 10cm between rows at a depth of 3cm.

2) Transplanting: transplant seedlings at 1 - 2 years of age. Seedlings are planted with spacing of 5cm x 5cm or 7cm x 5cm between rows at a depth of 3cm.

To keep the soil moist and prevent weeds from growing, (after the seeds are planted), the soil is covered with 4 - 5cm of thick leaves or 3cm thick sawdust. Alternatively, reed curtains can be used to cover the entire field.

It is suggested to use transplanting if the field is 5 or less hectares. Although it requires more labour force, transplanting ensures higher yields.

iii. Field Management

1) Mulching

Under field cultivation, covering the American Ginseng bed is vital. Mulching helps prevent weed seed germination and reducing soil moisture evaporation. When American ginseng seedlings emerge from the top soil, shade management should be carried out.

2) Shading

American Ginseng is a shade plant that requires some form of shading/plant tent to maximise growth. It requires at least 70% shading, while 80% is optimal. Entire fields are covered with flat-roofed sheds that provide shading for the plants. The flat roof of the sheds are manufactured by straw, or reed or polypropylene cloth shade nets, whilst the surrounding perimeter of the sheds are covered with straw curtains or similar. This is to ensure natural ventilation throughout.

3) Weeding

Pre-plant weed control is crucial for successful ginseng cultivation. Herbicides or chemicals should be applied to effectively eliminate all perennial weeds before planting. The goal is to ensure that the field is free from any competing vegetation that could hinder the growth and development of ginseng plants. After the initial weed control, it is important to regularly inspect the field to identify any signs of weed re-growth. During the first two summers of growth, hand weeding is the primary task. Weed pressure will be at the highest during year one. As the young ginseng plants are emerging so will weeds. Therefore it is necessary to eradicate any weeds that are observed. Weeds grown in close proximity with the ginseng plant, will impact the growth of the ginseng plant. If weeds are allowed to grow unchecked, they can become more firmly rooted in the soil and removing them may risk damaging or uprooting small ginseng seedlings in the process. After weeding and ensuring the area around the ginseng plants is clear of unwanted vegetation, it is important to restore the layer of sawdust or mulch around the plants.

4) Pest and disease management

Cultivated American Ginseng has relatively few insect pests, apart from slugs which can be combated by applying chemical pesticides. American Ginseng, particularly ginseng under field cultivation, is a plant prone to many diseases. Often, the cause of many ginseng diseases is due to excessive moisture, and not enough air movement through the plants. Stagnant air in a moist setting can create serious disease problems, which can be very hard to control. Common diseases include black spot disease, blight, Phytophthora and root rot. Chemicals are often used to treat these diseases.

4. Fertiliser requirement

Fertilisers, fungicides and herbicides

Fertilisers should not be used in the wild-simulated method.

In field cultivated method, cultivation is required prior to planting. It is suggested to do a basic soil test, which will provide a nutrition profile of the soil to confirm suitable fertiliser to be used. After planting seeds, a fungicide spray program and fertiliser program is used. It is common to spray out a field with a herbicides such as glyphosate to kill weeds.

5. Infrastructure and investment

I. Wild-simulated method

Infrastructure required:

- 1) Cultivation machinery
- 2) Sowing machinery
- 3) Tools
- 4) Netting
- 5) Processing facility

1) Cultivation machinery

Soil will need to be cultivated with tractor mounted discs or rotary hoe or tiller to create a suitable seed bed. As the planting beds are located within commercial pine forests, it is highly recommended to find sites that are not too sloped, and have enough width between tree rows to allow for machinery access. It is advisable to consult with a contractor or agricultural expert who can provide specific guidance on the most suitable cultivation techniques and equipment for the soil conditions and crop requirements in the given area.

2) Sowing machinery

A tractor mounted direct seed drill that can handle soft seeds should be used to sow the seeds directly. This would need to be discussed with the contractor to ensure the drill is suitable. Sowing machinery is specifically customised for planting American Ginseng, taking into account the size of land and the spacing of rows between the plants. If transplanting seedlings at 1 or 2 years of age, this will need to be planted by hand.

3) Tools

Few tools are needed for clearing planting beds and harvesting. These tools include but are not limited to leaf and garden rakes, pruning equipment, mattocks or shovels for digging weeds and harvesting tools.

4) Pest-proofing

Rabbit proof fencing and bird netting will be required to mitigate loss of stock. It is advisable to consult with a contractor who can provide specific guidance on the most suitable materials and construction techniques.

5) Processing facility

Harvested ginseng roots will need facilities to carry out the following procedures, including washing & cleaning, drying, chiller storage and packaging of final product.

II. Field cultivated method

Infrastructure required:

- 1) Cultivation machinery
- 2) Sowing machinery
- 3) Fertiliser spreader
- 4) Pesticides sprayer
- 5) Shades
- 6) Tools
- 7) Netting
- 8) Harvesting machinery
- 9) Processing facility

- 1) Cultivation machinery

Soil will need to be cultivated with tractor mounted discs or rotary hoe or tiller to create a suitable seed bed. It is advisable to consult with a contractor or agricultural expert who can provide specific guidance on the most suitable cultivation techniques and equipment for the soil conditions and crop requirements in the given area.

- 2) Sowing machinery

Same as wild-simulated section.

- 3) Fertiliser spreader

Fertiliser would normally be applied using a tractor mounted fertiliser spreader. It is recommended to consult a fertiliser expert to help ensure optimal nutrient management for the crop's growth and development.

- 4) Pesticides sprayer

If pesticides are required it may be important to have the plants in rows that will allow the tractor wheel to pass over without crushing the plants. It is recommended to consult a pesticide expert to ensure products used are suitable. The same goes for weeding (if done mechanically).

- 5) Shades

Entire fields are covered with flat-roofed sheds that provide shading for the plants. The materials of the shed should be selected according to local conditions. Hard wood, bamboo poles, cement columns, or metal poles can all be used for its construction (up to 250cm in height). Shading is maintained with straw, or reed or polypropylene cloth shade nets, whilst the surrounding perimeter of the sheds are covered with straw curtains or similar.

The typical specifications of a shade shed: 180 - 230cm in height measured from the ground, with a bed width of 150 cm, and raised 25 cm. The light transmittance is controlled at about 20%. The shade shed will be constructed immediately once the plant beds are formed.

6) Tools

Same as wild-simulated section.

7) Netting

Same as wild-simulated section.

8) Harvesting machinery

Harvesting would be best done mechanically on a large plantation. A potato harvester might be suitable for this. The contractor should also be able to give some advice prior to planting to ensure rows are suitable for mechanical harvesting. In China, hand harvesting may also be viable provided that the labour force is accessible.

9) Processing facility

Same as wild-simulated section.

III. Skills and labour

The manager of this operation would ideally have experience in growing American Ginseng or other ginseng species. Alternatively, experience in cultivating root vegetables could be suitable, provided they are willing to conduct research and adapt their knowledge as the project progresses.

This experienced manager would oversee the overall operations. Contractors would be hired to complete the jobs that require operation of large scale equipment. Whereas jobs such as hand weeding, spot spraying, and general maintenance can be completed by either the manager or low skilled labourers.

It is important to note that hand harvesting ginseng can be a labour-intensive process. It requires carefully digging up the ginseng roots by hand, ensuring minimal damage to the roots and preserving their quality. Hand harvesting is often preferred for ginseng to ensure the roots are handled with precision and care.

The number of hours required for hand harvesting may vary depending on factors such as the density of ginseng plants, the size of the operation, and the efficiency of the harvesters.

Depending on the size of the land, the manager may undertake most if not all of the tasks. For larger scale allotments, seasonal and/or additional workers may be required.

The role of the manager includes but is not limited to:

- Soil nutrition management
- Fertiliser application
- Weed control
- Pest and disease control
- Sowing of seeds and/or transplanting
- Harvest management
- Liaison with contractors and ensuring work is completed accurately
- Management of seasonal/additional workers

6. Processing requirements

Harvest

As time goes by, the roots will become thicker and longer, and the medicinal content will be higher. Generally, for wild-simulated ginseng, it takes at least 7 years to harvest; compared to 4 years or more for harvesting field cultivated ginseng.

Harvest preferably in autumn. Roots should be dug by hand to prevent any damage to the roots and stock, and ensuring all the fine roots are intact. A short handled mattock, know as “sang hoe” will be used to loosen the soil 20 - 30cm from the base of the stem in a wide arc around the plant. For any farmland over half of a hectare in size, a potato harvester pulled behind a tractor is used to lift the entire plant (roots and all) to the soil surface where they can be picked up by hand.

Processing

Allow freshly harvested roots to wilt for 3-4 days in order to help improve the colour. Afterwards, wash the entire root carefully with clean water. If roots are destined for the fresh trade, they are placed into cool storage. For the dried market, It is important to dry the roots, by either mechanically drying or natural air dry. Good air flow around the roots; and consistent temperature and humidity are important factors when drying roots. In order to get sufficient airflow to the roots when drying, screens are often used. Roots should be placed on screens in a single layer, evenly distributed without touching. This ensures that air can reach all sides of the roots while they are drying; it is also advised to use a fan to maintain good circulation around the drying roots. The roots are placed onto shallow trays and dried at around 30°C - 32°C, but not more than 35°C. It generally takes 14 days to dry all the roots.

7. Markets

Global consumption

American Ginseng root is prized for its medicinal qualities. It has been experiencing significant growth in the past decades as there has been an increasing awareness of its health benefits across the globe.

Dried American Ginseng root can be marketed in various forms or products. It is typically sold as whole roots or sliced pieces to consumers for direct consumption or to be used in tea, alcohol, soup, and even Chinese cuisine. It can also be used in value added pharmaceutical products such as compound Chinese medicines, powders, capsules, tablets and specialty drinks.

The Chinese market is the largest consumer of American Ginseng. Although China's American Ginseng industry has a large production scale, the quality of American ginseng grown in China is not considered high as it is mostly field cultivated, while the demand for high quality American Ginseng still exceeds the supply. In 2021, China imported over 1.8 million kg of American ginseng, mostly from Canada and the United States.

The global market size was valued at US\$ 1.3 billion in 2020 and is projected to reach US\$2.9 billion by 2028.

Global production

The production of American Ginseng in China was estimated at around 12 million kg in 2021. China, Canada and South Korea are the three main exporters, with each accounting for 25% of the global export amount. Canada produces 2.7 million kg annually, of which 90% export to Hong Kong, worth US\$127 million.

Domestic market

American Ginseng has high demand in both global and domestic markets. In New Zealand, the conservative estimate of demand for dried American Ginseng root is approximately 800kg per year, which is currently imported from China. At this moment, retailers in New Zealand are largely only importing/selling American Ginseng in the form of a sliced root product. The average retail price of imported field cultivated American Ginseng is NZ\$ 750/kg. The average retail price of wild-simulated ginseng is NZ\$ 2,000/kg.

Considered a high value herb locally and globally, it may be positioned at a premium price point. Local traditional Chinese practitioners/stores are likely to purchase New Zealand grown American Ginseng provided that the product is price-competitive and has similar or better qualities than the existing Chinese product. The fact that it will be New Zealand grown, and more easily accessible is an added bonus.

As one of the leading retailers in traditional Chinese medicine in New Zealand, Jean's Natural Herbs is always looking for opportunities to market New Zealand grown products. However most importantly, the product itself must be superior or comparable at the very least to the Chinese-grown.

8. Financial Indications

Investment in infrastructure will be impacted by the anticipated returns over future years, as well as available budget and existing assets that can be readily utilised.

Typical infrastructure may include a tractor, mounted tractor equipments, harvesting machinery, sprayers for weeding/pesticides and miscellaneous equipment.

As mentioned above, production systems vary from field cultivated to wild-simulated methods, and so do the costs. More investigation will be required in this area for individuals to budget for specific machine harvesting equipment.

Due to the numerous variables, we are unable to outline a precise breakdown of all the associated costs. The following table provides a rough outline of income as well as associated costs of growing one hectare of wild-simulated and field cultivated American Ginseng respectively. For the wild-simulated method, the data was collected from a consultant in New Zealand; whereas for the field cultivated method, the data was collected from consultants in China. The yield and expenses are calculated based off a per hectare rate. These details should be considered as a preliminary indication. There are many variables and costs that we have not included in the table, such as: farm manager salary, freight, maintenance & repair of machinery, fuel & electricity, water, overtime and/or miscellaneous costs. Further research should be conducted to ensure an accurate representation of the expenses for growing the very same herbs in New Zealand.

The costs associated with growing ginseng can vary greatly depending on several factors, including the grower's skills, expertise, and available equipment, as well as the need for external contractors. Additionally, whether the land is owned or leased can also impact costs. Furthermore, if the land is part of a larger forestry asset owned and managed by external foresters, there may be specific agreements or contracts that affect costs and the grower's ability to modify the land for ginseng cultivation.

American Ginseng - Wild-simulated method (per hectare)		
	Unit	Price
Income		
Yield	225 kg (dry root)	
Root price	\$2000/kg	
Total income		\$450,000
Expenses		
Growing costs	Site clearing and preparation for planting	
	Lime application	
	Rabbit proof fencing	
	Seed procurement & stratification	
	Seed sowing - Tractor mounted direct seed drill	
	Slug bait	
	Bird netting	
	Periodic monitoring of crop for duration of growing	
	Weed control	
		\$57,600
Harvesting costs	Hand harvesting	
	Washing sorting/grading	
	Cool storage of fresh product	
	Drying costs, including a dry room	
	Packaging	
		\$48,000
Land cost	Not included, assumed owned by grower	
Potential return		\$344,400

American Ginseng - Field cultivated method (per hectare)		
	Unit	Price
Income		
Yield	600 kg (dry root)	
	\$375/kg (assumed wholesale price) (retail price - \$750/kg)	
Total income	\$225,000	
Expenses		
Growing costs	Site clearing and preparation for planting	\$134,400
	Seed procurement	
	Seed sowing - Tractor mounted direct seed drill	
	Fertilisers	
	Weed and pest control	
	Shading (variable)	
	Labour costs for sowing and field management	
Harvesting costs	Hand harvesting	\$21,000
	Washing sorting/grading	
	Cool storage of fresh product	
	Drying costs, including a dry room	
	Packaging	
Land cost	Not included, assumed owned by grower	
Potential return	\$69,600	

9. Challenges

The choice of methods

As detailed throughout this report, there are two main methods to grow American Ginseng; field cultivated or wild-simulated. Field cultivated American Ginseng is planted underneath artificial canopies or trees at high densities and subject to intensive chemical and mechanical treatment. The application of fertilisers means a shortened rotation and results in well fattened roots that are considered lower in quality and less sought after by the Chinese or Asian markets. Therefore it is predominantly used in value added pharmaceutical products such as tonics or capsules or used as additives to soaps, shampoos, lozenges and such. However the upside is the shorter turnaround, higher yield and suitability for planting on existing farmland.

Wild-simulated American Ginseng, which is planted in an environment closely resembling its natural habitat and over a longer duration, commands prices second to those received for wild grown ginseng. This is because wild-simulated ginseng is believed to have similar appearance, potency, and chemical composition to wild-grown ginseng. The demand for wild-simulated ginseng stems from a perception that it retains qualities and properties associated with ginseng that grows from its native environment, and therefore has a higher demand and market, globally. However, it requires a suitable commercial forest as a planting as well as longer time investment and therefore further consideration should be done before making a decision.

Generally speaking, the cost of production increases and the price paid for roots decreases as one moves from wild-simulated to field cultivated production technique.

Relatively high investment and longer period to harvest

Ginseng production is not a guaranteed business venture, nor is it a quick path to earning a rapid return on investment. The growth period for field cultivated American Ginseng typically lasts four years, while wild-simulated ginseng can take seven years or more to reach maturity. Due to the significant investment required and the complex nature of the process, ginseng cultivation involves considerable time and financial commitment, making it a venture with potentially high risks. The success of ginseng cultivation depends on various factors, including soil quality, proper care and maintenance, and market demand. If any of these factors are not adequately addressed or if unforeseen circumstances arise, it could result in a substantial financial loss.

Market competition

As mentioned earlier, the market for wild-simulated American Ginseng can be competitive, with imported products often available at lower prices. Taking into account that there are some existing commercial products grown in New Zealand, establishing a niche market for New Zealand-grown American Ginseng and competing with local and imported products can be a challenge. Moreover, China currently dominates global production for both wild-simulated and field cultivated ginseng, with the market for field cultivated ginseng being largely saturated at the moment. In order to succeed on a global scale, New Zealand-grown ginseng must offer a unique selling proposition or point of difference to consumers while being price competitive. This could be achieved through various means, such as emphasising superior quality, sustainable cultivation practices, organic certification, or specific health benefits associated with the New Zealand growing environment. By highlighting these unique aspects, New Zealand-grown ginseng can distinguish itself from the competition and attract consumers who value these qualities.

Planting techniques and management

American Ginseng is a rare and special herb. Over the span of 4 years, farmers will need to regularly monitor the growth status and make adjustments where necessary. The process of growing ginseng involves various challenges, including special planting techniques, field management, shading design and construction, temperature and light regulation, as well as pest and disease control. Each region may have varying soil conditions and shading requirements, which can significantly impact the growth and nutrient availability for ginseng plants. Therefore, thorough research must be conducted and analysis specific to the target region in Taranaki is crucial to determine the suitable environment for successful American Ginseng cultivation.

10. Opportunities

Successful planting experience in New Zealand

It can be challenging to grow American Ginseng due to the various environmental and surrounding requirements. Yet considering that it is currently being planted in New Zealand, gives us an indication that it is a viable investment subject to conditions being met.

American Ginseng-derived products

There is an opportunity to capitalise on the global trend of utilising American Ginseng in the manufacturing of various value-added products. This is especially applicable to field cultivated ginseng which have larger, but less valuable roots. These products can include but are not limited to: capsules, extracts, herbal teas, flavoured honeys, beverages, wines, cosmetics, skincare and more.

Diversification of agricultural activities

Growing American Ginseng as an understory intercrop in commercial pine tree forests can offer landowners an opportunity to add value to their land and potentially increase their commercial yield.

By utilising the existing forest canopy, landowners can make efficient use of their land while simultaneously growing two valuable crops. The pine trees provide shade and protection for the ginseng plants, creating a suitable microclimate that mimics the natural habitat of ginseng. This can help enhance the growth and quality of the ginseng crop.

Ginseng is a high-value crop that commands a premium price in the market. By integrating ginseng cultivation with existing pine tree operations, landowners can diversify their revenue sources and potentially increase their overall profitability.