



Know-how for Horticulture™

**Developing new
export vegetables
with emphasis on
burdock, daikon and
globe artichoke**

Dr. Soon Chye Tan
Agriculture Western
Australia

Project Number: VG97042

VG97042

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Developing New Export Vegetables

VG 97042

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The project aimed to develop new export vegetables for Western Australia, such as burdock, daikon, shallots and other potential export vegetables. Horticulture Australia Ltd, Ausveg and the Department of Agriculture, Western Australia, funded this project.



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1.0. MEDIA SUMMARY

The second half of the 'Developing new export vegetables' project (VG 97042) with emphasis on root vegetables burdock and daikon, shallots and other vegetables, has been completed. The project was funded by Horticulture Australia Ltd. and the Department of Agriculture, Western Australia. The aim of the project was to identify optimal agronomy practices for burdock, daikon and shallots, which were identified as potential export vegetables for Western Australia from the first half of the project. Other project aims included determining the economic viability of exporting fresh and/or semi-processed burdock, and to identify other potential export vegetables for Western Australia.

The industry significance of the project is that it provides information to assist growers to make decisions when diversifying their businesses away from main stream vegetable production. The vegetable industry is keen to find suitable rotational crops and to develop new overseas markets with produce that meets market requirements. This project attempted to provide Western Australian growers with potential vegetable export opportunities.

The key outcomes/conclusions of the project are:

- A study tour to Japan in December 2001 concluded that WA could not viably export fresh burdock to Japan due to burdock imports from China.
- As fresh burdock was considered uneconomic, semi-processed burdock imported to Japan was investigated. The costs of processing burdock in WA and importing to Japan were also considered not viable based on the prices per kilogram received for imported processed burdock in Japan.
- Shallots have showed promising results in agronomic trials and may be a potential export crop, particularly to the Indonesian market.
- Japanese taro, Japanese yam, vegetable green soybean, and Japanese broad bean may have export potential for WA.

Some of the recommendations include:

- Discontinue further agronomy trials on burdock.
- Revise the economic analysis of semi-processed burdock exported to Japan when more detailed data are available.
- Conduct a detailed economic analysis on exporting shallots to a range of potential markets.
- Continue agronomic trials of Japanese taro in suitable areas.
- Monitor studies conducted by Central Queensland University and Taro Growers Association and remain involved in agronomic trials to determine best practice for WA growing conditions.
- Complete detailed market analyses on other potential export vegetables, Japanese yam, vegetable green soybean and Japanese broad bean.

2.0. TECHNICAL SUMMARY

Competition from other countries is a growing concern for the Western Australian export vegetable industry. Unfortunately, this statement is very true for the potential export vegetable, burdock (*Arctium lappa*). In the time it took for the research to determine optimum agronomic practices to produce high quality fresh burdock in WA for export to Japan, the fresh market has become uneconomic. Chinese imports into Japan have caused low prices of imported burdock resulting in low returns for fresh export burdock from WA. Initial studies into semi-processed burdock have also indicated that the Japanese market is not viable.

Daikon (*Raphanus sativus*) and shallots (*Allium ascalonicum*) were also identified as having export potential for Western Australia. This project has investigated the cultural practices required to successfully grow these vegetables in Western Australia. Desk-top studies have also been conducted on Japanese taro, Japanese yam, Japanese broad bean and Japanese green soybean with initial field trials on Japanese taro.

The major findings and industry outcomes were:

- Best total yield for burdock was about 47 t/ha when 400 – 600 kg N/ha was applied.
- Marketable yields recorded from the nitrogen burdock trial were very poor (8 t/ha or less) across all nitrogen treatments. Therefore, further trials should be conducted for spring-sown burdock before optimum N rate can be determined.
- Pre-emergent herbicides Kerb® (propryzamide) at 4.4 L/ha and trifluralin at 2.0 L/ha slightly affected burdock seedlings planted in November and January, with no effect on total yield. No pre-emergent herbicides are registered for use on burdock in Australia.
- Based on yields, an intra-row spacing of between 5 – 8 cm is suitable for spring-sown burdock if harvested at 20 weeks or 134 days after sowing.
- Priming burdock seed (soaked in water for 12 hours) did not significantly increase germination rate at a summer planting.
- A flat bed formation increased germination rate and marketable yields of summer-sown burdock compared to a hilled bed formation.
- Shallot varieties, Ambition and Matador, are suited for the Manjimup and Medina areas.
- The optimum density for Ambition and Matador is 905,797 plants/ha and 1,602,564 plants/ha respectively.
- Small bulbs (0 – 20 mm diameter) can be used to propagate shallot vegetatively.
- To achieve higher total and marketable yields in daikon, a density of 18 plants/m² (14.5 cm x 29 cm) harvested at 65 days after sowing is better for both varieties, Narumi and Minowase Summer Cross No. 3.
- A study tour to Japan in December 2001 concluded that WA could not viably export fresh burdock to Japan due to burdock imports from China.
- As fresh burdock was considered uneconomic, semi-processed burdock imported to Japan was investigated. The costs of processing burdock in WA and importing to Japan were also considered not viable (A\$8.69 /kg) based on the prices per kilo received for imported processed burdock in Japan (A\$4.00 - \$6.00 /kg).
- Four export vegetables, Japanese taro, Japanese yam, vegetable green soybean, and Japanese broad bean may have export potential for WA.
- Japanese taro trials at Medina Research Station have shown promising results with a comparable total yield of 48.3 t/ha.

Some of the recommendations include:

- Discontinue further agronomic trials on burdock.
- Revise the economic analysis on semi-processed burdock exported to Japan with more detailed costings.
- Continue agronomic trials of Japanese taro.
- Conduct a detailed economic analysis on exporting shallots from Australia with input from industry partners.
- Revise market analyses on other potential export vegetables, Japanese yam, vegetable green soybean and Japanese broad bean, before conducting any agronomic trials in WA.

3.0. INTRODUCTION

A preliminary evaluation of potential export opportunities was presented to industry at the 'Asian Vegetable Opportunities in Japan and North-East Asia – Export Focus Workshop', conducted in Perth, December 1995. The workshop, jointly funded by Department of Agriculture and the Rural Industries Research and Development Corporation, identified several seasonal and high value Asian vegetables to be evaluated further regarding suitable varieties/cultivars, yield, cultural practices, location of commercial production and postharvest handling. Burdock (*Arctium lappa*) and daikon (*Raphanus sativus*) were identified as potential new export vegetables for Western Australia. Hence the first half of the project 'Developing new export vegetables with emphasis on burdock, daikon and globe artichoke 1997 - 2000' (VG 97042) was undertaken.

The aims of part one (1997 – 2000) of the project were:

- To evaluate and identify burdock and daikon varieties/cultivars suitable for Western Australian conditions.
- To carry out a feasibility study to evaluate market potential and requirements for globe artichoke.
- To improve/develop innovative postharvest handling and storage methods for export markets.

Part two of the project (2001 – 2003) follows on from the initial project and mainly focussed on further agronomic trials of burdock, shallots and daikon, as well as desk-top studies of other potential vegetables such as Japanese taro, Japanese yam, vegetable green soybean and Japanese broad bean.

The aims of part two of the project were:

- To conduct further agronomic trials such as fertiliser trials, herbicide crop tolerance, intra-row spacing, effect of fungicides on germination, seed priming and bed formation effects and the effects of storage temperature.
- To conduct a study tour to Japan with the following objectives:
 - i) To visit burdock growers to determine their growing and handling methods for burdock and to gather information on crop agronomy.
 - ii) To visit vegetable importers, wholesalers and processors to discuss prospects of exporting fresh and/or semi-processed burdock to Japan.
 - iii) To visit wholesale markets and inspect local and imported burdock quality and determine wholesale price.
- Preliminary studies were carried out by Food Science Australia to assess the possibility of semi-processing burdock roots
- To conduct an economic analysis of supplying Western Australian semi-processed burdock to Japan.
- Agronomy trials on shallots to include variety evaluation, density and seed bulb-size trials.
- To conduct a trial to determine optimum density of two daikon varieties.
- Assess other potential export vegetables such as Japanese taro, Japanese yam, vegetable green soybean and Japanese broad bean.

The project's significance to industry is to diversify the Western Australian vegetable industry, to provide suitable rotational crops by developing new overseas markets with products that meet market requirements.

12.0. RECOMMENDATIONS

12.1. Burdock research

From the burdock agronomy and postharvest trials, the following recommendations were developed:

- A rate of 400 – 600 kg N/ha should be applied to increase total yields when planting in spring.
- Further research needs to be conducted on why marketable yields are less from a spring sown crop (8t/ha or less) compared to a summer sown crop (20 – 22 t/ha) before an optimum N rate can be determined.
- Pre-emergent herbicides, Kerb® at 4.4 L/ha and trifluralin at 2.0 L/ha, had slight effects (minimal stunting and chlorosis) on burdock seedlings sown in January and November. As at May 2003 no herbicides were registered for burdock in Australia.
- Intra-row spacing of spring-sown burdock is recommended at 5 – 8 cm (16.7 – 26.4 plants/m²) if harvested at 20 weeks to achieve total yields of 31 – 36 t/ha.
- Priming burdock seed (in water for 12 hours) does not have any significant benefit on the germination rate of summer-sown burdock, therefore it is recommended to sow natural, untreated burdock seed.
- Higher germination (96 – 97%) and marketable yields (8 – 9 t/ha) were achieved when summer sown burdock was sown on a flat bed or a flat bed with furrow compared to the hilled bed formation. Therefore, it is recommended to sow burdock on a flat bed for summer planting.
- Although, 0 - 1°C is the preferred storage temperature for burdock, it is a challenge to maintain this temperature in transit to export markets. Storage of burdock in L213 LifeSpan® bags at 0 - 9°C for 28 days had minimal effects on burdock quality, therefore this barrier bag may be suitable to maintain quality during transit to export market. However, further research should be done after the storage period as differences in quality may be more noticeable when the product is on the supermarket shelf at ambient temperatures for 2 – 3 days, particularly if the product has experienced high temperatures during in-transit storage.

12.2. Shallot research

- Although, yields from the variety evaluation planted at the Medina Research Station were low, it showed that shallot varieties Ambition and Matador are the most suited varieties for Medina.
- The varieties Ambition and Matador also showed the greatest potential in terms of yields at the Manjimup Horticultural Research Institute, with total yields of 73.4 t/ha and 52.9 t/ha respectively.

- The optimum density for Ambition and Matador is 90.6 plants/m² and 160.3 plants/m² respectively. This corresponds to a seed spacing of 9.02 and 3.12 cm when an eight row air seeder with a distance of 40 cm between each pair of double-rows is used.
- Small bulbs (up to 20 mm maximum diameter) can be used to propagate shallots vegetatively, thus giving an outlet for otherwise waste product. Medium (21 – 45 mm maximum diameter) and large (46 – 65 mm maximum diameter) bulbs tended to flower prematurely, and produced more small bulbs. Vegetatively propagated plants matured approximately one month earlier than seeded shallots.
- A detailed economic analysis should be conducted on exporting shallots to Indonesia and other markets.

12.3. Daikon research

- The preferred root weight of daikon exported to Taiwan is 1000 – 1500 g. The recommended densities and harvest time to achieve the desired export weight is 6 - 12 plant/m² at 65 days after sowing (DAS), and 12 - 18 plants/m² at 80 DAS. However, to achieve higher total and marketable yields, a density of 18 plants/m² (14.5 cm x 29 cm) harvested at 65 DAS is better for both daikon varieties, Narumi and Minowase Summer Cross No. 3 as this achieved an average root weight of 810 grams.

12.4. New export vegetables study tour

- A study tour to Japan in December 2001 concluded that Western Australia could not viably export fresh burdock to Japan due to burdock imports from China. Therefore, more emphasis was placed on the viability of developing a higher value semi-processed burdock product with an extended shelf life.
- From the study tour report, it was recommended to conduct economic feasibility analysis on the prospects of processed burdock into the Japanese market.

12.5. Processing fresh-cut burdock

- Preliminary studies to prevent browning in fresh-cut burdock were conducted by Food Science Australia. The recommendation from the report was to study the microbiological and sensory properties of the product under current experimental conditions to understand or predict the shelf life of burdock.
- It was also recommended to select suitable packaging material based on respiration rate and browning of the product.
- Unfortunately, due to the unfavourable findings of the initial economic analysis of semi-processing burdock for export to Japan, no further research was conducted.

12.6. Economic analysis of supplying semi-processed burdock to Japan

- According to Rahmig (2002), the opportunities for a semi-processed burdock product from Australia is limited. The price calculation shows a landed price per unit of A\$8.69 per kilogram. With a focused price range of A\$4.00 - \$6.50 per kilogram for imported semi-processed burdock, the enterprise would not be profitable.
- From the economic analysis, other recommendations were given (Rahmig, 2002):
 - i) Conduct further research on the processing costs based on the findings in this analysis and on the figures provided by Jeff Hastings to build up a Western Australian semi-processed burdock industry into Japan.
 - ii) Gather information about the production practices in China. Find out if there are imminent disease or pest problems or unsustainable production practices which could lead to supply problems in future years.
 - iii) Further analysis of the general demand trend for burdock. Who will demand burdock in the future (international and domestic) and who will pay a premium for the product.
 - iv) Investigate opportunities for Western Australian growers to establish joint-ventures with Japanese companies to grow burdock in WA and to export the product to the Japanese market.

12.7. Other potential export vegetables

- Continue agronomic trials of Japanese taro in the Perth area.
- Monitor studies conducted by Central Queensland University and Taro Growers Australia Inc. and remain involved in agronomic trials as part of the national project.
- Detailed market analyses need to be completed on other potential export vegetables, Japanese yam, vegetable green soybean and Japanese broad bean, before conducting any agronomic trials in WA.

13.0. ACKNOWLEDGMENTS

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