

VG312

**Eda-mame (vegetable soybean)
development for the frozen export market**

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Queensland Department of Primary
Industries**



Know-how for Horticulture™

VG312

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EDA-MAME (VEGETABLE SOYBEAN) DEVELOPMENT FOR THE FROZEN EXPORT MARKET

HRDC REF NO. VG312

FINAL REPORT

INTRODUCTION

A previous Eda-Mame project involving HRDC, Edgell-Birdseye and QDPI, VG025, concluded that commercialisation of the frozen Eda-Mame industry in Queensland could not proceed until superior varieties were developed by the QDPI breeding program.

This project allowed the Eda-Mame breeding program to be expanded with rapid seed multiplication of new varieties. The project also continues to expand information on commercial growing, harvesting, processing and marketing.

This project was scaled down after the first year when Edgell-Birdseye announced the closure of freezing facilities in Queensland and withdrew from the project.

TRIAL PROGRAM

The following Project Progress Report submitted to HRDC in April, 1994 summarised progress on each project objective.

PROGRESS REPORT APRIL 1994

(A) PROGRESS SUMMARY

Samples of the Eda-Mame vegetable soybean variety Koala (the first variety developed by the QDPI breeding program) sent to Japan for assessment, indicated pod size was not large enough. Work has progressed on developing larger podded varieties. Selection BI/93 has a seed size of 35.7 g/100 seeds, selection B12/93 36.1 g/100 seeds, selection B 14/93 36.3 g/100 seeds, selection B15/93 37.5 g/100 seeds and B17/93 40.1 g/100 seeds. In comparison, Koala has a seed size of 26.2 g/100 seeds. New selections are being multiplied in preparation for market assessment.

The assessment of markets and the development of commercial growing and harvesting techniques have progressed satisfactorily.

(B) PROGRESS DETAIL**i) Commercialisation of Processed Eda-Mame Industry**

This project has achieved the objectives outlined in the project submission, but the industry has not commercialised because Pacific/Dunlop, the cooperating private industry participants have decided not to continue with the project. Australia remains world competitive in the production of Eda-Mame, so new processing interests are being investigated as the Japanese market has a shortfall of 50,000 to 100,000 t of frozen Eda-Mame.

ii) Variety Assessment and Breeding**Variety Assessment - including testing of the QDPI bred selection 39/11 (Koala)**

Selection 39/11 (Koala) is the first release from the QDPI breeding programme. Field trials indicated tolerance to bacterial pustule, bacterial blight, soybean mosaic virus and most commercial strains of *Phytophthora* (root rot). The main problem with Koala is its small pod size. Varieties imported from Asia (Indonesia, The Philippines, Japan and Taiwan) failed in Queensland because of these diseases. QDPI varieties also overcame the severe shattering problems (seed shatters near maturity preventing efficient mechanical heading of seed crops) encountered with Asian varieties. Varieties imported from the U.S.A. are non-shattering and have acceptable disease tolerance but pod quality is inferior (small) and yield is low (Class 2 to Class 3 maturity). A new range of QDPI selections, including crosses with the Taiwanese variety Kaoshiung No. 1 are being trialled at G.R.S. in 1994. These new lines have much larger pod size. In the 1994 trials at G.R.S. the problem of lucerne crown borer damage has largely been overcome by watchful observations and regular sprayings, where detection of the pest has occurred. Mechanical harvesting is a very efficient operation requiring no further development.

**VEGETABLE SOYBEAN VARIETIES
GATTON 1993**

Variety	wt/100	Hilum colour	Seed colour	Setting height	Uniformity	Pod size
Grain soybean	17.24	dark	pale	low to medium	good	small
39/11 Koala	26.20	dark	variable	low	good	medium
B1/93	35.66	pale	pale	low	good	large
B12/93	36.12	colourless	pale	medium	fair	very large
B14/93	36.34	colourless	pale	low	fair	large
B15/93	37.52	dark	pale	low	fair	large

Variety	wt/100	Hilum colour	Seed colour	Setting height	Uniformity	Pod size
B17/93	40.11	colourless	pale	medium	not uniform	large
Green (blk-17-14-91)	29.38	dark	variable pale green	medium	fair	medium

iii) Development of Growing/Harvesting Techniques

As outlined in previous progress reports, the development of commercial growing/harvesting techniques has been completed. Crops are sown in 0.7 m single rows with a within row plant spacing of 5 cm (this gives a plant population of 286,000 plants/ha). At this density, plants set maximum yields, pod maturity is uniform allowing once over mechanical harvesting and plants carry approximately 90% of pods higher than 6 cm above the ground. Pods below 6 cm cannot be picked with mechanical harvesters.

Nodulation is only partly effective in Eda-Mame, using grain soybean inoculum. Best results have been obtained by applying 60 units of N as a basal fertiliser and an additional 60 units of N at early flowering. If strains of inoculum more suitable to Eda-Mame could be developed, the side dressing of N would not be necessary.

Trifluralin can be used as a pre-planting herbicide.

iv) Extending the Harvesting Window

Varieties developed by this project continue to demonstrate a high degree of day length insensitivity. This allows harvesting over an extended period (12 weeks) by staggering planting. There is also three weeks variation in the maturity of varieties.

v) Commercial Seed Production

None of the varieties developed by this project demonstrate the seed shattering characteristic. Hence, commercial grain soybean seed production techniques can be used.

vi) Study of Japanese markets and the Taiwanese Industry

It has not been possible for the project leader to visit these countries. However, these areas were visited in 1991 and contact has been maintained.

(C) CONCLUSION

A processed Eda-Mame industry could now develop in Queensland using the varieties, techniques and market contacts developed by this project. There is every indication a Queensland Eda-Mame industry would be world competitive so expression of interest from the private sector is being sought.

Project Progress in 1994/95

Objectives

Because of shortages of funds caused by the withdrawal of Pacific Dunlop (Edgell-Birdseye) from the project, work on this project in 1994/95 was restricted to three areas:-

- (a) Scaled-down selection programme to complete work initiated in 1993/94.
- (b) Field testing and preliminary market evaluation of new lines multiplied in 1993/94.
- (c) Seed multiplication of new lines selected in 1993/94.

RESULTS

Approximately 40 new crosses were selected for further evaluation from plots at Hermitage Research Station. Selection criteria were disease resistance, pod characteristics, plant type and machine harvestability.

Three new selections - B12/93, B14/93 and B17/93 were planted early (December) mid (January) and late (February) season and machine harvested when pods were at the mature green stage. To gauge Japanese acceptance of this material, samples were sent to major Japanese restaurants in Cairns, Noosa, Gold Coast, Brisbane and Sydney. In addition, Edgell-Birdseye froze a small sample. Results of these samples indicate all three new selections are superior in quality to imported varieties and Koala. It is now proposed to proceed with industry development by encouraging major investment in a processing plant.

Seed multiplication plots were established on the Darling Down in December 1994. These plots harvested April 1995. A nucleus of seed now exists. This seed could form the nucleus seed for the establishment of a commercial industry.

PROJECT GENERAL DISCUSSION INCLUDING RECOMMENDATIONS

(i) Extension/Adoption by Industry of Research Findings

This project has significantly progressed the commercialisation of a major Eda-Mame industry in Queensland but commercialisation cannot proceed until seed stocks of the new varieties - B12/93, B14/93 and B17/93 - are increased several times and investment occurs to establish processing capacity. In preparation for commercialisation a paper entitled "A Review of the Potential to

Produce Eda-Mame in Queensland" has been produced and distributed as a basis for discussion with industry - Refer to Attachment No. 1.

Following the recent trials, the Meyer Strategy Group have been commissioned by the Queensland Department of Business and Regional Development (DBIRD) to conduct detailed market research in Japan, Korea, Hong Kong and other markets. Once this market survey is completed it will form the basis for developing a detailed Business Plan/Feasibility Study. This initiative will culminate in the preparation of an Investment Brief which will be discussed in detail with potential food processors.

(ii) Directions for Future Research and/or Activities Supported by HRDC.

The production side of this industry has now progressed to a stage where industry establishment is not being restricted by available varieties. Hence, while it is preferable to continue the Eda-Mame breeding program to extend the harvest season (by producing varieties with a range of maturities) industry commercialisation is now paramount. General business development funds are available for industry development.

Once a significant industry does develop, this industry will need to work with agronomists, harvest engineers and the Eda-Mame breeding team to perfect production/harvesting systems, extend the harvest season and improve quality. Future involvement by HRDC will probably be to assist with this work.

(iii) Financial/Commercial Benefits of Adoption of Research Findings

Attachment 1 covers most aspects of the potential commercial benefits associated with this project. A commercial industry is likely to involve farmers in the Bowen, Bundaberg and SE Queensland regions with processing in at least two of these regions. It is probable sweetcorn and Eda-Mame will be processed through each plant.

ATTACHMENT 1

A REVIEW OF
THE POTENTIAL TO PRODUCE EDA-MAME IN QUEENSLAND

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BACKGROUND:

Large podded, green vegetable soybean known in Japan as Eda-Mame have been grown in China, Japan and many other Asian countries for hundreds of years. Eda-Mame remain largely unknown in countries of European descent.

PURPOSE OF PAPER:

This paper reviews the potential for Queensland to develop a viable Eda-Mame industry, primarily for export to Japan in the fresh or frozen form. All values are in Australian dollars.

WORLD PRODUCTION:

Japan and Taiwan produce large quantities of high quality Eda-Mame with South Korea and China producing varying quality Eda-Mame for domestic markets. Japan is the major importer of fresh and processed Eda-Mame, primarily from Taiwan.

JAPANESE DEMAND AND PRODUCTION

- **Japanese Production.** Japan produces approximately 104,500 t of Eda-Mame from 14,400 ha. Production is from green houses (heated and non-heated), plastic tunnels or open fields (Figure 1).

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Green house (heated)	●●	*****										
Green house (non-heated)		●●●●	----	*****								
Plastic tunnel		●●●●●●●●	----	*****								
Outdoors				●●●●	----	*****						
Outdoors (Northern region)						●●●●	----	*****				

Figure 1. Eda-Mame production calendar from different farming systems in Japan; ●●● sowing period; --- growing period; *** harvesting period.

- **Japanese Prices.** Prices received on the Tokyo Wholesale Markets reflect supply (Figure 2). In Japan, Eda-Mame is only consumed as a snack with beverages, especially beer. Consumption of Eda-Mame in Japan remains constant at 0.29 kg/person/annum. Demand is lowest during winter months when beer consumption falls.

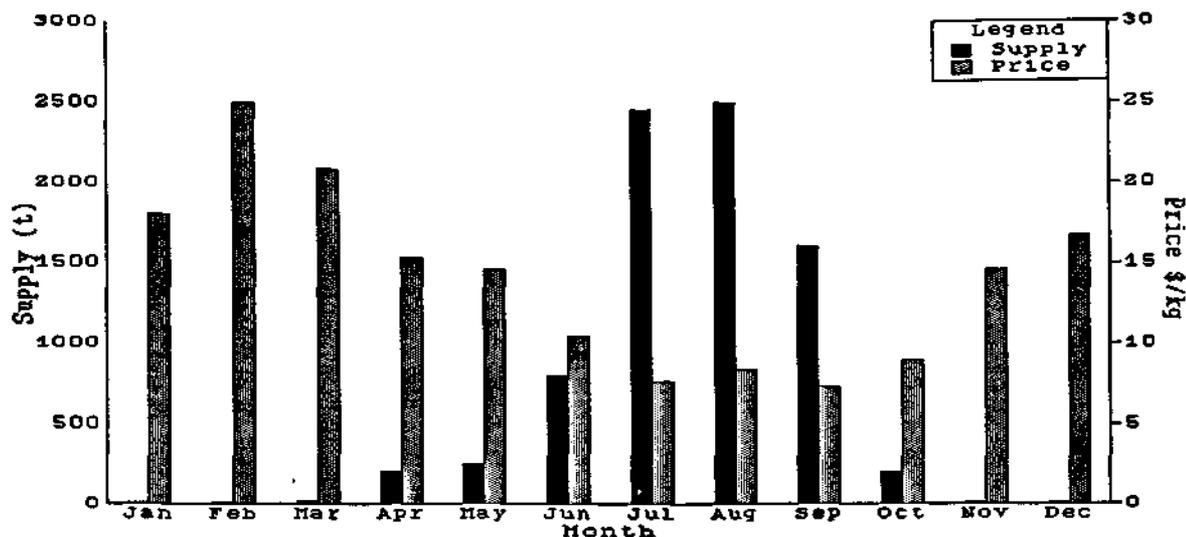


Figure 2. Throughput and price of fresh Eda-Mame in the Tokyo Wholesale Markets - 1989.

- **Japanese Imports.**

Frozen Eda-Mame. Japan imports approximately 34,000 t of frozen Eda-Mame pods, primarily (99%) from Taiwan.

Non-processed, fresh Eda-Mame. Fresh soybeans can be imported 'on plants' or as pods detached from plants. These originate from Taiwan, China, Thailand or Mexico. A premium price is paid for 'on plant' Eda-Mame as these are considered to be the freshest. Statistics are not available in fresh market Eda-Mame imports, but the trade is dominated by frozen imports.

- **Production Costs and Prices in Japan.** Eda-Mame are expensive to grow and market in Japan. Open field production (and marketing) costs \$17,220/ha, plastic tunnels cost \$27,080/ha and heated plastic glasshouses cost \$62,500/ha. This industry could not survive without a significant level of protection and is likely to decline as a result of recent GATT agreements.

TAIWANESE DEMAND AND PRODUCTION

- **Taiwanese Production.** Taiwan produces approximately 63,000 t of Eda-Mame from 7140 ha. Production is static. Eighty per cent of Taiwanese Eda-Mame production is exported, primarily to Japan (Cheng, 1991). The FOB value of Eda-Mame exported annually from Taiwan is approximately \$110,000,000.
- **Taiwanese Production Periods.** Crops are sown in Spring (mid February to early March) and Autumn (mid September to early October) with both production periods being of equal importance.
- **Taiwanese Consumption of Eda-Mame.** The domestic consumption of Eda-Mame in Taiwan increased from 4710 t in 1984 to 15824 t in 1987. It is estimated domestic demand will continue to increase as the standard of living increases. This increase in domestic consumption will reduce exports as a shortage of suitable land will prevent increased production.

POTENTIAL EDA-MAME PRODUCTION IN QUEENSLAND

- **QDPI Breeding Program.** Traditional Japanese and Taiwanese varieties will not produce commercial yields in Queensland because of disease susceptibility, pod shattering and low yield potential. Eda-Mame breeding program is conducted in conjunction with Dr J. Rose at Hermitage Research Station. Commercial varieties are now available.
- **Production Areas/Seasons.** Trials have been conducted at Gatton, Bundaberg and Bowen. Gatton can harvest Eda-Mame from the end of February until mid May. Bundaberg has a longer Eda-Mame harvest window. Preliminary work at Bundaberg Research Station indicates a harvest period from November to June.

The varieties developed for Bundaberg and Gatton are not suitable for winter production at Bowen as plants are too short for harvesting and yields are relatively low. Slower maturing varieties are being developed for Bowen but these will not be commercial before 1995/1996.

- **Yields.** All varieties released from the QDPI program are relatively high yielding, high quality (large 2-3 seeded pods, dark green, white pod hairs and are suitable for machine harvesting). Yields average 5 to 9 t/ha.

QUEENSLAND EXPORT POTENTIAL

- **Product Form.** Fresh soybeans could be pre-cooled and air freighted or shipped to Japan in large quantities. However, the presence of Mediterranean Fruitfly on Mainland Australia prevents achievement of this potential. The work currently being undertaken on Vapour Heat Treatment in mangoes could have important implications for Eda-Mame. This would involve extending mango treatment technology to Eda-Mame. Funding for this project will need to be addressed. Frozen Eda-Mame are not subject to quarantine regulations. Queensland vegetable processors do not have freezing capacity so for this potential to be realised, considerable investment in new freezing capacity would be required. Preliminary negotiations to establish additional freezing capacity have commenced but this will be a difficult task considering the losses being occurred by vegetable freezing factories processing traditional vegetables in Australia.
- **Varietal Adaptability and Market Acceptance.** The QDPI breeding program has produced varieties of Eda-Mame which have excellent physical pod characteristics and appear (not tested extensively in Japan) to have acceptable eating qualities. These varieties are relatively easy to grow and machine harvest and produce yields 30% to 50% higher than varieties grown in Taiwan.
- **Cost of Production in Queensland.**
 - **Growing.** Eda-Mame is not an expensive crop to grow. Major costs are seed (100 kg/ha @ \$1.50/kg), fertiliser (plants are legumes so may fix atmospheric N) and insect control (up to six sprays may be required with *Heliothis* being the major pest). An effective range of registered chemicals is available for weed control. High quality, green stubble remains after harvesting so could be baled as an additional source of revenue. QDPI varieties are resistant to major bacterial and fungal disease so chemical disease control will not be necessary. (This is in contrast to varieties grown in Taiwan where foliar diseases necessitate spraying on a regular basis - often every 5 days). It is likely total production costs (to the point of harvest) in Queensland will be less than \$1000/ha. With payable yields expected to average in excess of 6 t/ha, production costs will be approximately 16.7 ¢/kg. This anticipated cost could be further reduced by the sale of hay. Processors or central packing sheds would probably negotiate a pre-harvest price in the range of 25¢-30¢/kg with growers.
 - **Harvesting and transport to packing shed.** All crops in Queensland would be machine harvested utilising existing French bean harvesters. Cost of harvesting is estimated at 5.5 ¢/kg. Freight from paddocks to central packing sheds or freezing factories will vary from two to four cents/kg.
 - **Fresh market, grading and packing Costs.** Fresh market grading and packing costs will vary, but are likely to be approximately 30¢/kg.
 - **Processing and packaging costs.** Freezing and packaging costs are also likely to vary. However, freezing costs are estimated at 15¢/kg and packaging costs at 60¢/kg.
 - **Total cost.** Total growing, harvesting and packaging costs are likely to be approximately 64¢/kg for the fresh market and \$1.10/kg for the frozen trade.
- **Profit Expectations for Queensland Production/Processing**
 - **Expected profits - Fresh Eda-Mame.** Figure 2 indicates the average monthly price for fresh Eda-Mame on the Tokyo Wholesale Market. The mean price is in the vicinity of \$14/kg for 12 months. Allowing the Japanese importer to take 30% of the sale price, and sea freight and handling costs between Brisbane and Tokyo of 23¢/kg, average profit from exported fresh soybeans would be approximately \$11.50/kg. These market figures indicate Queensland is well positioned to market fresh Eda-Mame in Japan provided Quarantine restrictions can be overcome.
 - **Expected profits - Frozen Eda-Mame.** In 1990, the average FOB export price for frozen Eda-Mame in Japan was \$5.25/t. Taking the sea, frozen freight differential between Taiwan and Japan (\$55/t) and Brisbane and Japan (\$222/t) into account, the FOB Brisbane export price would be in the vicinity of \$5.05/kg. With growing, harvesting freezing and packaging costs estimated at \$1.10/kg, frozen Eda-Mame production in Queensland would be highly profitable.
- **Market Size.** Japanese consumption is directly related to beer sales. Figure 3 indicates large quantities of Eda Mame are consumed in July, August and September with consumption of fresh soybeans falling off dramatically outside of these months because of supply shortages. It is probable fresh Eda-Mame

exports from Queensland would find a ready market from December to June with 1000 t to 2000 t required each month for the Tokyo market alone and an estimated 3000 t to 6000 t required for the total Japanese market. The South Korean market also requires Eda-Mame but no estimate of requirements is available.

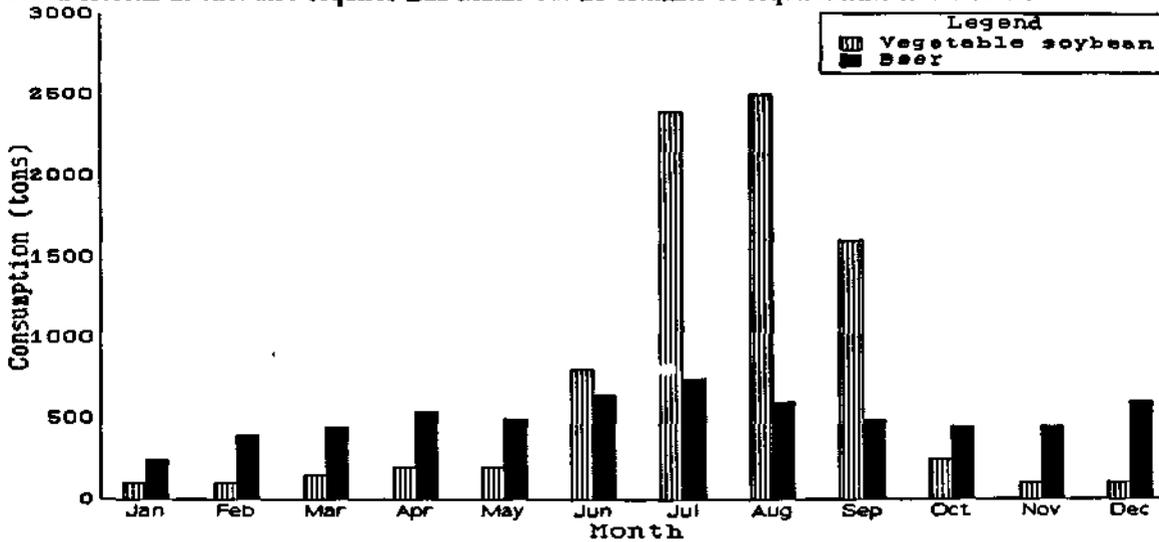


Figure 3. Seasonal changes in beer consumption and vegetable soybean consumption in Tokyo.

Any expansion in fresh Eda-Mame sales in Japan would have a direct effect on frozen product sales. However, with frozen exported Eda-Mame shipments from Taiwan expected to decrease, and the current frozen sales estimated to be 30,000 t short of requirements, a potential Japanese export market in excess of 30,000 t is realistic.

Australia is importing increasing quantities of frozen Eda-Mame for the Japanese tourist trade. Accurate figures are not available but at least 1000t are known to be imported for the Queensland trade.

CONCLUSION

Excellent potential exists to establish a major, export orientated, Eda-Mame industry in Queensland. Markets would be significant and profitable. QDPI varieties and technology are available to support the establishment of this industry. Other Queensland Government Departments could also provide assistance to establish an Eda-Mame industry.

ADDITIONAL INFORMATION

Additional information on the Eda-Mame production potential in Queensland is available from Ron McMahon, Gatton Research Station, P.O. Box 241, Gatton, Q. 4343, Telephone +61 (0)74 621122; Fax +61 (0)74 623223.

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