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Fresh and processed vegetable imports to Australia – Health risks and economic opportunities

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Agriculture Victoria

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Fresh and Processed vegetable imports to Australia – Health risks and economic opportunities

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TABLE OF CONTENTS

Background

This report constitutes two main parts. The first examines the safety aspects and potential health risks associated with imported vegetable products, due to either microbial contaminants or chemical residues. The second investigates the economics involved in the production of some of the higher valued vegetable imports in Australia.

Media Summary

In the 1997-1998 financial year Australia imported A$274 million of fresh and processed vegetables from approximately 74 countries. It may be possible to replace some of these imports with Australian grown produce. To gain a better understanding of the major vegetable crop imports and the replacement possibilities which may exist, a desk top study was conducted. This focused on gathering information on the type, quantity, value, source and timing of imported fresh, frozen, canned, pickled and dried vegetables. The major levied vegetable imports include frozen and canned sweet corn, fresh garlic, processed peas and beans, fresh snow peas and beans and frozen spinach. Information on local vegetable prices, production and seasonal timing was collected for comparison with the data on imported vegetables.

It appears that it is becoming increasingly difficult for Australian producers to compete with vegetable imports when it comes to price. This is largely due to the lower production costs of competing countries, as well as the increased globalisation of the processing industry. It appears that if local growers are to compete on price with imported vegetables, unit costs of production will have to be reduced. Strategies to achieve this may include the development of new technologies such as mechanical harvesting and achieving greater economies of scale.

For Australian growers and processors to compete with vegetable imports, it seems they must also identify market niches where local product can compete on price, quality and continuity of supply. For example locally grown garlic may be marketed for it's superior health benefits. Local snow pea production can be increased in different climatic zones to extend the local season and compete with the imported product.

Imported horticultural produce has potential health risks from microbial contaminants and chemical residues. Fresh and processed vegetables fall into a low risk group of foods that are randomly tested by the Australian Quarantine and Inspection Service (AQIS) for chemical residues. However, vegetables are not currently tested for microbial contaminants.

A review of the potential hazards and the regulations in countries exporting to Australia has been completed. Products and their country of origin were identified and sampling was carried out on selected imported vegetables identified to have higher health risks. Fresh garlic and baby corn were analysed for microbial contamination. Products were tested for the presence of human pathogens capable of causing illness in humans and faecal contaminants, organisms that can indicate unhygienic practices during production. Of the samples tested baby corn from

Thailand was the only product found to contain human pathogens and indicators of faecal contamination.

The AQIS data on chemical residues in imported vegetable products and the Department of Natural Resources and Environment (NRE) Victorian Produce Monitoring survey for chemical residues in locally grown vegetables were used to determine the extent of chemical contamination in imported and local vegetables. Samples of imported fresh garlic, processed cucumbers and gherkins and fresh snow peas were analysed for pesticide residues. Garlic was chosen for analysis, as it represents the largest fresh vegetable import into Australia. Of the samples tested, one violation was detected in imported cucumber and / or gherkins. The Australian Maximum Residue Limit (MRL) for residues according to the Australian Food Standards Code was used as the acceptable limit. The results indicate that the pesticide residue status of imported and local vegetables is comparable.

Technical Summary

In the 1997-1998 financial year Australia imported A$274 million of fresh and processed vegetables from approximately 74 countries. It may be possible to replace some of these imports with Australian grown produce. To gain a better understanding of the major vegetable crop imports and the replacement possibilities which may exist, a desk top study was conducted. This focused on gathering information on the type, quantity, value, source and timing of imported fresh, frozen, canned, pickled and dried vegetables. The major levied vegetable imports include frozen and canned sweet corn, fresh garlic, processed peas and beans, fresh snow peas and beans and frozen spinach. Information on local vegetable prices, production and seasonal timing was collected for comparison with the data on imported vegetables.

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For Australian growers and processors to compete with vegetable imports, it seems they must also identify market niches where local product can compete on price, quality and continuity of supply. For example locally grown garlic may be marketed for it's superior health benefits. Local snow pea production can be increased in different climatic zones to extend the local season and compete with the imported product.

Imported horticultural produce has potential health risks from microbial contaminants and chemical residues. Fresh and processed vegetables fall into a low risk group of foods that are randomly tested by the Australian Quarantine and Inspection Service (AQIS) for chemical residues. However, vegetables are not currently tested for microbial contaminants.

A review of the potential hazards and the regulations in countries exporting to Australia has been completed. Products and their country of origin were identified and sampling was carried out on selected imported vegetables identified to have higher health risks. Fresh garlic and baby sweet corn were analysed for microbial contamination. Each product was surveyed for the presence of six microorganisms, *Salmonella* spp., *Listeria monocytogenes*, *E. coli* (enterohaemophagic types), *E. coli* (generic) *Streptococcus faecalis* and faecal coliforms. The first three listed are human pathogens capable of causing illness. The presence of generic *E. coli*, *S. faecalis* and faecal coliforms can indicate unhygienic practices during production. Of the samples tested baby corn from Thailand was the only product found to contain human pathogens (*Salmonella java* 3bvar3) and indicators of faecal contamination. *Listeria welshimeri* and *L. innocua* (both are non pathogenic bacteria) were also detected.

The AQIS data on chemical residues in imported vegetable products and the Department of Natural Resources and Environment (NRE) Victorian Produce Monitoring survey for chemical residues in locally grown vegetables were used to determine the extent of chemical contamination in imported and local vegetables. Samples of imported fresh garlic, processed cucumbers and gherkins and fresh snow peas were analysed for pesticide residues. Garlic was chosen for analysis, as it represents the largest fresh vegetable import into Australia. Of the samples tested, one violation was detected in imported cucumber and / or gherkins. The Australian Maximum Residue Limit (MRL) for residues according to the Australian Food Standards Code was used as the acceptable limit. The results indicate that the pesticide residue status of imported and local vegetables is comparable.

Part A. Potential health risks associated with fresh and processed vegetable imports into Australia

1. Introduction

In the 1997-1998 financial year Australia imported 183,000 tonnes of frozen, preserved, dried and fresh vegetables from approximately 74 countries. For chemical residues fresh and processed vegetables currently fall into a low risk group of foods which are randomly tested by the AQIS. The AQIS do not sample for microorganisms on vegetables.

A review highlighting the potential health risks associated with fresh and processed vegetable imports into Australia was completed earlier in the project (Behrsing *et al*, 1999b). It examined the safety aspects and potential health risks associated with imported vegetables related to microbial contaminants or chemical residues. It included a review of the regulations controlling agricultural chemical use and the measures of control for microbial contamination of vegetables in the countries that export to Australia. It summarised the current testing regime carried out by the Imported Food Inspection Program (IFIP).

The review and import data were used to select vegetables to sample for microbial contaminants and pesticide residues. The vegetables selected for analysis of microbial contaminants were fresh garlic, fresh baby sweet corn, fresh snow peas and fresh beans. These vegetables were selected because they represent major vegetable imports and can be consumed raw and so are not subjected to cooking which will destroy pathogens.

The vegetables selected for pesticide residues analysis were fresh garlic, fresh snow peas, fresh and frozen beans, frozen spinach, fresh carrots, fresh turnips and fresh shallots (mature). These were chosen on the basis that substantial amounts are imported, they are vegetables that may be consumed without cooking and/or have only been subjected to light processing or are fresh.

1.1 Organisation of sample collection

In late 1999, after consultation with the program manager of Imported Foods at the AQIS, it was established that it is not legally permissible for staff of the AQIS to collect vegetable samples for pesticide or microbial analysis from import shipments other than those set down legislatively by the ANZFA. It is under the ANZFA's jurisdiction to set down what samples are tested, the tests that are carried out and the level of testing on any particular commodity. During the proposal stages of this project and also in it's early stages staff at the AQIS assured us that we would be able to collect vegetable samples from import consignments for our own analysis purposes.

As vegetable samples could not be accessed through the AQIS, it was decided that samples should be obtained from the next step in the supply chain; the importers or the supermarket chains at the distribution level. After consultation with importers (describing what we intended doing), it was determined that they were generally unwilling to provide us with samples. They saw the test results as posing a threat to business. Supermarkets were contacted and they responded in a similar manner to the

importers. Letters were sent to supermarket national quality managers detailing the vegetables we hoped to sample, the microbes for which we would be testing and the reasons behind the study. The letter stated that the sample source would not be disclosed. After consultation one supermarket agreed to supply us with samples for testing, but after two months of negotiation withdrew their support.

It was decided that we would buy samples from the wholesale traders at the Melbourne Market Authority through Plant Standards staff. A contract was arranged with Plant Standards enabling their staff to collect the vegetable samples on our behalf. Staff looked for vegetable samples on a weekly basis and collected samples according to their availability.

2. Microbiological analysis

2.1 Methodology

2.1.1 Collection of samples

Fresh vegetable samples to be analysed for microbial contaminants were collected by Plant Standards officers over a period of nine months. Plant Standards officers looked for samples of the various commodity / country combinations (Table 1) from wholesalers at the Melbourne Markets, as well as from wholesaler and importer warehouses outside the market. They also enquired at the Sydney wholesale market and at a larger retail market in Melbourne for samples which were difficult to obtain. Samples were collected from packages that had not been opened since they were originally packed. If the package required sub sampling (which was generally the case for fresh garlic), surgical gloves were used to place sub samples into plastic zip-lock bags. Baby sweet corn was bought in pre-packed trays. Samples were refrigerated until they were collected for delivery to the Microbiological Diagnostics Unit, Melbourne University, for microbial analysis.

It was not possible to find all of the combinations listed. Fresh garlic from China, Argentina and Australia was collected for microbial testing. Beans were not found at all. Imported snow peas were also not obtained, as during the period we were searching, the local snow peas were relatively abundant and cheaper in price. We did collect local snow peas (in the event that we collected imported snow peas) and so have the results for these. Fresh baby corn from Thailand was collected, but as it is not feasible to grow baby corn commercially in Australia no locally grown produce was found. Each sample/product combination was collected on several different occasions.

Table 1: Products and countries chosen for assessment for microbial contaminants

Fresh garlic	**Fresh snow peas**	**Fresh baby corn**	**Fresh beans**
China	Zimbabwe	Thailand	Thailand
Argentina	Zambia	local	China
local	India		local
	China		
	local		

2.1.2 Analysis of Microorganisms

Samples were analysed at the Microbiological Diagnostics Unit (MDU), Melbourne University. Each product was surveyed for the presence of six microorganisms , these included *Salmonella* spp., *Listeria monocytogenes*, *E. coli* (enterohaemorrhagic types), *E. coli* (generic), *Streptococcus faecalis* and faecal coliforms. The first three listed are human pathogens capable of causing illness. The presence of generic *E. coli, S. faecalis* and faecal coliforms can indicate unhygienic practices during production. Their presence can also indicate that the sample is contaminated with human pathogens.

At MDU a sub-sample was taken from each bulk sample. In the case of baby sweet corn, samples were removed from each of the ten pre-packed trays that constituted the bulk sample, to form a sub sample of approximately 100 grams. In the case of garlic 1-2 cloves per corm were removed forming a sub-sample of approximately 100 grams.

Approximately 100 grams of each vegetable type was vitamised with equal weight of diluent. The 1:2 dilution was then used for preparing the 1 in 10 working dilution for the microbiological tests. The diluent used was 0.1% peptone. In the case of garlic, potassium sulphite (K_2S0_3) was added to a level of 0.5% buffered peptone water for *Salmonella* testing, to neutralise the antibacterial properties.

Australian/ New Zealand Microbiological Standard methods were used for the detection of the different bacteria. The standards used were as follows: *Listeria* spp 1766.2.16-1998, *Salmonella* spp. 1766.2.5-1991, Enterohaemorrhagic *E. coli* (EHEC) FB 004M, faecal coliforms and *E.coli* FB 004 and faecal streptococci FB 024.

2.2 Results

2.2.1 Baby corn

Seven samples of baby corn imported from Thailand were collected and assessed for the presence of microbiological contaminants (Table 2.). Diagnostic results showed the presence of generic *E.coli* and faecal coliforms in all seven. Faecal streptococci were present in four samples. *Salmonella java* 3bvar3 was detected in one sample, *Listeria innocua* in one sample and *L. welshimeri* in one sample. It was not possible to find any locally produced baby corn for comparison. This is because it is not possible to produce it as cheaply in Australia due to our high labour costs and so virtually none is grown here. Consequently the majority of fresh baby corn is imported.

Table 2: Results of tests on fresh baby corn

Baby corn sample no and date collected.	*Listeria* spp. per 25g	*Salmonella* spp. per 25g	Enterohaemorrhagic *E. coli* per 25g	Faecal coliforms/g	*E. coli*/g	Faecal streptococci/g
1. 18/5/00	Not detected	Not detected	Not detected	>161	161	Not detected
2. 18/5/00	Not detected	Not detected	Not detected	161	22	Not detected
3. 1/6/00	*L. welshimeri*	Not detected	Not detected	>161	1.4	1,000
4. 16/6/00	Not detected	Not detected	Not detected	>161	54	Not detected
5. 7/7/00	Not detected	Not detected	Not detected	>161	4.9	24
6. 7/7/00	*L. innocua*	*S. java* 3bvar3	Not detected	>161	~161	24
7. 7/7/00	Not detected	Not detected	Not detected	>161	0.4	24

When the baby corn sample tested positive for *Salmonella java* the MDU reported it to the Department of Health since it is a notifiable disease. They informed the Australian Quarantine and Inspection Service (AQIS) Imported Food Inspection Program (IFIP) who placed the product on their test and hold program. They tested 5 consignments for *Salmonella* spp., all of which were found to be negative.

The contamination issue was addressed by the Maribynong City Council, since it fell under it's jurisdiction. They contacted the importers to alert them to the problem and to enable them to sort it out with their suppliers. Over a period of approximately one month the Maribynong City Council collected six samples to test for *Salmonella* spp. and all were negative. They collected a further six samples for *Salmonella* spp., coagulase positive *Staphylococci, Bacillus cereus* and *Clostridium perfringens.* No pathogens were isolated. These six samples were also tested for *E. coli* as an indicator of faecal contamination. Two of these had *E. coli* levels of 0.7 per gram, one at 92 per gram and in the other three *E. coli* was not detected. All samples were sent to the MDU for analysis.

Both the Department of Health and the AQIS were satisfied with these results and stopped collecting and testing baby corn samples.

2.2.2 Garlic

Four samples of garlic imported from China and two from Argentina tested negative for human pathogens or indicators of faecal contaminants. Three samples of Australian grown garlic tested negative for human pathogens or indicators of faecal contaminants. One sample of garlic tested negative for all human pathogens but showed low levels of the faecal indicator contaminant faecal streptococci (Table 3, 4 and 5).

Table 3: Results of tests on garlic from China

Chinese garlic sample no and date collected.	*Listeria* spp. per 25g	*Salmonella* spp. per 25g	Enterohaemorrhagic *E. coli* per 25g	Faecal coliforms/g	*E. coli*/g	Faecal streptococci/g
1. 18/5/00	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected
2. 18/5/00	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected
3. 1/6/00	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected
4. 7/7/00	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected

Table 4: Results of tests on garlic from Argentina

Argentinian garlic sample no and date collected.	*Listeria* spp. per 25g	*Salmonella* spp. per 25g	Enterohaemorrhagic *E. coli* per 25g	Faecal coliforms/g	*E. coli*/g	Faecal streptococci/g
1. 18/5/00	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected
2. 1/6/00	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected

Table 5: Results of tests on Australian grown garlic

Australian garlic sample no and date collected.	*Listeria* spp. per 25g	*Salmonella* spp. per 25g	Enterohaemorrhagic *E. coli* per 25g	Faecal coliforms/g	*E. coli*/g	Faecal streptococci/g
1. 27/12/00	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected
2. 27/12/00	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected
3. 27/12/00	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected
4. 27/12/00	Not detected	Not detected	Not detected	Not detected	Not detected	0.8

2.2.3 Snow Peas

Four samples of Australian grown snow peas tested negative for human pathogens or indicators of faecal contaminants (Table 6). Imported snow peas could not be obtained.

Table 6: Results of tests on Australian grown snow peas

Australian snow pea sample no and date collected.	*Listeria* spp. per 25g	*Salmonella* spp. per 25g	Enterohaemorrhagic *E. coli* per 25g	Faecal coliforms/g	*E. coli*/g	Faecal streptococci/g
1. 5/12/00	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected
2.	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected
3.	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected
4.	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected

2.3 Discussion

Of the 21 samples that were collected and analysed, two samples were contaminated with *Listeria* spp., one sample was contaminated with *Salmonella java* b3var3, seven samples were contaminated with faecal coliforms and *E. coli* (generic) and five samples were contaminated with faecal streptococci (four samples of baby corn and one samples of Australian garlic). All but one of the contaminated samples (garlic) was Thai baby corn.

The fact that indicators of faecal contamination were found in all seven baby corn samples is of concern. This indicates that poor hygiene practices during production, harvest or packing are being consistently used. Faecal contaminants indicate that human pathogens may also be present and in one sample *Salmonella java* was detected. The two *Listeria* species are not pathogenic to humans.

The presence of faecal indicators gives some indication of the level of hygiene during production, harvest and packing. The results suggest that baby corn from Thailand should be inspected randomly for microbial contaminants.

3 Pesticide residue analysis

3.1 Methodology

Although it was not possible for the AQIS to collect vegetable samples for our work, they did provide us with the results of the pesticide residue tests from the IFIP.

The AQIS test vegetables for a range of organochloride and organophosphate pesticides. As we had planned to test for a similar range of pesticides it was decided that we mainly use their data. Exceptions to this were fresh garlic from China and Argentina and preserved cucumbers / gherkins from a range of countries. The information provided by the AQIS included only one sample of garlic from China. Garlic is the largest fresh vegetable import and most is imported from China. Five to

six thousand tonnes of garlic were traded in Australia in 1998/1999 and of this 4000 tonnes were imported. Imports of garlic from China will continue to grow as China targets the Australian market (Salmons, 2000). Australian growers have responded, highlighting that they believe local garlic is of a better quality and free of toxic chemical residues. Testing cucumbers / gherkins was in response to grower concerns about chemical residues in the imported product and the inability to compete. Plus they are a fairly high volume import. We had planned to test fresh imported and locally produced snow peas for pesticide residues, but during the period we were searching we could not obtain the imported product.

3.1.1 Collection of samples

Fresh vegetable samples to be analysed for pesticide residues were collected by Plant Standards Officers over a period of nine months. They collected samples of fresh garlic produced in China and Australia at the Melbourne Markets. Samples were refrigerated until they were collected for delivery to the State Chemistry Laboratory, for pesticide residue analysis.

Bottles of preserved cucumber / gherkins grown and produced in Israel, India, Macedonia, Poland, Sri Lanka and Australia for sampling were bought from Melbourne supermarkets.

Fresh and frozen beans from China and Kenya, frozen spinach from Egypt, fresh carrots or turnips and fresh shallots from the Netherlands could not be accessed and therefore, were not tested for pesticide residues.

3.2 Results

3.2.1 Garlic

Of the five samples of Chinese garlic and four samples of Australian garlic tested for a range of organochlorides, organophosphates and synthetic pyrthroides (a total of 360 tests, see Appendix I) no violations were detected.

3.2.2 Cucumbers/gherkins

Of the five samples of imported cucumbers/gherkins collected and tested for a range of organochlorides, organophosphates, synthetic pyrthroides and cadmium (a total of 205 tests, see Appendix II) one violation was detected. One sample of cucumbers/gherkins from Sri Lanka exceeded the ANZFA MRL for chloropyrifos (0.03 mg/kg). The ANZFA MRL for chloropyrifos in this product is 0.01 mg/kg. This sample also violated the codex MRL for chloropyrifos.

Of the five samples of locally grown and produced cucumbers/gherkins collected and placed through a range of organochlorides, organophosphates and synthetic pyrethroides (a total of 200 tests) no violations were detected.

3.2.3 AQIS data

The results of the AQIS pesticide residue monitoring program for organochloride and organophosphate levels in our highest value imported fresh and processed vegetables (that are covered by the vegetable levy) for July 1997 to June 1999 are presented in table 7. Appendix III lists the pesticides analysed. Of the 13 product types and 47 consignments tested, one product type, frozen spinach and two separate consignments of this product violated ANZFA regulations for levels of the organphosphate deltamethrin (0.11mg/kg and 0.24 mg/kg respectively). There is no Maximum Residue Limit (MRL) set for this chemical in the ANZFA Food Standards Code so any detection is considered unacceptable. The MRL is the maximum level of a chemical which is allowed to be present in a food, expressed in milligrams per kilogram of the food (mg/kg) (McGowan, 1999). The Maximum Permitted Level (MPL) is the highest concentration of impurity not deliberately added to agricultural produce which is legally permissible in Australian food (McGowan, 1999).

Table 7: Results of pesticide residue tests for organochlorides and organophosphates conducted by the AQIS on fresh and processed vegetable imports into Australia for the period July 97 to June 99 with a value of A$592,754 or greater and covered by the HRDC vegetable levy.

Product	Export country	Date tested	Quantity (kg)	Pesticide tests	Overall result	Pass test results
Fresh garlic	China	Sept 97	22	OC OP	Pass Pass	<MRL <MRL
Fresh garlic	Hong Kong	June 98	24	OC OP	Pass Pass	<0.1 mg/kg <0.1 mg/kg
Fresh garlic	Hong Kong	July 98	NA	OC OP	Pass Pass	<0.1 mg/kg <0.1 mg/kg
Fresh snow peas	Zimbabwe	July 97	1,855	OC OP	Pass Pass	<MRL <MRL
Fresh snow peas	Zimbabwe	July 97	1,000	OC OP	Pass Pass	Pass Pass
Fresh snow peas	Zimbabwe	July 97	4,500	OC OP	Pass Pass	Pass Pass
Fresh snow peas	Zimbabwe	Sept 97	3,200	OC OP	Pass Pass	<MPL <MPL
Fresh snow peas	USA	NA	3,100	OC OP	Pass Pass	<0.1 mg/kg <0.1 mg/kg
Fresh snow peas	Zimbabwe	NA	3,150	OC OP	Pass Pass	<0.1 mg/kg <0.1 mg/kg
Fresh snow peas	Zimbabwe	NA	3,150	OC OP	Pass Pass	<0.1 mg/kg <0.1 mg/kg
Fresh snow peas	Zimbabwe	NA	1,200	OC OP	Pass Pass	<0.1 mg/kg <0.1 mg/kg
Fresh snow peas	Zimbabwe	June 98	3,750	OC OP	Pass Pass	Pass Pass
Fresh snow peas	Zimbabwe	June 98	2,900	OC OP	Pass Pass	<0.1 mg/kg <0.1 mg/kg
Fresh snow peas	Zambia	June 98	2,750	OC OP	Pass Pass	<0.1 mg/kg <0.1 mg/kg
Fresh snow peas	Zimbabwe	July 98	1,000	OC OP	Pass Pass	Pass Pass
Fresh snow peas	South Africa	Sept 98	2,000	OC OP	Pass Pass	all< MRL all< MRL
Fresh snow peas	Zimbabwe	Sept 98	2,560	OC OP	Pass Pass	Pass Pass
Fresh snow peas	Zimbabwe	Oct 98	2,000	OC OP	Pass Pass	Pass Pass
Fresh snow peas	Zimbabwe	June 99	81	OC	Pass	Pass

Product	Export country	Date tested	Quantity (kg)	Pesticide tests	Overall result	Pass test results
				OP	Pass	Pass
Fresh snow peas	Zimbabwe	June 99	600	OC OP	Pass Pass	Pass Pass
Fresh snow peas	Zimbabwe	June 99	400	OC OP	Pass Pass	Pass Pass
Fresh snow peas	Zimbabwe	June 99	1,000	OC OP	Pass Pass	Pass Pass
Fresh snow peas	Zimbabwe	June 99	1,000	OC OP	Pass Pass	all< MRL all< MRL
Fresh snow peas	Zimbabwe	June 99	54	OC OP	Pass Pass	< 0.05 mg/kg < 0.06 mg/kg
Fresh snow peas	Zimbabwe	June 99	1,000	OC OP	Pass Pass	< 0.05 mg/kg < 0.06 mg/kg
Sugar snap peas	Zimbabwe	June 99	800	OC OP	Pass Pass	< 0.05 mg/kg < 0.06 mg/kg
Fresh baby corn	Thailand	Oct 97	900	OC OP	Pass Pass	< MRL < MRL
Fresh baby corn	Thailand	Oct 97	900	OC OP	Pass Pass	< MRL < MRL
Fresh baby corn	Thailand	July 98	450	OC OP	Pass Pass	Pass Pass
Fresh baby corn	Thailand	Oct 98	573	OC OP	Pass Pass	< 0.1 mg/kg < 0.1 mg/kg
Frozen peas	New Zealand	Feb 98	6,588	OC OP	Pass Pass	< MRL < MRL
Frozen beans (1 kg pack)	New Zealand	Nov 97	5,376	OC OP	Pass Pass	< MRL < MRL
Frozen Spinach	Belgium Luxembourg	NA	258	OC OP	Pass Pass	< 0.1 mg/kg < 0.1 mg/kg
Frozen Spinach	Belgium Luxembourg	Feb 99	NA	OC OP	Pass Pass	< MRL < MRL
Frozen Spinach	Belgium Luxembourg	Feb 99	NA	OC OP	Pass Fail 0.11 mg/kg Deltamethrin	< MRL
Frozen Spinach	Belgium Luxembourg	Feb 99	6,144	OC OP	Pass Fail 0.24 mg/kg Deltamethrin	< MRL
Frozen Spinach	Belgium Luxembourg	NA	NA	OC OP	Pass Pass	< MRL < MRL
Frozen Spinach	Belgium Luxembourg	Jun 99	6,144	OC OP	Pass Pass	< 0.05 mg/kg < 0.05 mg/kg
Frozen baby pea and corn mix	New Zealand	Feb 98	2,040	OC OP	Pass Pass	< MRL < MRL
Dried garlic	USA	Jun 99	2,500	OC OP	Pass Pass	< 0.05 mg/kg < 0.05 mg/kg
Preserved beans	Italy	Nov 97	NA	OC OP	Pass Pass	aldrin & dieldrin < 0.05 mg/kg, all others < 0.1 mg/kg all < 0.1 mg/kg
Preserved beans	Korea	Dec 98	48	OC OP	Pass Pass	< MRL < MRL
Prepared beans	Taiwan	Oct 97	99	OC OP	Pass Pass	< 0.1 mg/kg < 0.1 mg/kg

Product	Export country	Date tested	Quantity (kg)	Pesticide tests	Overall result	Pass test results
Baby corn in brine	Thailand	Jul 98	1,114	OC OP	Pass Pass	Pass Pass
Canned baby corn	Thailand	Oct 97	6,960	OC OP	Pass Pass	Pass Pass
Canned baby corn	Thailand	Apr 99	3,315	OC OP	Pass Pass	< 0.05 mg/kg < 0.05 mg/kg
Canned corn	Vietnam	NA	5,184	OC OP	Pass Pass	< 0.05 mg/kg < 0.05 mg/kg

The results from the AQIS pesticide residue testing carried out under the IFIP for vegetable imports of less than A$592,754 in value for July 1997 to June 1999 are presented in table 8. Of the 27 different product types tested, one product type spinach/celery flakes in one consignment exceeded the MRL for the organophosphate diazinon. Diazinon was detected at 0.78mg/kg. The MRL for diazinon in the ANZFA Food Standards Code is 0.7 mg/kg.

Table: 8 Results of pesticide residue tests for organochlorides and organophosphates conducted by the AQIS on fresh and processed vegetable imports into Australia for the period July 97 to June 99

Product	Export country	Date tested	Quantity (kg)	Pesticide tests	Overall results	Pass test results
Other vegetables fresh or chilled	Fiji	N/A	2,643	OC OP	Pass Pass	<0.1 mg/kg <0.1 mg/kg
Other vegetables fresh or chilled	Fiji	N/A	1,537	OC OP	Pass Pass	passed passed
Frozen vegetables other	China	July 98	5,000	OC OP	Pass Pass	passed passed
Frozen bamboo shoots	China	Sept 97	300	OC OP	Pass Pass	below limit below limit
Frozen bamboo shoots	China	Nov 97	300	OC OP	Pass Pass	aldrin & dieldrin < 0.05mg/kg all others <0.1 mg/kg all < 0.1 mg/kg
Frozen vegetables other	Philippines	Dec 97	1,633	OC OP	Pass Pass	< MRL < MRL
Frozen vegetables & bamboo shoots	China	Mar 98	3,500	OC OP	Pass Pass	< MRL < MRL
Frozen bamboo shoots	China	Jun 98	500	OC OP	Pass Pass	< 0.1 < 0.1
Frozen vegetables other	Philippines	Apr 99	683	OC OP	Pass Pass	< 0.05 < 0.05
Frozen mixed vegetables	New Zealand	May 98	3,486	OC OP	Pass Pass	Pass Pass
Dried vegetables	China	Nov 97	120	OC OP	Pass Pass	aldrin & dieldrin < 0.05 mg/kg all others, 0.1 mg/kg Fenvalerate-0.214 mg/kg all others < 0.1mg/kg
Dried vegetables	Hong Kong	Jan 98	390	OC OP	Pass Pass	< MRL < MRL
Other dried vegetables	USA	Nov 98	N/A	OC OP	Pass Pass	< 0.05 < 0.05
Dried vegetables	USA	Dec 98	99	OC OP	Pass Pass	< MRL < MRL
Zucchini freeze dried	USA	Apr 99	200	OC OP	Pass Pass	< 0.05 < 0.05
Spinach/ Celery flakes	USA	May 99	2,193	OC OP	Pass Fail Diazinon level detected to 0.78 mg/kg	< MRL
Preserved vegetables	Taiwan	Aug 97	20	OC OP	Pass Pass	< MRL < MRL
Pickled vegetables	Japan	Feb 98	385	OC OP	Pass Pass	< 0.1 mg/kg < 0.1 mg/kg

Product	Export country	Date tested	Quantity (kg)	Pesticide tests	Overall results	Pass test results
Pickled vegetables	Japan	Jun 99	752	OC OP	Pass Pass	< MRL < MRL
Other prepared vegetables	USA	Jul 97	N/A	OC OP	Pass Pass	Pass Pass
Frozen fried sweet potato	China	Jul 97	500	OC OP	N/A Pass	N/A < MRL
Other prepared vegetables	USA	Sep 97	4,652	OC OP	Pass Pass	N/A N/A
Frozen preserved vegetables	China	Apr 98	4,000	OC OP	Pass Pass	< 0.1 mg/kg < 0.1 mg/kg
Frozen preserved vegetables	China	Jun 98	2,000	OC OP	Pass Pass	< 0.1 mg/kg < 0.1 mg/kg
Other prepared vegetables	USA	Jan 99	6,656	OC OP	Pass Pass	< MRL < MRL
Preserved vegetables	China	Jun 99	200	OC OP	Pass Pass	< MRL < MRL
Mixed vegetables	Macedonia	Dec 97	1,650	OC OP	Pass Pass	aldrin & deldrin < 0.05 mg/kg all others < 0.1 mg/kg all < 0.1 mg/kg
Canned bamboo shoots/salted vegetables	Thailand	Dec 97	2,647	OC OP	Pass Pass	< MPL < MPL
Other vegetable & mixtures of vegetables	Mexico	Jul 97	N/A	OC OP	Pass Pass	< MRL < MRL
Preserved vegetables	Sri Lanka	Feb 99	201	OC OP	Pass Pass	N/A N/A
Red peppers	Macedonia	Apr 99	2,359	OC OP	Pass Pass	N/A <0.05 mg/kg
Cucumber in brine	Israel	Jun 99	1,709	OC OP	Pass Pass	MPL MPL
Grated cassava	Philippines	97	2,724	OC OP	Pass Pass	< MRl < MRL
Dalo, Taro roots & tubers (fresh or dried)	Fiji	97	4,150	OC OP	Pass Pass	< MRL < MRL
Other vegetables fresh or chilled	Fiji	97	1,537	OC OP	Pass Pass	Passed Passed
Dried lotus root	China	97	200	OC OP	Pass Pass	< MRL < MRL
Preserved onions	Netherlands	97	24,000	OC OP	Pass Pass	< MRL < MRL
Dehydrated chopped onions	USA	97	7,838	OC OP	Pass Pass	< 0.05 mg/kg < 0.05 mg/kg
Other onions	USA	97	11,000	OC OP	Pass Pass	< 0.1 mg/kg < 0.1 mg/kg
Frozen soya beans	China	97	6,040	OC OP	Pass Pass	< 0.05 mg/kg < 0.05 mg/kg
Frozen fresh taro	Thailand	97	1,200	OC OP	Pass Pass	Passed Passed

3.2.4 Victorian Produce Monitoring Program

For the period 1996-1997 eight types of vegetables were tested in the Victorian Produce Monitoring Program (Cook, 1998). The following vegetable types were selected for monitoring, asparagus, broccoli, Chinese vegetables (Chinese cabbage, spring onions, silverbeet, Chinese chard and white radish) and potatoes. Of the 564 tests conducted on 120 vegetable samples, four violations were detected. Dithiocarbamate in one spring onion sample, deltamethrin in one Chinese cabbage sample and permethrin in one Chinese cabbage sample and one Chinese chard sample. In addition one half MRL level (50%-100% of MRL) for dithiocarbamates was detected in one spring onion sample. Deltamethrin and permethrin are not registered for use on Chinese vegetables, hence the violations. The results are shown in Table 9.

For the period 1997-1998 11 types of vegetables were tested in the Victorian Produce Monitoring Program (McGowan, 1999). The vegetables were asparagus, broccoli, Chinese greens (Chinese cabbage, leeks, Chinese chard, Bok Choy, Chinese Rata, Chinese broccoli), lettuce (open hearted and loose leaf varieties) and potatoes. Three thousand and nine pesticide residue tests were carried out on 121 vegetable samples and five violations (3% of samples) were detected in four vegetable types. Pesticide violations were detected in one sample of open-hearted lettuce which exceeded the MRL for procymidone, two samples of open-hearted lettuce which exceeded the MRL for dithiocarbamate, one sample of Chinese broccoli which exceeded the MRL for dithiocarbamate, and one sample of leeks which exceeded the MRL for dithiocarbamate. The results are shown in Table 9.

Table 9: Results from the Victorian Produce Monitoring program, identifying vegetables in which pesticide levels exceeded the MRLs set by the ANZFA Food Standards Code.

Vegetable	Pesticide	Year detected	Description
Spring onion	Dithiocarbamate	1996/97	One sample of spring onion exceeded the MRL (26 mg/kg). The ANZFA MRL is 5 mg/kg
Chinese cabbage	Deltamethrin	1996/97	One sample of Chinese cabbage exceeded the ANZFA MRL. There is no MRL set by ANZFA for the use of this chemical in Chinese cabbage
Chinese chard	Permethrin	1996/97	One sample of Chinese chard exceeded the ANZFA MRL. There is no MRL set by ANZFA for the use of this chemical in Chinese cabbage
Chinese cabbage	Permethrin	1996/97	One sample of Chinese cabbage exceeded the ANZFA MRL. There is no MRL set by ANZFA for the use of this chemical in Chinese cabbage.
Open hearted lettuce	Procymidone	1997/98	One sample of open hearted lettuce exceeded the MRL (3.7 mg/kg). The ANZFA MRL is 2 mg/kg
Open hearted lettuce	Dithiocarbamate	1997/98	Two samples of open hearted lettuce exceeded the MRL. The lettuce samples were found to have 3.1 and 9.8 mg/kg of the chemical and the MRL set by ANZFA is 3.0 mg/kg
Chinese Broccoli	Dithiocarbamate	1997/98	One sample of Chinese Broccoli exceeded the MRL (5.1 mg/kg). The ANZFA MRL is 2.0 mg/kg
Leeks	Dithiocarbamate	1997/98	One sample of leek exceeded the MRL (0.10 mg/kg). There is no MRL set by ANZFA for the use of this chemical in leeks

3.3 Discussion

Of the 19 vegetable samples collected and analysed for a range of organochlorides, organophosphates and synthetic pyrethroides (a total of 760 tests) Maximum Residue Limits (MRLs) were exceeded on one occasion. One sample of cucumber / gherkin from Sri Lanka exceeded the MRL for chloropyrifos (0.03 mg/kg). The ANZFA MRL for chloropyrifos in cucumber / gherkin is 0.01 mg/kg. No violations were detected in the Australian grown and produced cucumber / gherkin samples.

No violations were detected in the imported or locally produced garlic. Both would seem to have safe production methods in place. However, because of the small number of samples collected we cannot say this with certainty.

The IFIP pesticide residue testing program for July1997 to June 1998 Maximum Residue Limits (MRLs) indicated that there was a problem with pesticide residues in spinach products. Through this program they are actively addressing this situation.

In comparison, the Victorian Produce Monitoring Program also showed a small number of violations in locally produced vegetables.

The results from our study and the work of the AQIS and the Victorian Produce Monitoring Program indicate that the pesticide residue status of imported and local vegetables is of an equivalent nature.

Part B. Economic analysis of fresh and processed vegetable imports into Australia.

1. Introduction

A preliminary review was conducted during the first 6 months of this project and submitted to the HRDC in February 1999a (Behrsing *et al*, 1999). This report summarises some of the findings of that review and includes additional data and information to provide a more accurate analysis on the feasibility of increasing local production for some of the largest imports. The vegetables selected were frozen sweet corn, garlic, snow peas, green peas and beans.

2. Methodology

Import data for the period 1992-1998 were purchased from the Victorian University of Technology (Anon, 1998c). Information on the type, quantity, value, source and timing of imported fresh, frozen, canned, pickled and dried vegetables was collated using the 1997-1998 financial year data. The data was organised using pivot tables in the Microsoft Excel® computer package. The value data covering 1992-1996 was examined to check for any anomalies, which may have occurred during the 1997-1998 financial year.

To determine which vegetables to study in greater detail, the data were ranked according to the cost, including insurance and freight (CIF value). Imports of the value A$592,000 or greater were studied in further detail (value, volume, source and seasonality). Those vegetables not covered by the HRDC vegetable levy, such as processed tomatoes were excluded from this list.

The Customs Department groups some vegetables according to their custom tariff code. While the vegetables comprising groups are named, it was not possible to obtain detail on values or quantities of individual vegetables within the groups. Therefore further analysis of grouped vegetable categories was not possible.

The farm-gate prices for fresh, locally produced vegetables were obtained from the Australian Bureau of Statistics (Pers. comm. anon) and from the Australian Horticultural Corporation (Anon, 1998a) and Datafresh (Anon, 1998b).

To compare the prices of local to imported processed vegetable imports, retail prices were purchased from a Queensland market research company called Informed Sources. It was necessary to purchase this information as supermarkets would not provide information on prices.

3 Results and discussion

3.1 Main vegetable imports

The complete list of vegetable imports, ranked according to the CIF value, for the financial year 1997-98 is shown in Appendix IV. Omission of products with values less than A$592,000, those not represented in the HRDC vegetable levy and grouped categories reduced the list to 13 products (Table 10). Frozen sweet corn was the highest value processed import, and was ranked third in value overall, after potatoes and tomatoes (Appendix IV). Garlic was the highest value fresh import with A$9,421,038 worth imported in 1997-1998. Peas and beans, in both fresh and processed forms appear several times on the shortened list. The majority of imported fresh peas were snow peas. The total values of processed and fresh peas and beans were A$16,633,550 and A$10,846,348 respectively. There were also substantial imports of frozen spinach and canned sweet corn at A$3,315,087 and A$2,911,141 respectively.

Table10: Vegetable imports (processed and fresh) for the financial year 1997-98 with a value of A$592,754 or greater and covered by the HRDC vegetable levy.

Processed and fresh vegetable imports	Value including insurance and freight (CIF value) (A$)	Total Volume (tonnes)
Frozen sweet corn, uncooked or cooked by steaming or boiling in water	14,573,890	7,323
Garlic fresh or chilled	9,421,038	5,152
Frozen shelled peas (*Pisum sativum*), uncooked or cooked by steaming or boiling in water, all pack sizes	7,766,186	8,568
Dried, shelled peas (*Pisum sativum*)	5,736,443	3,502
Cucumber and gherkins in packs, prepared or preserved by vinegar or acetic acid	4,634,948	3,879
Frozen green (French) beans (*Vigna* spp., *Phaseolus* spp.), uncooked or cooked by steaming or boiling in water	3,592,370	3,760
Frozen spinach, New Zealand spinach and orache spinach (garden spinach), uncooked or cooked by steaming or boiling in water	3,315,087	2,322
Peas (*Pisum sativum*), fresh or chilled	3,130,921	679
Sweet corn, canned, prepared or preserved otherwise than by vinegar, acetic acid or sugar, not frozen	2,911,141	2,772
Beans (excl. shelled beans), prepared or preserved otherwise than by vinegar, acetic acid or sugar, packed in liquid or in air-tight containers, not frozen	1,633,278	1,606
Frozen beans (*Vigna* spp., *Phaseolus* spp.), (excl. green (French) beans), uncooked or cooked by steaming or boiling in water	1,077,127	1,686
Cucumbers and gherkins, prepared or preserved otherwise than by vinegar, acetic acid or sugar, packed in liquid or in air-tight containers, not frozen	866,067	500
Beans (*Vigna* spp., *Phaseolus* spp.), fresh or chilled	592,754	719

3.2 Sources of vegetable imports

The main countries of origin for each of the non-grouped vegetable imports of A$592,000 or greater in value for the 1997-98 financial year are presented in Tables 11 to 23. The countries of origin were graded according to the CIF value of the imported product.

The four major countries exporting vegetables to Australia in 1997/98 were New Zealand, the USA, Italy and China. More than A$70 million of vegetables were

imported from New Zealand, over A$41 million from the USA, A$36 million from Italy (the majority of this being made up of tomato products) and around A$27 million from China.

The majority of frozen sweet corn was imported from New Zealand and the USA, whilst most canned sweet corn was imported from Thailand and New Zealand. The main sources of fresh or chilled garlic are China, the USA and Argentina. The majority of frozen peas were imported from New Zealand and China and the major sources of fresh snow peas were Zimbabwe, China and Zambia. Processed and fresh beans were mainly imported from New Zealand and the USA, processed cucumbers and gherkins imports predominated from Canada and Hungary and the main sources of frozen spinach were the Netherlands and Belgium.

For the financial period 1997/98, the average value per kilogram for imported frozen sweet corn landed in Australia was A$1.99. Frozen sweet corn from the USA had the lowest landed value of A$1.77/kg, whilst frozen sweet corn from Thailand was landed at A$2.48/kg.

The average landed price for fresh or chilled imported garlic in the period 1997-1998 was A$1.83/kg. In comparison, the gross wholesale value of fresh Australian grown garlic was A$3.40/kg (average, 1997 period). The landed price of imported garlic ranged from A$0.97/kg (Hong Kong) to A$3.16/kg (USA).

The average value of imported frozen shelled peas was A$ 0.91/kg and the price ranged from A$0.90 (New Zealand) to A$1.43 (China). Imported dried shelled peas had an average landed price of A$1.64/kg, but ranged in price from A$1.59/kg (New Zealand) to A$6.61/kg (France).

Imported cucumbers and gherkins packed in vinegar or acetic acid, had an average landed value of A$1.19/kg. Hungarian and Croatian cucumbers and gherkins had the lowest landed values of A$1.04/kg and A$1.11/kg. The average value of cucumbers and gherkins not prepared or preserved with vinegar, acetic acid or sugar was A$1.73/kg and ranged in value from A$1.31/kg (Hungary) to A$1.94/kg (Germany).

The average landed value of imported frozen green (French) beans was A$0.96/kg whilst frozen beans (excluding French) were A$0.64/kg. Frozen French bean prices ranged from A$0.55/kg to A$1.68/kg and frozen non French beans were A$0.54 to A$2.99.

Frozen spinach imports had an average landed value of A$1.43/kg. Frozen spinach from the USA, Belgium and the Netherlands had landed values of A$1.25/kg, A$1.29/kg and A$1.55/kg respectively, whilst frozen spinach from China had a landed value of A$3.05.

The majority of fresh/chilled snow peas were imported from Zimbabwe, priced at A$4.96/kg.

The large difference in price between the New Zealand peas (A$1.98) and the peas from Zimbabwe, China and Zambia (A$4.96, A$6.58 and A$4.57 respectively) was due to the fact that the New Zealand peas were garden peas.

Imported canned sweet corn had an average value of A$1.05/kg and prepared or preserved beans a value of A$1.02/kg. The USA was the largest exporter of prepared beans to Australia, exporting a total of 968 tonnes.

The average value of fresh or chilled beans was A$0.82 and ranged in value from. A$0.69/kg (USA) to A$1.65/kg (New Zealand). In comparison, fresh Australian grown beans (for the 1995/1996 season) had a gross value of A$1.15/kg.

Table 11: Frozen sweet corn

Country	New Zealand	USA	Thailand	Egypt	Other	Mean
Value (A$)	10,601,608	3,367,213	600,256	2,018	2795	
Volume (kg)	5,176,000	1,905,000	242,000	N/A*	N/A	
Price/kg (A$)	2.05	1.77	2.48			1.99

* = N/A data not available

Table 12: Garlic, fresh or chilled

Country	China	USA	Argentina	Hong Kong	Other	Mean
Value (A$)	3,739,426	2,582,509	1,152,103	396,534	1,550,466	
Volume (kg)	3,076,000	817,000	438,000	407,000	414,000	
Price/kg (A$)	1.22	3.16	2.63	0.97	3.75	1.83

Table 13: Frozen, shelled peas (*Pisum sativum*)

Country	New Zealand	China	Netherlands	Fiji	Other	Mean
Value (A$)	7,492,956	235,566	25,315	8,544	3805	
Volume (kg)	8,371,000	165,000	26,000	6,000	N/A	
Price/kg (A$)	0.90	1.43	0.97	1.42		0.91

Table 14: Dried, shelled peas (*Pisum sativum*)

Country	New Zealand	USA	South Korea	France	Other	Mean
Value (A$)	5,160,042	483,002	30,029	19,843	43,527	
Volume (kg)	3,241,000	249,000	6,000	3,000	3,000	
Price/kg (A$)	1.59	1.94	5.00	6.61	14.51	1.64

Table 15: Cucumber and gherkins in packs, prepared or preserved by vinegar or acetic acid

Country	Canada	Hungary	Croatia	Czech Republic	Other	Mean
Value (A$)	1,251,625	935,059	477,045	410,765	1,560,454	
Volume (kg)	879,000	895,000	429,000	286,000	1,390,000	
Price/kg (A$)	1.42	1.04	1.11	1.44	1.12	1.19

Table 16: Frozen green (French) beans

Country	New Zealand	USA	Belgium	Netherlands	Other	Mean
Value (A$)	2,318,815	1,198,974	40,728	30,383	3,470	
Volume (kg)	1,382,000	2,271,000	65,000	42,000	N/A	
Price/kg (A$)	1.68	0.53	0.63	0.72		0.96

Table 17: Frozen Spinach

Country	Netherlands	Belgium	USA	China	Other	Mean
Value (A$)	1,723,457	901,703	600,187	70,105	19,635	
Volume (kg)	1,111,000	700,000	479,000	23,000	9,000	
Price/kg (A$)	1.55	1.29	1.25	3.05	2.18	1.43

Table 18: Peas (*Pisum sativum*), fresh or chilled

Country	Zimbabwe	China	Zambia	New Zealand	Other	Mean
Value (A$)	1,715,238	460,647	457,198	194,271	303,567	
Volume (kg)	346,000	70,000	100,000	98,000	65,000	
Price/kg (A$)	4.96	6.58	4.57	1.98	4.67	4.61

Table 19: Sweet corn, canned

Country	Thailand	New Zealand	Singapore	China	Other	Mean
Value (A$)	2,625,164	243,036	29,815	6,954	6,172	
Volume (kg)	2,464,000	267,000	41,000	N/A	N/A	
Price/kg (A$)	1.07	0.91	0.73			1.05

Table 20: Beans (excl. shelled beans), prepared or preserved

Country	USA	New Zealand	Italy	Japan	Other	Mean
Value (A$)	1,130,114	182,676	88,691	38,314	193,483	
Volume (kg)	968,000	205,000	129,000	44,000	260,000	
Price/kg (A$)	1.17	0.89	0.69	0.87	0.74	1.02

Table 21: Frozen Beans (excl. (French) beans)

Country	USA	New Zealand	China	Kenya	Other	Mean
Value (A$)	587,859	412,422	71,363	2,993	2,490	
Volume (kg)	874,000	768,000	43,000	1,000	N/A	
Price/kg (A$)	0.67	0.54	1.66	2.99		0.64

Table 22: Cucumbers and gherkins, prepared or preserved otherwise than by vinegar, acetic acid or sugar

Country	Israel	Hungary	Germany	Taiwan	Other	Mean
Value (A$)	481,681	111,178	98,931	69,025	105,252	
Volume (kg)	319,000	80,000	51,000	N/A	50,000	
Price/kg (A$)	1.51	1.31	1.94		2.11	1.73

Table 23: Beans, fresh or chilled

Country	USA	New Zealand	Thailand	China	Other	Mean
Value (A$)	479,522	46,304	33,956	29,766	3,206	
Volume (kg)	691,000	28,000	N/A	N/A	N/A	
Price/kg (A$)	0.69	1.65				0.82

3.3 Comparison of imported value to local value

Comparative prices for locally grown produce and fresh imports are shown in Table 24.

Fresh garlic, fresh beans and fresh snow peas can be imported for less than they can be produced in Australia. Fresh garlic from the three main importing countries was cheaper than Australian grown garlic. Alternatively, fresh snow peas from China (A$6.58) and fresh beans from New Zealand (A1.65/kg) were more expensive than the locally grown products. This is an indication that price is not the only factor determining why vegetables are imported. Maintaining a consistent supply of specific vegetables is also a major factor influencing imports. Furthermore the fact that vegetables are sometimes imported at a cost greater then they can be produced locally suggests that there are opportunities for import replacement at times.

Table 24: Comparison of imported value (CIF value) to local farm-gate values

Vegetable import	Cost ($ per Kg)	
	Imported (average cost)	Local
Garlic, fresh or chilled	1.83 (1997/98)	3.40 (1997)
Snow Peas, fresh or chilled (green)	4.61 (1997/98)	5.40 (1997, gross value)
Fresh Beans (French and runner)	0.82 (1997/98)	1.15 (1997)

Table 25: Comparison of retail prices for imported and local processed vegetables for 1997/98

Product	Data	Imported	Export Countries		Local
			Israel	Poland	
Cucumbers	Average of price A$/kg	4.00	4.00	4.00	3.31
	Max of price A$/kg	4.00	4.00	4.00	3.96
	Min of price A$/kg	4.00	4.00	4.00	2.43
			New Zealand		
Frozen baby peas	Average of price A$kg	3.70	3.70		3.44
	Max of price A$/kg	3.70	3.70		3.52
	Min of price A$/kg	3.70	3.70		3.39
			New Zealand		
Frozen beans	Average of price A$/kg	3.10	3.10		3.50
	Max of price A$/kg	3.10	3.10		3.50
	Min of price A$/kg	3.10	3.10		3.50
			New Zealand		
Frozen peas	Average of price A$/kg	2.84	2.84		2.62
	Max of price A$kg	2.89	2.89		3.40
	Min of priceA$/kg	2.78	2.78		1.65
			New Zealand		
Frozen sweet corn cobs	Average of price A$/kg	3.22	3.22		3.14
	Max of price A$/kg	3.31	3.31		3.31
	Min of price A$/kg	3.13	3.13		2.99
			New Zealand	USA	
Frozen sweet corn kernels	Average of price A$/kg	3.60	3.70	3.50	3.40
	Max of price A$/kg	4.00	4.0	3.50	3.90
	Min of price A$/kg	3.40	3.40	3.50	2.90

3.4 Comparison of the retail prices of locally produced processed vegetables to imported processed vegetables

The average retail prices of locally produced processed cucumbers, frozen baby peas, frozen sweet corn cobs and frozen sweet corn kernels were less than the average retail prices of the imported products (Table 25). In the case of frozen beans, the average retail price of imports was lower than the average price of the Australian product. The average retail price of imported frozen peas was higher than that of the locally produced ones, however the maximum price of the imported frozen peas (A$2.89/kg) was less than that of the locally produced frozen peas (A$3.40/kg). In the financial period 1997-1998 locally processed cucumbers (A$3.31/kg) were cheaper than imports from Israel (A$4.00) and Poland (A$4.00).

The fact that Australia imports large quantities of frozen peas, beans and corn and that there is no real price advantage (at the retail level) in doing so, indicates that factors other than price influence the production and importation of the processed vegetables we eat. For example, multinational companies find it more profitable to mass-produce their product in one country and at one facility and then export that product to other countries. A recent example of this was the closure of the Heinz Wattie's manufacturing plant in Dandenong, Victoria (Robinson, 2000). Production from the Dandenong plant and another in Japan are being absorbed by a Heinz Wattie's facility in Hastings, New Zealand. By doing so, processing companies optimise the usage and output of their production facilities and maximise their return. This is most likely the case with the production and import of frozen peas, beans and sweet corn. The other major factor influencing vegetable imports is the need of local wholesalers/retailers to maintain a consistent supply of products to their customers throughout the year.

3.5 Local production

3.5.1 Sweet corn

The Australian sweet corn industry produces 81,900 tonnes at a gross value of A$35.43 million (1995/1996). For the year ending March 1996, 6,472 hectares of sweet corn were under production. Sweet corn is grown in all states of Australia and can be grown year round in some localities. NSW followed by Queensland and Victoria are the major areas of Australian production (Deuter, 1997). NSW produces 53% of the Australian output, most of which is destined for processing. The main growing areas are the Sydney basin, Hunter Valley, Riverina and Tumut. Queensland produces 19% and Victoria 10% of the Australian output and this is mainly for the fresh and export markets, with some for processing. Queensland's main growing areas are in the Southeast, Gympie, Bundaberg and the Bowen/Burdekin region. In Victoria, sweet corn is grown in Gippsland and the Northern districts. A recent study of land suitability in Victoria for selected horticultural crops indicated that 424,900 ha of land was highly suitable and 11,868,300 ha of land in Victoria was moderately suitable for sweet corn production (Bluml *et al.* 1999). The main varieties under production in Australia are Golden Jubilee, Golden Sweet (super sweet) and Pearl (bicolour super sweet).

Table 26: Sweet corn growing areas in Australia and production estimates for 1996 (Deuter, 1997)

State	District	Timing	Tonnes	ha
Queensland	Bundaberg (fresh)	All year (peak harvest in Nov)	650	70
	Burdekin (fresh)	Plant Mar to Aug Harvest June to Oct	1800	200
	Bowen (fresh)	Plant Mar to Aug Harvest June to Oct	4100	700
	Southern Qld (Lockyer Valley & Eastern Darling Downs)	Fresh Plant Sept to Mar Harvest Dec to Feb	1800	200
		Processing Plant Sept to Nov Harvest Dec to Feb	10000	750
New South Wales (mainly processing)	Central West (Dubbo/Narromine/Bathurst/Cowra/Forbes)	Plant Sept to Jan Harvest Dec to May	45000	2800
	Riverina (Gundagi to Hay)	Plant Oct to Nov Harvest Jan to Feb		
Victoria (mostly for fresh market)	East Gippsland, West Gippsland, Cranbourne, Swan Hill, Mildura	Plant late Sept to Feb Harvest late Dec to May	6000	550
Tasmania (mainly processing)	North West Tasmania	Plant early Nov to Jan Harvest Jan to April	5600	350
Western Australia	Bunbury and outer Perth		1100	100
South Australia	Riverland	Plant Sept to Feb Harvest Dec to May	700	600
		Total	76750	5780

During 1997/98 imports of frozen sweet corn steadily increased from 420 tonnes in February to 773 tonnes and 768 tonnes in August and October respectively (Figure 1). However, the highest import values occurred in June ($1,610,955) and October ($1,547,876). For canned sweet corn, distinct peaks in June (430 tonnes), and to a lesser extent in September (342 tonnes), were evident (Figure 2). While the greatest quantity of canned sweet corn was imported in June, this was also the month with the lowest price ($0.67 / kg).

At present a limiting factor to the expansion of fresh corn in the local and export market exists, in the inability to produce cobs free of corn earworm or heliothis (*Helicoverpa armigera*) and damage caused by the larvae (Deuter, 1997). This is due to the development of insecticide resistance in heliothis. Only a limited number of insecticides are registered for use on sweet corn and with the development of increased resistance by heliothis these are becoming less effective. In Northern Queensland in the 1996 winter season, resistance levels were assessed at 100%. In the instances where this was observed complete crop failure resulted. Research work looking into the heliothis problem is being lead by the Queensland Department of Primary Industry (QDPI) at the Gatton Research Station (Deuter, 2000). This work has been assessing natural predators to control the heliothis problem. The wasp Trichogramma has been identified as a useful control measure in the Lockyer valley in Qld. Integrated Pest Management is showing success in controlling this insect problem. Biological insecticides which do not kill the beneficial predators are being trialed on sweet corn crops. The insecticide Success® has now been registered for use on sweet corn and a natural virus, the nuclear polyhedrosis virus (NPV) is being trialed and may soon be registered for use.

The limited number of cultivars available for cultivation in Australia, and the restrictions on the import of new cultivars due to the risk of introducing boil smut are also limiting the expansion of local sweet corn production (Ridland and Deuter, 1997).

In two separate benchmarking studies the following trends and observations were noted.

A 1990 benchmarking study compared sweet corn production in Victorian to that of the USA, Chile and New Zealand (Pers. comm. Robert Dimsey). Recommendations from this study for sweet corn farming were that by increasing farm size to 750 acres (the average size of a US corn farm) Victorian growers could lower costs by A$35/tonne. Costs are reduced by reducing the overhead costs of the land and other associated costs. In addition sharing equipment or hiring operators using high cost machinery can increase access to the most advanced and efficient equipment or significantly lower machinery input costs.

This study reported that in some parts of New Zealand and the USA natural rainfall during the growing season almost eliminates the need for costly irrigation. In parts of New Zealand low amounts of fertilisers are needed due to naturally fertile soils. For these reasons, New Zealand farmers can produce sweet corn for $13/tonne less than Australian producers.

It was calculated that to produce and deliver Australian sweet corn to the factory door, it costs A$171/tonne in NSW, A$167/tonne in Victoria, A$152/tonne in Queensland and A$148/tonne in Tasmania. This compares to A$90/tonne in New Zealand, A$99/tonne in the USA (or A$70 with subsidy) and A$137/tonne in Chile.

A 1993 benchmarking study of the processing sweet corn industries in the USA, New Zealand and Australia found that New Zealand was "best in class" in terms of raw production costs to the factory door for sweet corn (Stephens et al, 1993). In comparison, sweet corn production in NSW to this point was 46% more expensive. Areas identified where costs could be reduced were harvesting (75% more expensive), transport of raw product (1,150% more expensive) and grower variable costs (eg. seed, fertiliser, contracting operations and casual labour).

The retail price per kilogram of locally produced frozen sweet corn does not reflect the differences in the gross values as highlighted in the benchmarking studies. There is not much difference in the retail price of local and imported sweet corn for the period 1997/98 and often the retail price of local frozen sweet corn is less than that of the New Zealand equivalent. Yet, benchmarking studies show that sweet corn can be produced for much less in countries such as New Zealand and the USA. Our import data suggests that Australian importers import the frozen sweet corn for less than it can be produced in Australia and then mark up the price at the retail level, thereby increasing their profit margins. The 1997/98 import data shows that frozen sweet corn from New Zealand was landed into Australia at $2.05/kg (Table 11). We were unable to obtain the wholesale value of Australian produced frozen sweet corn for comparison, but the average and minimum retail prices of Australian frozen cob corn were A$3.14/kg and A$2.99/kg respectively.

3.5.2 Beans

French beans are grown all year round in Australia, while runner beans are in production from February to March and September to October. The major areas for bean production in Australia are Tasmania and Queensland. Over half of the total production is in Queensland (Stanthorpe, Gympie, Bundaberg, Bowen and Burdekin). Northwest Tasmania is the second largest production area. Other production areas are Victoria (Sunraysia and Gippsland regions), SA (Adelaide plains and Riverland district), WA (Carnarvon and outer Perth) and NSW (Sydney basin, mid north coast and Stanthorpe). For the year ending March 1996 7,102 hectares of beans were under cultivation in Australia, resulting in the production of 32 million kilograms of beans with a farm-gate value of A$36.7 million. During 1997/98 Australia imported A$10.8 million fresh and processed beans.

French beans for the fresh market are grown in all states. French beans for the processing market are grown in Tasmania and Queensland.

Fresh / chilled bean imports were characterised by one distinct peak in April / May (Figure 3). The April and May CIF values were A$212,204 and A$220,604 respectively. The corresponding volumes were 311 tonnes and 306 tonnes respectively out of the yearly total of a little over 700 tonnes.

There was no clear time of the year when frozen bean imports (excluding French beans) were greater – timing of imports appears to be erratic (Figure 4). Frozen beans were the cheapest vegetable import considered here with a yearly average value of A$0.64 / kg. Imports were cheapest in December (A$0.36 / kg) and most expensive in May (A$4.41 / kg). Large quantities of frozen French beans were imported from October through to December with a peak in November (Figure 5). Prices ranged from A$0.56 / kg in November to A$1.43 / kg in February, the yearly average being A$0.96 / kg.

The quantity of canned bean imports was greatest in October (Figure 6), but this was also the month with the second lowest import price (A$0.61 / kg). Peak CIF values occurred in May (A$281,234), and this steadily declined down to A$77,371 in September.

A benchmarking study of processing vegetables in the early 90's established that the Australian processed bean industry was not internationally competitive with processors in New Zealand and the USA (Pers. comm. Robert Dimsey). This study determined that US production of raw beans was the most cost competitive. Australia produced low yields of beans (8 tonnes/hectare) compared to the USA 13.2 tonnes/hectare and New Zealand 13 tonnes/hectare. Possible means to improve the local yield of beans and improve local competitiveness were highlighted. Bean varieties bred in overseas breeding programs and released in Australia may not be as well suited to local growing conditions. They suggested assessment of this breeding material or the establishment of a local breeding program.

It was suggested that field practices also needed to be reviewed if yield was to be improved. Soil preparation, crop rotations, sowing techniques, pest and disease control, irrigation and nutrient regimes should all be assessed.

Australian fixed costs to growers (machinery, land costs including rates, interest on land and rent of land, labour costs and other costs such as accountant, legal, and bank etc) were also significantly higher than those of the USA and New Zealand.

In 1993 a benchmarking study of fresh bean production also determined that the USA and New Zealand were more cost competitive producers of fresh beans than the Australian producers (Stephens et al, 1993). It cost A$313 /tonne to produce beans to the factory door in Victoria compared to A$195 /tonne (A$138 with subsidy) in the USA and A$239 /tonne in New Zealand. It was suggested that Victorian bean growers could lower production costs by A$100/tonne if farm size was increased to around 380 acres.

3.5.3 Green Peas

For the year ending 1997, 1.4 million kilograms of fresh peas, with a gross value of A$2.6 million and 42 million kilograms of processing peas, with a gross value of A$15.5 million, were produced in Australia.

Green peas for the fresh industry are grown close to the capital cities and major centres in Australia and processing peas are mainly grown in Tasmania and Queensland. Peas require cool growing conditions and consequently are grown in

Queensland and NSW during the winter and in Tasmania, Victoria and south-west Western Australia in spring to early summer. Pea crops are often grown by farmers as a rotation crop, as they have a relatively low return. Farmers also harvest the plants as pea straw to supplement income.

The greatest volume of frozen shelled peas is imported in March and this is also the month of the lowest price (Figure 7). Consequently, the value of imports did not peak in this month, but instead, reached a maximum in May, the month with the second greatest volume of imports.

Dried shelled pea imports reached a maximum in both volume and value in August (Figure 8). In general, the lowest quantities were imported from October through to January. There was considerable variation in prices over the year.

In the early 1990's, a benchmarking study compared the production and delivery costs of fresh peas to the factory door in four countries (Pers. comm. Robert Dimsey). Production and delivery cost A$431 /tonne in Victoria and A$438 /tonne in Tasmania, compared to A$271 /tonne in Chile, A$337 /tonne in New Zealand and A$368 / tonne (A$261 with subsidy) in the USA.

A 1993 benchmarking study assessed the competitiveness of the processing pea industries in the USA, New Zealand, the UK and Australia (Stephens et al, 1993). New Zealand was determined to be best in class in terms of raw pea production to the processing plant. At the same point in production, Tasmanian peas were 33% more expensive to produce and Queensland peas were 25% more expensive to produce. In this study Australia was found to be competitive as far as pea yields per hectare were concerned, Tasmania 5.5 tonnes/hectare, Queensland 5 tonnes/hectare compared to New Zealand 5.5 tonnes/hectare. But in terms of harvesting, cost of transport, grower fixed costs and grower variable costs Australia was uncompetitive.

Our data supports the findings that New Zealand was the "best in class" for pea production. This view is borne out by the fact that New Zealand is the largest supplier of frozen peas to Australia, with exports of approximately 8,300 tonnes during the period 1997/98.

It was thought that small farm size in Australia compounded by high land values had a major impact on the fixed and harvesting costs of Australian peas (Stephens et al, 1993). It was suggested that fixed production costs could be significantly reduced by concentrating production areas, sharing farm equipment, forming farming cooperatives and by the better utilisation of land. Identifying best practice methods for crop rotation, soil preparation, precision sowing, uniformity of planting depth, disease and weed control and nutrition and irrigation management were areas where it was proposed the variable costs in pea production could be reduced.

3.5.4 Snow Peas

In 1997, Australia produced 907 tonnes of fresh snow peas with a gross farm gate value of A$4.9 million. In the same period, Australia imported A$ 2.14 million (gross value) of fresh snow peas from Zimbabwe, Zambia and New Zealand. The major

snow pea growing regions of Australia is Victoria, followed by Queensland. The main growing region for snow peas in Victoria is South Gippsland. The Victorian growing season is from mid October to early June, while the Queensland growing season is from late May to early October. Victorian producers and suppliers of snow peas state that continuity of supply to their customers is of major importance to their business. During the Victorian off-season from June to early October some Victorian suppliers lease land in Queensland to grow snow peas and supply the local market. But during the Queensland growing season only one third to one half of what is grown in Victoria over an equivalent period of time is produced. A Victorian cooperative of snow pea growers has ensured a continuity of supply to the local retail market by buying and leasing land in Queensland for snow pea production (Smith, 2001). The same cooperative was also looking to supplement or increase it's turnover of snow peas during the off season with imports from China. From an economic point of view it would have been viable, however when they saw the snow peas it was found that they were actually frozen, so this was no longer an option.

The major buyers of snow peas in Australia are supermarkets. Australian growers feel that as long as they can consistently supply the supermarkets with good quality snow peas year round, the supermarkets will continue to support them and buy their product. One Victorian supplier of snow peas felt that imported snow peas did not threaten the locally grown produce. This is because local produce is superior in quality and has a consistency of supply during the growing season. He felt that the imported product supplements the Australian market when local production is low. For example, imported snow peas are in the Victorian markets from June through until late September when local Victorian produce is out of season and when there is not enough Queensland product to meet local demands. It appears that there is a market niche during this period for Australian snow peas grown in warmer climates such as Queensland during this period.

During May 2000 to January 2001 we tried to find imported consignments of snow peas to analyse but were unable to. This could be an indication of an increase in local production (particularly in Queensland) since the 1997-98 import data. It could also be due to the fact that most of the imported Snow peas are landed and marketed in Western Australia (Smith, 2001).

Fresh and chilled peas (Figure 9) were substantially more expensive than any other imported vegetable considered here; the yearly average price being A$4.61 / kg. Prices peaked in October (A$11.37 / kg) and were lowest in January (A$2.69 / kg). This suggests that the fresh peas referred to in this data are actually snow peas.

Although Australian snow peas are hand picked, some producers are installing mechanised grading and packing lines, to reduce labour costs and damage in the grading and packing operation.

3.5.5 Garlic

Garlic can be grown all year round and cured garlic (garlic that has been air dried for 4-6 weeks) can be stored for 12 months in Australia. It is cultivated near Perth in WA, in the Adelaide Plains and the Riverland in SA, in the Sunraysia district of Victoria, the Riverland district of NSW and the Lockyer Valley in Queensland. In

1993-94, Australia produced 346 tonnes of garlic with a farm-gate value of A$1.305 million.

In 1997-98, Australia imported 5,152 tonnes of garlic, the majority of this was from China, but we also import garlic from the USA, New Zealand and Argentina. In general between 300 to 600 tonnes of fresh garlic was imported each month (Figure 10). The exception was July when 722 tonnes was imported. The greatest monthly values were observed from January through to March, when the price and total volume were relatively high.

In 1998, garlic production in Australia increased substantially. Grower estimates indicated an expected yield of 2000 tonnes of garlic from 260 hectares. The garlic was to be harvested from December 1998 to February 1999 and most of this was destined for the pharmaceutical industry (export market).

Research being conducted at the Institute for Horticultural Development in collaboration with a commercial partner has identified value added opportunities for Australian grown garlic to be used as a source of health compounds for the pharmaceutical market. Results to date have identified Australian grown garlic as the most potent source of the cholesterol-lowering compound alliin, yet recorded in the world. This is seen as a marketing tool, by which Australian garlic can be differentiated for added value.

Australian production costs for garlic vary between A$3.04-A$3.10/kg (not including transport costs). Chinese garlic is landed in Australia (usually Perth) at approximately A$0.80-A$1.20/kg. In Australia our biggest costs are labour and fuel. We can't compete on price with countries such as the USA which have labour costs of $US6.00/hr.

A report in the Age newspaper (Salmons, 2000) states that local garlic growers are starting to rally behind their product. Because they can't compete on price with imports they are promoting the quality and freshness. Another problem the Australian garlic industry must overcome is the fact that they don't produce enough to consistently supply supermarkets. A spokesperson for garlic growers stated that supermarkets want to support the local garlic industry by marketing more Australian garlic.

Australian growers believe that there may be problems associated with chemical residues and food safety issues associated with imported product and see an opportunity to market Australian garlic based on it's health benefits. They also believe that Australia produces the largest and best quality garlic in the world.

3.5.6 Processed cucumbers and gherkins

In the period 1997-1998, Australia imported A$5.5 million worth of processed cucumbers and gherkins. During this period prices for packed cucumber and gherkin imports remained fairly consistent ranging from A$1.03/kg (August) to A$1.31/kg (November) (Figure 11). The yearly average was A$1.19/kg. For canned cucumber imports the yearly average value was A$1.61/kg and minimum and maximum values

of A$0.51/kg and A$3.73/kg were recorded in August and November respectively (Figure 12).

Cucumbers and gherkins can be grown all year round in Australia. Cucumbers can be grown in all the states and territories, however they are only grown for processing in East Gippsland in Victoria and near Griffith (for McDonalds) and Cowra in NSW.

Most local cucumber and gherkin processors used to buy Australian grown product. However, they are now increasingly buying imported processed cucumbers and gherkins. These are bought in bulk containers for repacking or bottled for relabelling under local brand names. A local vegetable grower who supplies cucumbers for the processing industry stated that the local processors don't buy local product any more. The only cucumbers grown for processing now in Australia are grown for the McDonalds chain of restaurants.

One local producer stated that the local industry cannot compete with imported product. He believed that even if local processors were supplied cucumbers free of charge, it would still be cheaper to import bottled product for relabelling.

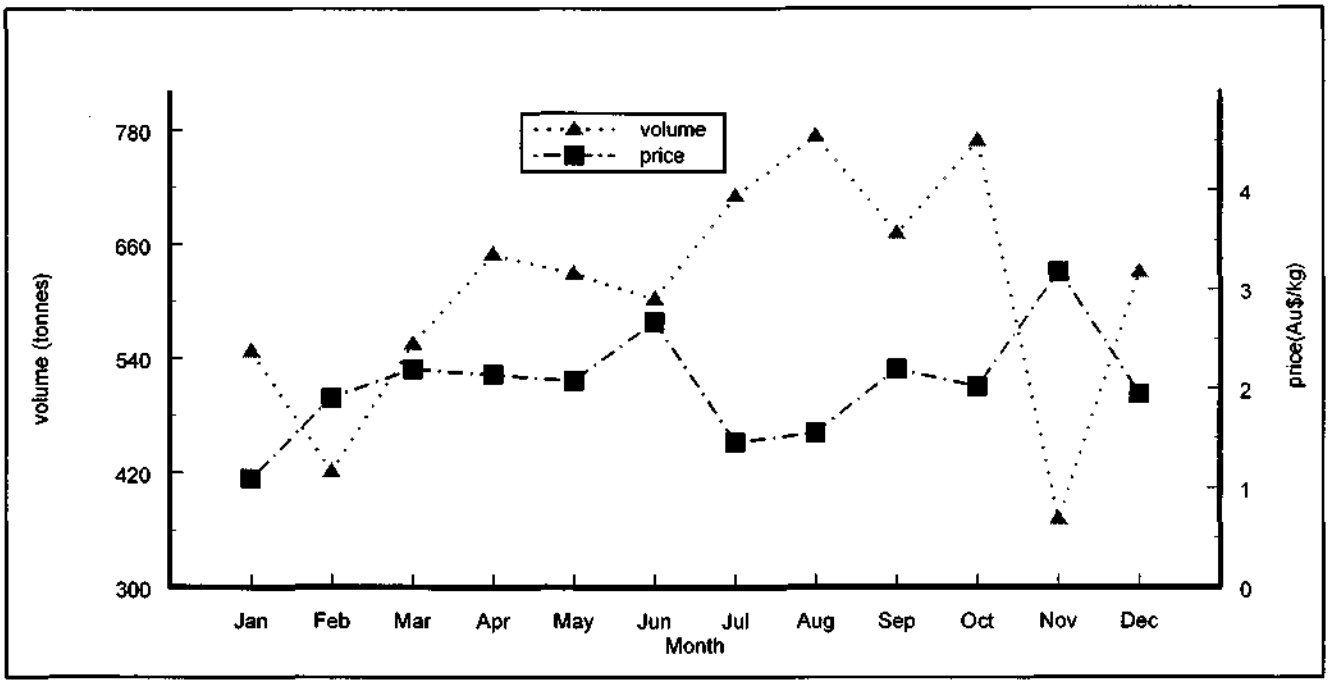

Figure 1: Imports (1997-1998 financial year) of frozen sweet corn, uncooked or cooked by steaming or boiling in water– expressed as price and volume.

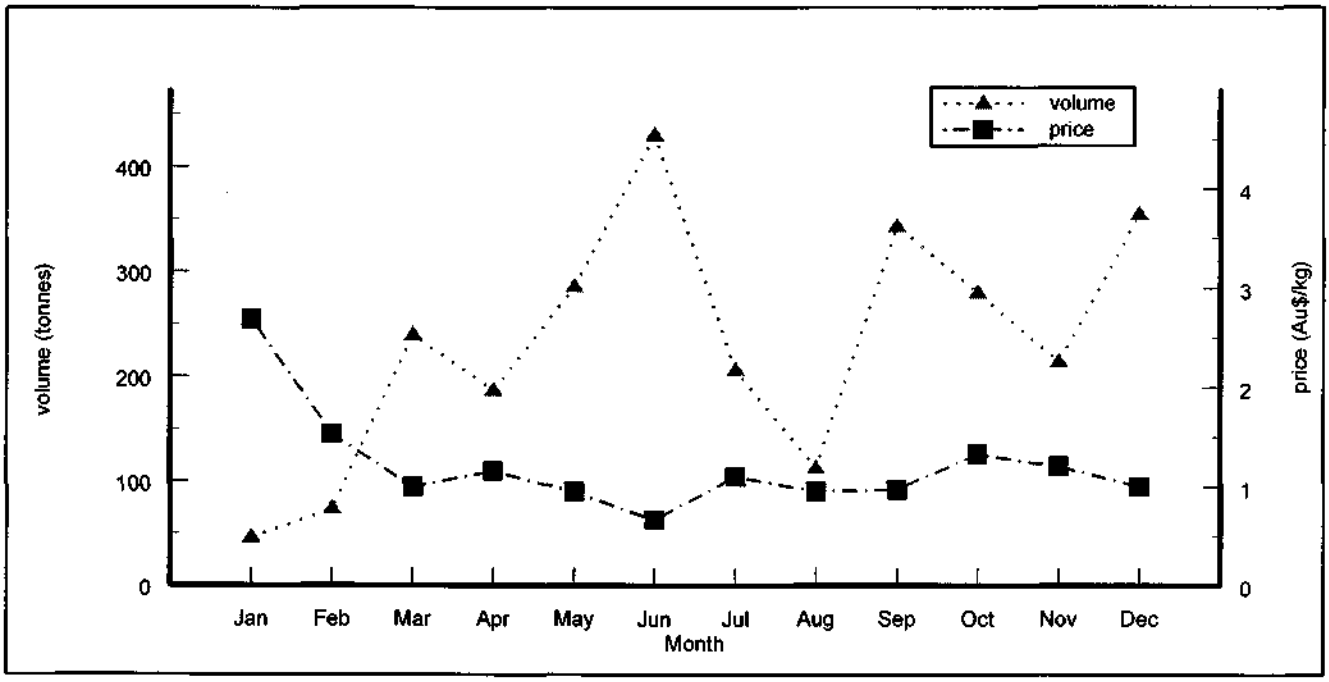

Figure 2: Imports (1997-1998 financial year) of sweet corn, canned, prepared or preserved otherwise than by acetic acidor sugar, not frozen – expressed as price and volume.

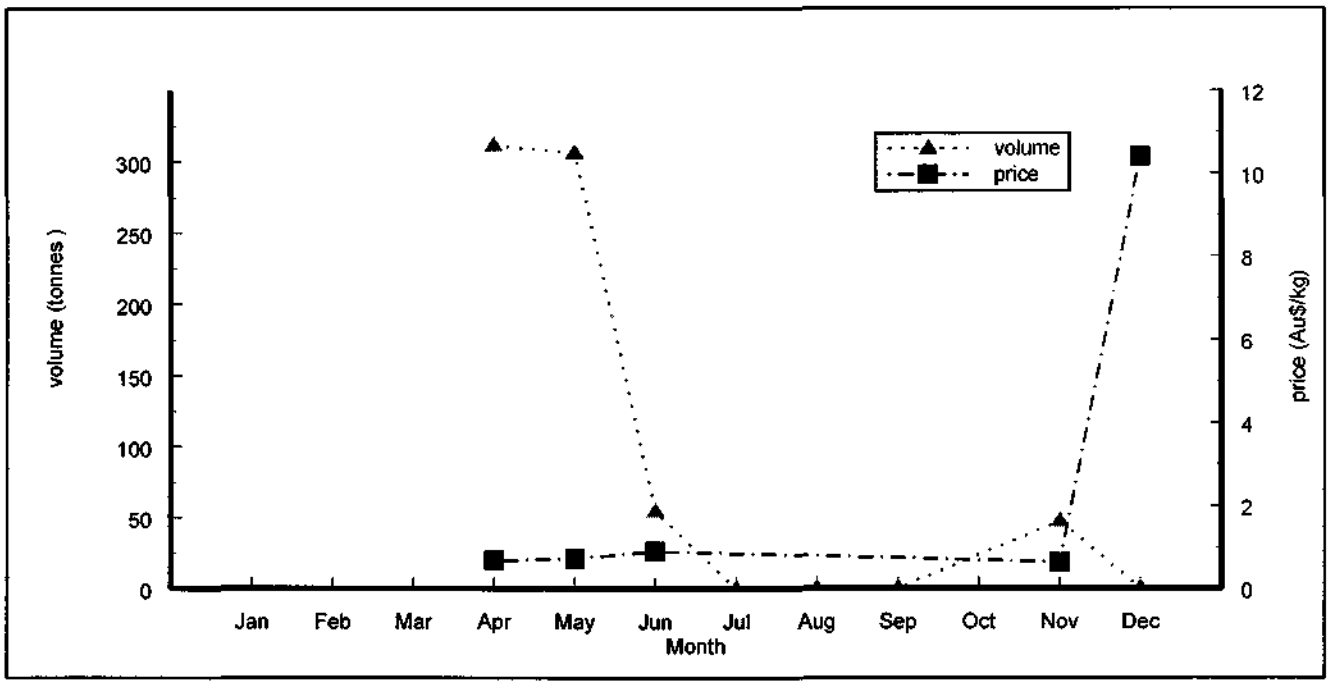

Figure 3: Imports (1997-1998 financial year) of beans (*Vigna* spp., *Phaseolus* spp.), fresh or chilled – expressed as price and volume.

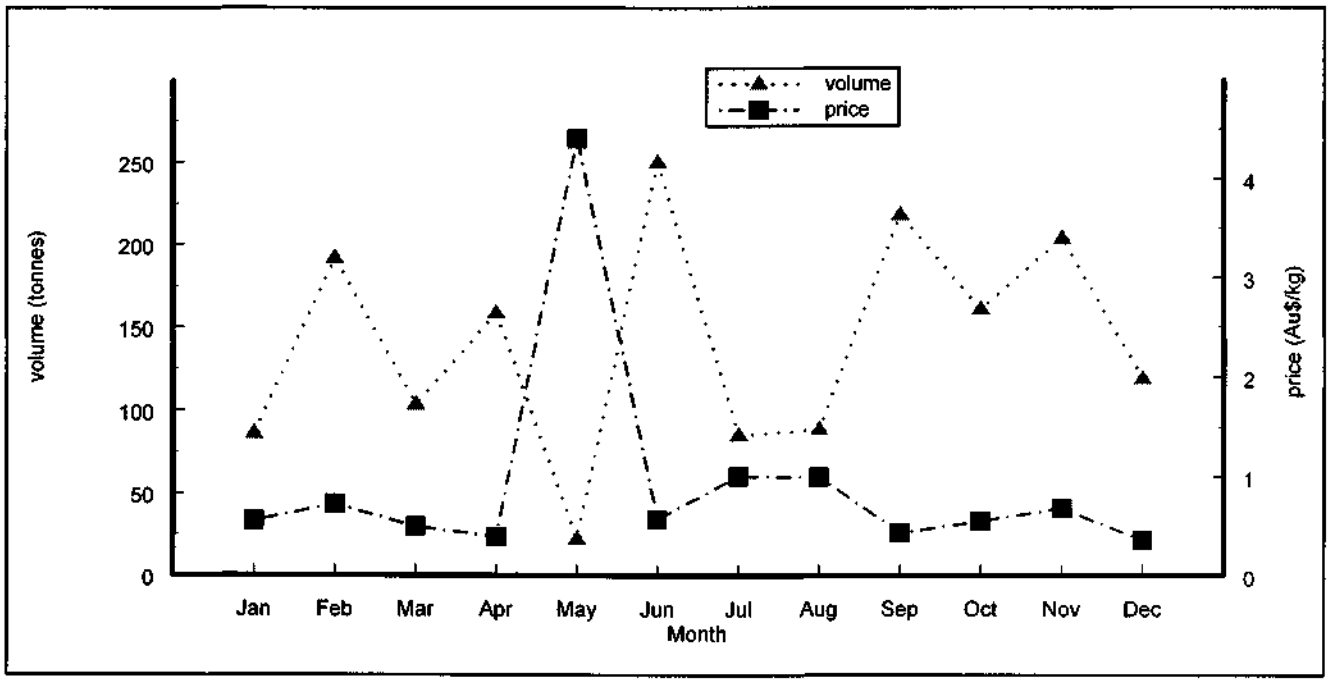

Figure 4: Imports (1997-1998 financial year) of frozen beans (*Vigna* spp., *Phaseolus* spp.), excluding green (French) beans – expressed as price and volume.

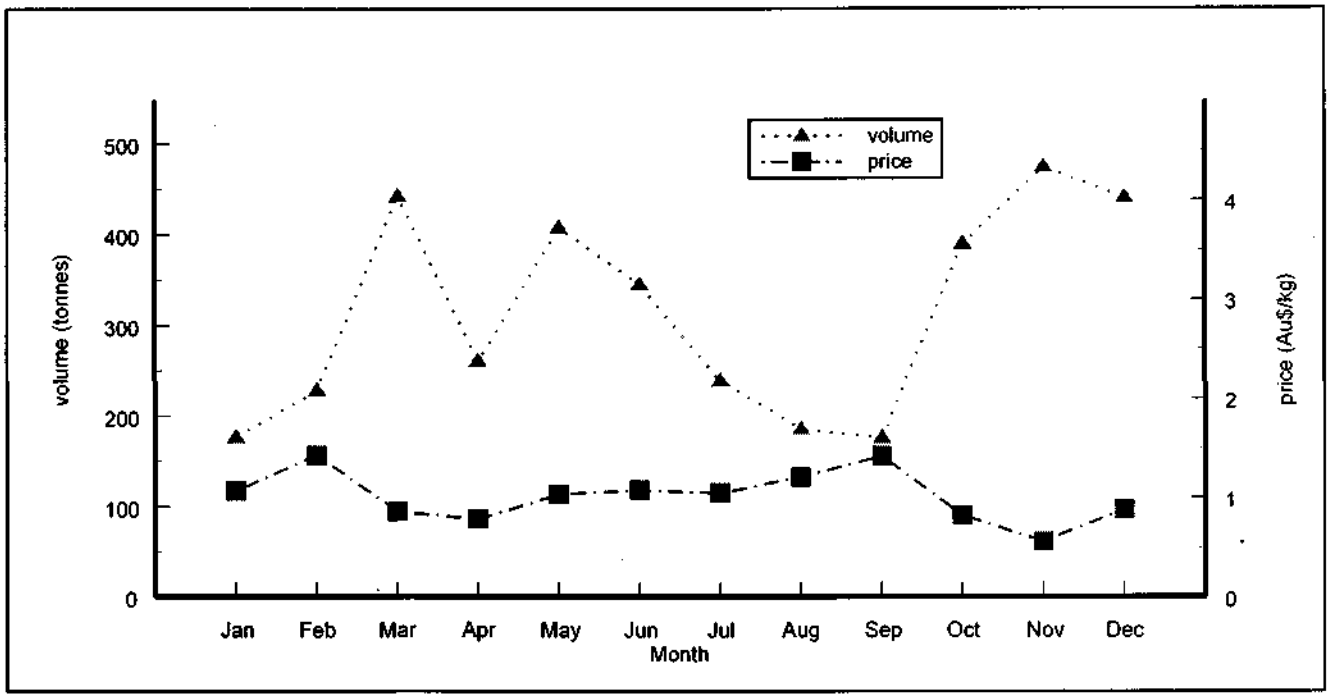

Figure 5: Imports (1997-1998 financial year) of frozen green (French) beans (*Vigna* spp., *Phaselous* spp.), uncooked or cooked by steaming or boiling in water – expressed as price and volume.

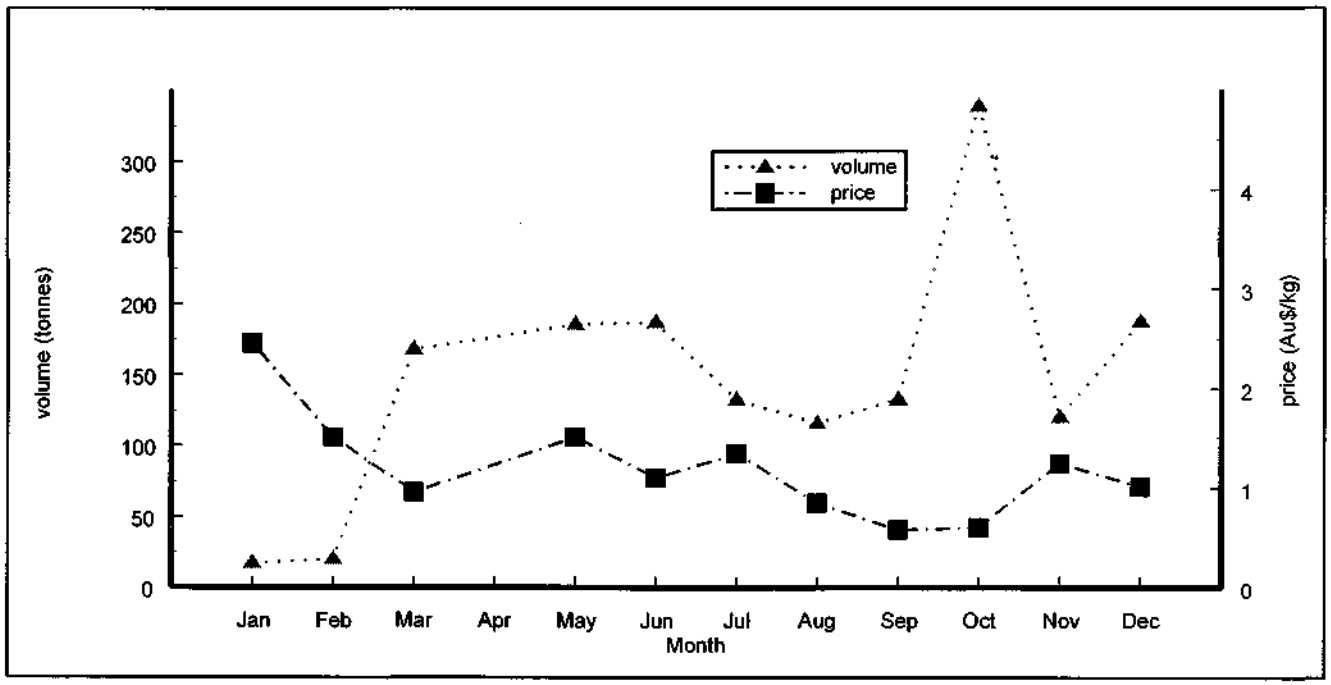

Figure 6: Imports (1997-1998 financial year) of beans (excluding shelled beans), prepared or preserved otherwise than by acetic acid or sugar, packed in liquid or air-tight containers, not frozen – expressed as price and volume.

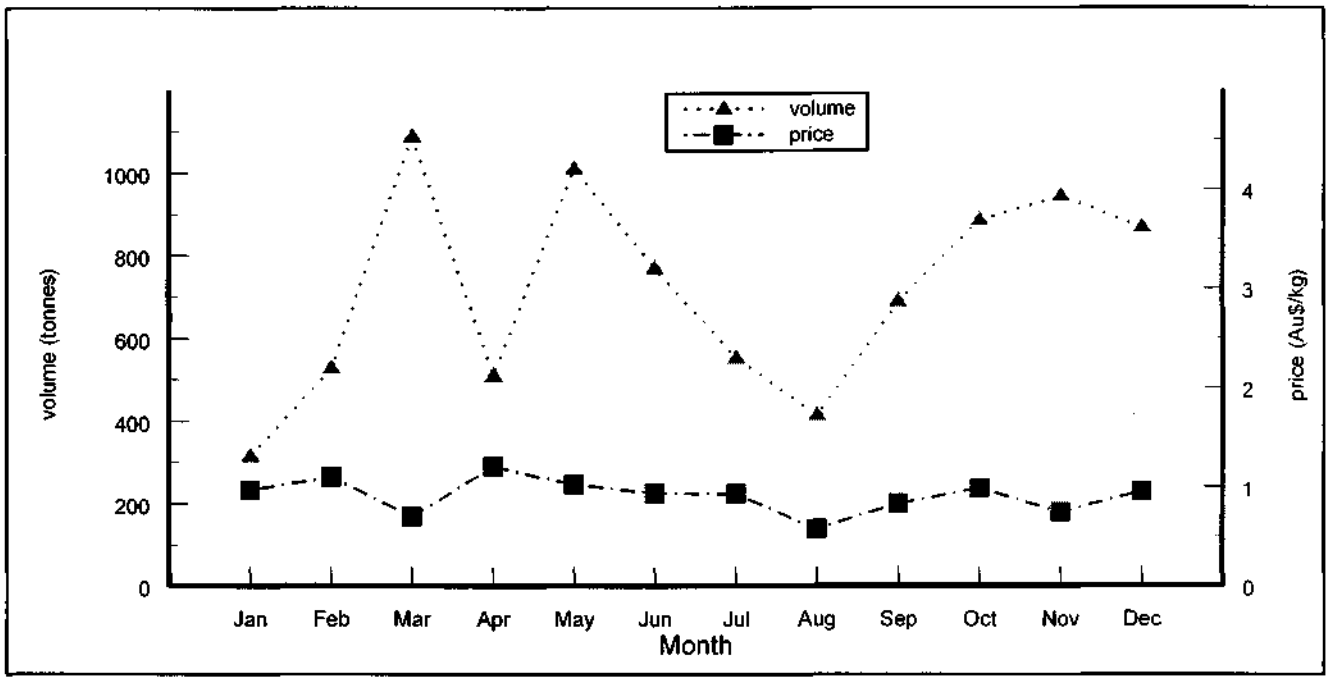

Figure 7: Imports (1997-1998 financial year) of frozen, shelled peas (*Pisum sativum*), uncooked or cooked by steaming or boiling in water, in packs – expressed as price and volume.

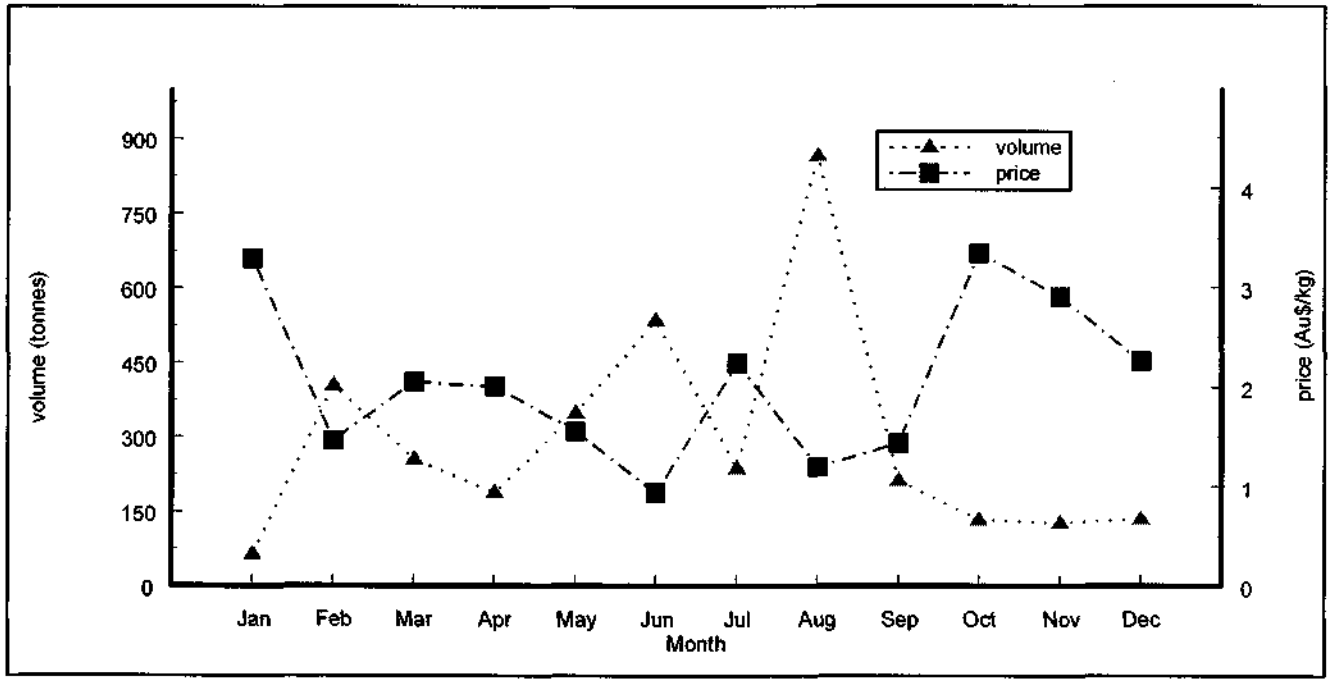

Figure 8: Imports (1997-1998 financial year) of dried, shelled peas (*Pisum sativum*) – expressed as price and volume.

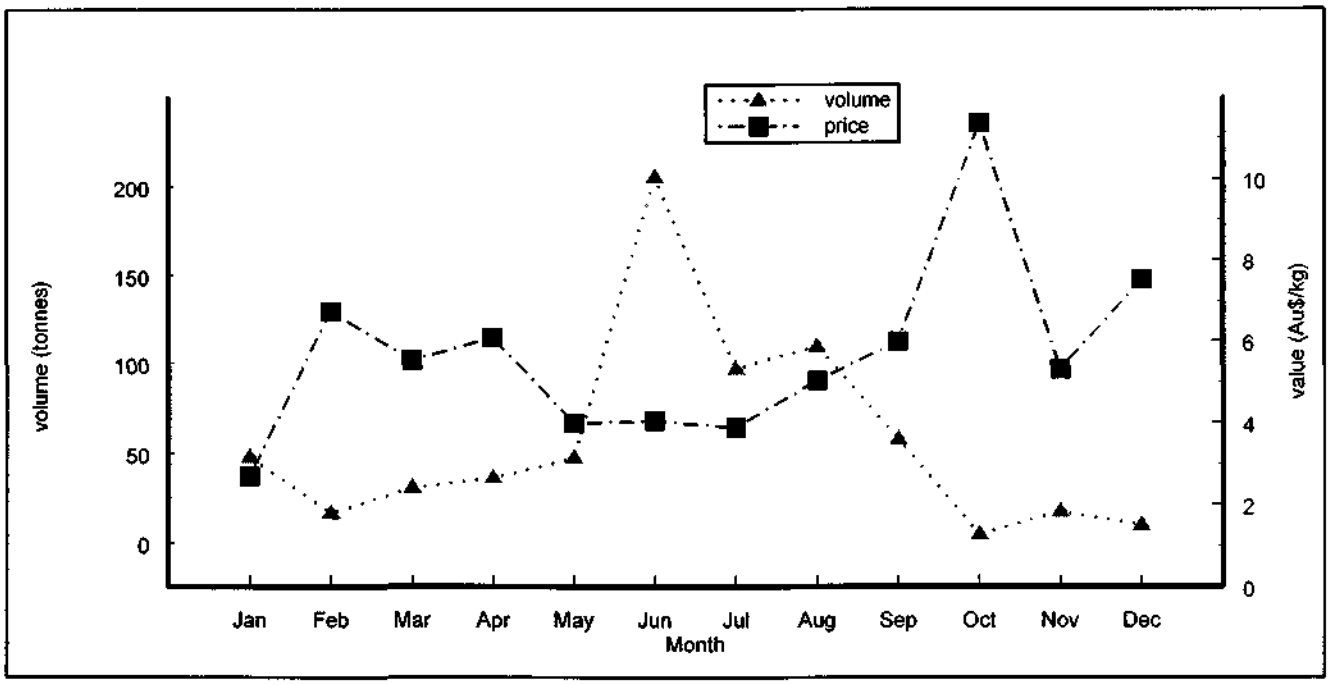

Figure 9: Imports (1997-1998 financial year) of peas (*Pisum sativum*), fresh or chilled – expressed as price and volume.

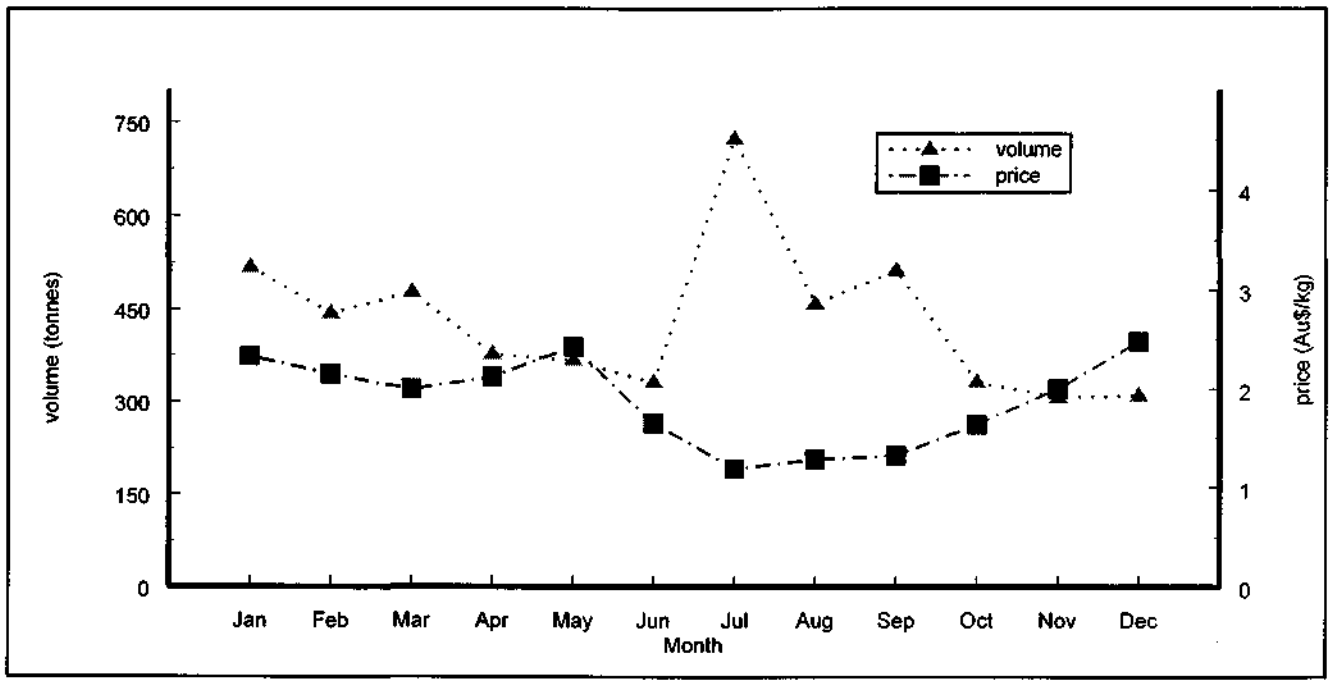

Figure 10: Imports (1997-1998 financial year) of garlic fresh or chilled – expressed as price and volume.

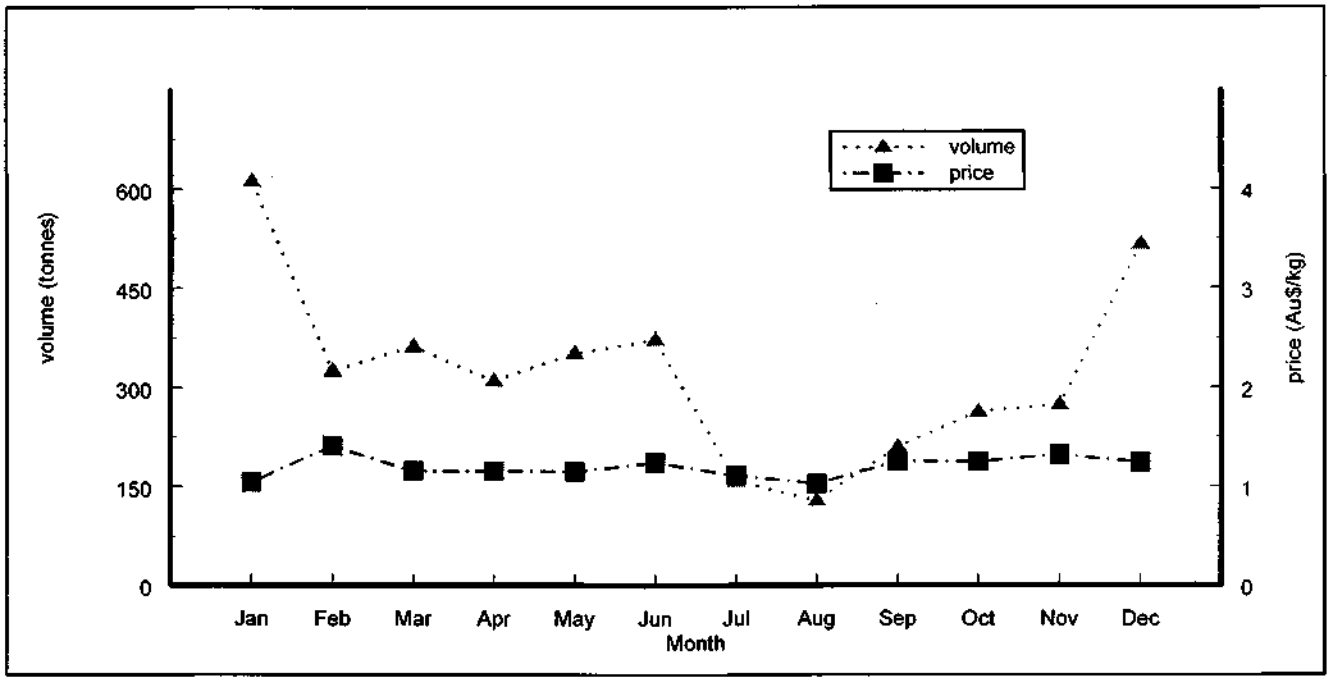

Figure 11: Imports (1997-1998 financial year) of cucumbers and gherkins in packs, prepared or preserved by vinegar or acetic acid – expressed as price or volume.

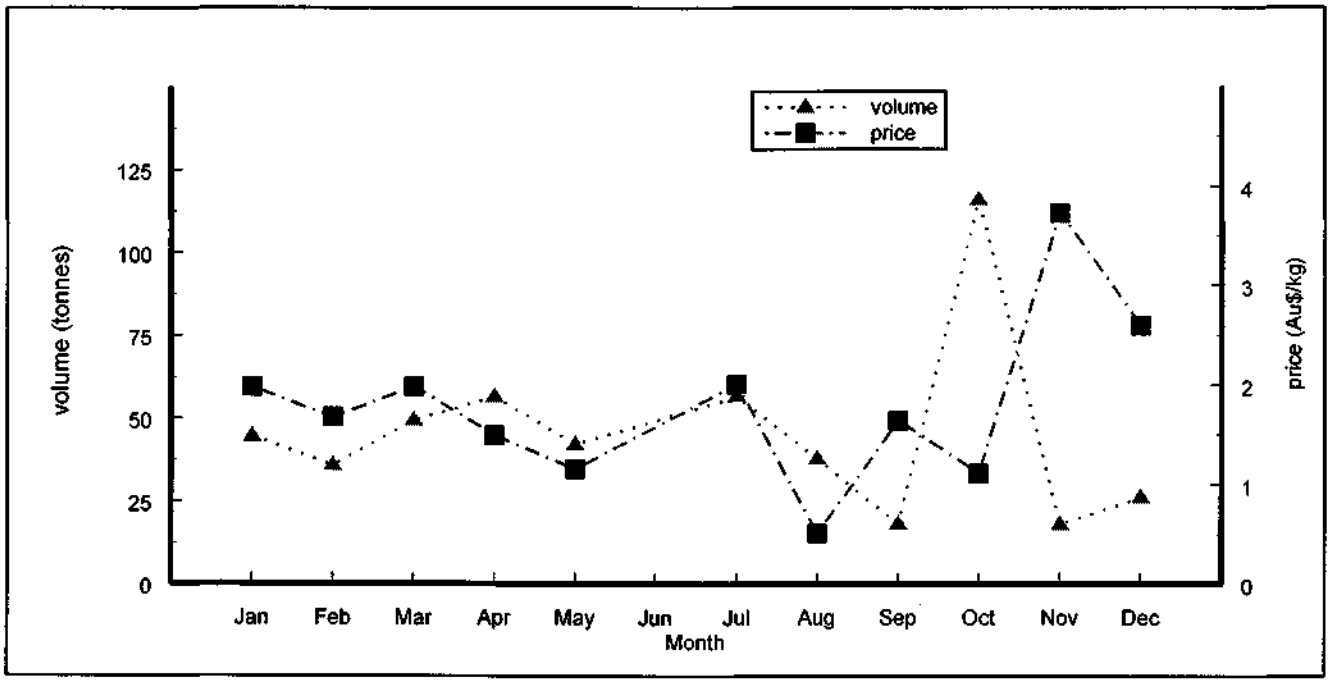

Figure 12: Imports (1997-1998 financial year) of cucumbers and gherkins, prepared or preserved otherwise than by vinegar, acetic acid or sugar, packed in liquid or air-tight conatiners, not frozen – expressed as price and volume.

4. Conclusions and recommendations

In the 1997/98 financial year, Australia imported 183 million kilograms of fresh and processed vegetables, valued at A$274 million (CIF value). In 1996, Australia produced 2.98 billion kilograms of fresh vegetables with a gross value of A$1.6 billion. The largest processed vegetable import which is covered by the HRDC vegetable levy is frozen sweet corn valued at A$14,573,890. Garlic is the highest value fresh vegetable import at A$9,421,038. Total pea and bean imports, processed and fresh, are valued at A$16,633,550 and A$10,846,348 respectively. Spinach production in Australia is minor and consequently A$3,315,087 worth of frozen spinach was imported in 1997/98.

Sweet corn, beans and garlic can be grown all year round in Australia. Frozen sweet corn imports tend to peak in October, which may correspond to slower local production periods. Canned sweet corn imports also peaked around this period, June and September.

Peas can only be grown from winter to early summer in Australia. This may be one of the main reasons for importing both fresh and processed peas. As imported fresh peas are more expensive compared to local fresh garden peas it appears that fresh snow peas are being categorised as fresh garden peas in the customs classifications. On a gross value basis, this would make more sense as there is less of a price difference between the CIF value of imported fresh peas (A$4.61/kg(1997/98)) and the gross value of local snow peas (A$5.40/kg (1997)). Fresh pea imports peak in June and then remain fairly constant for the rest of the year. This June peak corresponds with the period between June and September when Victorian snow pea production is at it's lowest.

The local fresh snow pea industry has taken on the challenge, competing with imports. This has been achieved by the formation of a cooperative of growers who have established a single packinghouse facility that incorporates mechanised grading and packing. The mechanisation of packaging has reduced production costs and improved product quality. Good quality snow peas are being grown year round in different climatic zones (Victoria and Queensland) to meet consumer demand. The group is able to compete with imported product by insuring a continuity of supply of high quality snow peas.

Fresh beans can be imported at a lower price per kilogram, $0.71 (imported) compared to $1.15 (local). Fresh green bean imports peaked from April to May when there may have been a trough in local production. So it may be possible to extend local production of fresh beans by increasing production in warmer regions during this time. There is no seasonal trend for the timing of imports of frozen green beans or imported frozen French beans.

The average price of imported garlic is A$1.83/kg compared to the average farm gate price of A$3.40/kg for garlic produced locally. If the local garlic industry is to expand it must look towards making the most of any market niches that exist. It should heavily promote that Australian garlic is the most potent source of the cholesterol-lowering compound alliin to potential markets such as the pharmaceutical industry.

A major factor influencing processed vegetable imports into Australia is that many of the major processors are multinational companies, which may have processing plants in other countries such as New Zealand or the USA. It would therefore be in their interests to utilise existing facilities to full production capacity, and then export the products to where it is economically feasible. This may be the case when it comes to imports of processed corn, peas and beans. It appears that the majority of frozen spinach retailed in Australia is imported; this is probably due to little spinach being grown locally. A recent example of a multinational company rationalising production activities was the closure of the Heinz Watties processing plant in Dandenong, Victoria. Heinz Watties had the options of upgrading the Dandenong processing facility (at a cost of $25 million), or relocating and consolidating processing to a more modern plant on New Zealand's North Island. They chose the later (Robinson, 2000).

Canned sweet corn is composed of two categories, corn kernels and baby corn. From inspections of supermarket shelves it seems that the corn kernels are sourced locally or imported from New Zealand or the USA. Corn kernels from the USA are the super sweet variety, which are probably imported because there is not enough product grown locally. All baby corn is sourced from Thailand and it appears that very little baby corn is grown in Australia. The most likely reason is that Thailand can produce it more cheaply than we can locally.

If local growers are to compete on price with imported products, unit costs of production have to be reduced. Strategies to achieve this may include the development of new technologies such as mechanical harvesting and achieving greater economies of scale, through more efficient land usage, equipment sharing or the hiring of contractors and equipment.

5. Technology Transfer

Information from the economic and food safety components of this project is available in printed form through the economic review of vegetable imports and review of health risks, which were produced as milestones for this project.

A poster and abstract was presented at the Growing for Profit – Gympie workshop on the 15 November 2000. We also plan to produce posters and abstracts on both components of this project for the Australasian Postharvest Conference 2001, Adelaide.

We plan to include summaries of the outcomes in a newsletter to be distributed to growers through the Vegetable Industry Development Officers in each state.

The outcomes of this project will be presented at industry meetings and in industry publications.

6. Acknowledgments

We would like to thank the Australian Quarantine Inspection Service, the Department of Natural Resources and the Environment Plant Standards, the State Chemistry Laboratory, the Microbiological Diagnostics Unit for the help received in the

collection and/or analysis of vegetable samples. We would like to thank the following people for their advice and support during the project life, Robert Holmes, Robert Premier, Colin Hall, Agnes Chan, Robert Dimsey, Ruth McGowan, Fawzia Tawfik, Graham Roberts, John Faragher, Gray Harrison and Fouad Goubran.

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Appendices

Appendix I: Results of pesticide residue tests on imported and local fresh garlic as reported by State Chemistry Laboratory, Werribee Victoria

Table 1. Imported fresh garlic from China

Test Method	Units	Results imported garlic #1	Results imported garlic #2	Results imported garlic #3	Results imported garlic #4	Results imported garlic #5
Organochlorine Residues						
BHC (alpha isomer)	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
BHC (beta isomer)	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Hexachlorobenzene	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Aldrin	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Lindane	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Heptachlor	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Heptachlor Epoxide	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Dieldrin	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
DDE	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
DDD	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
DDT	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Endosulfan (alpha isomer)	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Endosulfan (beta isomer)	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Endosulfan Sulphate	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Endrin	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
oxy - Chlordane	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
cis - Chlordane	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
trans - Chlordane	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Organophosphate Residues						
Azinphos Ethyl	mg/kg	<0.10	<0.10	<0.10	<0.02	<0.02
Azinphos Methyl	mg/kg	<0.04	<0.04	<0.04	<0.1	<0.1
Chorpyrifos	mg/kg	<0.01	<0.01	<0.01	<0.02	<0.02
Chorpyrifos Methyl	mg/kg	<0.10	<0.10	<0.10	<0.02	<0.02
Diazinon	mg/kg	<0.10	<0.10	<0.10	<0.02	<0.02
Dichlorvos	mg/kg	<0.10	<0.10	<0.10	<0.02	<0.02
Dimethoate	mg/kg	<0.10	<0.10	<0.10	<0.02	<0.02
Ethion	mg/kg	<0.10	<0.10	<0.10	<0.02	<0.02
Fenchlorphos	mg/kg	<0.10	<0.10	<0.10	<0.02	<0.02
Fenitrothion	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02
Fenthion	mg/kg	<0.10	<0.10	<0.10	<0.02	<0.02
Malathion	mg/kg	<0.10	<0.10	<0.10	<0.02	<0.02
Mevinthos	mg/kg	<0.10	<0.10	<0.10	<0.02	<0.02
Parathion Ethyl	mg/kg	<0.10	<0.10	<0.10	<0.02	<0.02
Parathion Methyl	mg/kg	<0.10	<0.10	<0.10	<0.02	<0.02
Synthetic Pyrethroids						
Cyfluthrin	mg/kg	<0.1	<0.1	<0.1	<0.05	<0.05
Cyhalothrin	mg/kg	<0.01	<0.01	<0.01	<0.05	<0.05
Cypermethrin	mg/kg	<0.02	<0.02	<0.02	<0.05	<0.05
Deltamethrin	mg/kg	<0.1	<0.1	<0.1	<0.05	<0.05
Fenvalerate	mg/kg	<0.1	<0.1	<0.1	<0.05	<0.05
Flumethrin	mg/kg	<0.1	<0.1	<0.1	<0.05	<0.05
Permethrin	mg/kg	<0.1	<0.1	<0.1	<0.05	<0.05
Total Cadmium (Cd)	mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03

Table 2. Australian garlic

Test Method	Units	Results Australian garlic #1	Results Australian garlic #2	Results Australian garlic #3	Results Australian garlic #4
Organochlorine Residues		<0.01	<0.01	<0.01	<0.01
BHC (alpha isomer)	mg/kg	<0.01	<0.01	<0.01	<0.01
BHC (beta isomer)	mg/kg	<0.01	<0.01	<0.01	<0.01
Hexachlorobenzene	mg/kg	<0.01	<0.01	<0.01	<0.01
Aldrin	mg/kg	<0.01	<0.01	<0.01	<0.01
Lindane	mg/kg	<0.01	<0.01	<0.01	<0.01
Heptachlor	mg/kg	<0.01	<0.01	<0.01	<0.01
Heptachlor Epoxide	mg/kg	<0.01	<0.01	<0.01	<0.01
Dieldrin	mg/kg	<0.01	<0.01	<0.01	<0.01
DDE	mg/kg	<0.01	<0.01	<0.01	<0.01
DDD	mg/kg	<0.01	<0.01	<0.01	<0.01
DDT	mg/kg	<0.01	<0.01	<0.01	<0.01
Endosulfan (alpha isomer)	mg/kg	<0.01	<0.01	<0.01	<0.01
Endosulfan (beta isomer)	mg/kg	<0.01	<0.01	<0.01	<0.01
Endosulfan Sulphate	mg/kg	<0.01	<0.01	<0.01	<0.01
Endrin	mg/kg	<0.01	<0.01	<0.01	<0.01
oxy - Chlordane	mg/kg	<0.01	<0.01	<0.01	<0.01
cis - Chlordane	mg/kg	<0.01	<0.01	<0.01	<0.01
trans - Chlordane	mg/kg	<0.01	<0.01	<0.01	<0.01
Organophosphate Residues					
Azinphos Ethyl	mg/kg	<0.02	<0.02	<0.02	<0.02
Azinphos Methyl	mg/kg	<0.02	<0.02	<0.02	<0.02
Chorpyrifos	mg/kg	<0.02	<0.02	<0.02	<0.02
Chorpyrifos Methyl	mg/kg	<0.02	<0.02	<0.02	<0.02
Diazinon	mg/kg	<0.02	<0.02	<0.02	<0.02
Dichlorvos	mg/kg	<0.02	<0.02	<0.02	<0.02
Dimethoate	mg/kg	<0.02	<0.02	<0.02	<0.02
Ethion	mg/kg	<0.02	<0.02	<0.02	<0.02
Fenchlorphos	mg/kg	<0.02	<0.02	<0.02	<0.02
Fenitrothion	mg/kg	<0.02	<0.02	<0.02	<0.02
Fenthion	mg/kg	<0.02	<0.02	<0.02	<0.02
Malathion	mg/kg	<0.02	<0.02	<0.02	<0.02
Mevinthos	mg/kg	<0.02	<0.02	<0.02	<0.02
Parathion Ethyl	mg/kg	<0.02	<0.02	<0.02	<0.02
Parathion Methyl	mg/kg	<0.02	<0.02	<0.02	<0.02
Synthetic Pyrethroids					
Cyfluthrin	mg/kg	<0.01	<0.01	<0.01	<0.01
Cyhalothrin	mg/kg	<0.01	<0.01	<0.01	<0.01
Cypermethrin	mg/kg	<0.01	<0.01	<0.01	<0.01
Deltamethrin	mg/kg	<0.01	<0.01	<0.01	<0.01
Fenvalerate	mg/kg	<0.01	<0.01	<0.01	<0.01
Flumethrin	mg/kg	<0.01	<0.01	<0.01	<0.01
Permethrin	mg/kg	<0.01	<0.01	<0.01	<0.01
Total Cadmium (Cd)	mg/kg	0.04	<0.03	<0.03	<0.03

Appendix II: Results of pesticide residue tests on imported and local processed cucumbers/gherkins as reported by the State Chemistry Laboratory, Werribee Victoria

Table 1. Imported processed cucumbers/gherkins

Test Method	Units	Results imported gherkin #1*	Results imported gherkin #2*	Results imported gherkin #3*	Results imported gherkin #4*	Results imported gherkin #5*
Organochlorine Residues		<0.005	<0.005	<0.005	<0.005	<0.005
BHC (alpha isomer)	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
BHC (beta isomer)	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Hexachlorobenzene	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Aldrin	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Lindane	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Heptachlor	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Heptachlor Epoxide	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Dieldrin	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
DDE	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
DDD	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
DDT	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Endosulfan (alpha isomer)	mg/kg	0.007	<0.005	<0.005	<0.005	<0.005
Endosulfan (beta isomer)	mg/kg	0.006	<0.005	<0.005	<0.005	<0.005
Endosulfan Sulphate	mg/kg	0.012	<0.005	<0.005	<0.005	<0.005
Total Endosulfan	mg/kg	0.025	<0.005	<0.005	<0.005	<0.005
Endrin	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
oxy - Chlordane	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
cis - Chlordane	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
trans - Chlordane	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Organophosphate Residues						
Azinphos Ethyl	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Azinphos Methyl	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04
Chorpyrifos	mg/kg	<0.01	<0.01	<0.01	<0.01	0.03
Chorpyrifos Methyl	mg/kg	<0.01	<0.01	<0.01		
Diazinon	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Dichlorvos	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Dimethoate	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Ethion	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Fenchlorphos	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Fenitrothion	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Fenthion	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Malathion	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Mevinthos	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Parathion Ethyl	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Parathion Methyl	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Synthetic Pyrethroids						
Cyfluthrin	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Cyhalothrin	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Cypermethrin	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Deltamethrin	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Fenvalerate	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Flumethrin	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Permethrin	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Total Cadmium (Cd)	mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03

* = Sample Identification
imported gherkin #1 = Product of Israel
imported gherkin #2 = Product of India
imported gherkin #3 = Product of Macedonia
imported gherkin #4 = Product of Poland
imported gherkin #5 = Product of Sri Lanka

Table 2. Australian processed cucumbers/gherkins

Test Method	Units	Results Australian gherkins #1	Results Australian gherkin #2	Results Australian gherkin #3	Results Australian gherkin #4	Results Australian gherkin #5
Organochlorine Residues						
BHC (alpha isomer)	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
BHC (beta isomer)	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Hexachlorobenzene	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Aldrin	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Lindane	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Heptachlor	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Heptachlor Epoxide	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Dieldrin	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
DDE	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
DDD	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
DDT	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Endosulfan (alpha isomer)	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Endosulfan (beta isomer)	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Endosulfan Sulphate	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Endrin	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
oxy - Chlordane	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
cis - Chlordane	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
trans - Chlordane	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Organophosphate Residues						
Azinphos Ethyl	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Azinphos Methyl	mg/kg	<0.04	<0.04	<0.04	<0.04	<0.04
Chorpyrifos	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Chorpyrifos Methyl	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Diazinon	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Dichlorvos	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Dimethoate	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Ethion	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Fenchlorphos	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Fenitrothion	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Fenthion	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Malathion	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Mevinthos	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Parathion Ethyl	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Parathion Methyl	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Synthetic Pyrethroids						
Cyfluthrin	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Cyhalothrin	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Cypermethrin	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Deltamethrin	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Fenvalerate	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Flumethrin	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005
Permethrin	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005

Appendix III: Chemical analyses performed by the AQIS through the Imported Food Inspection Program (IFIP) on vegetable imports

Organochlorines

Aldrin and Dieldrin (combined)
BHC [gamma-HCH (other than the gamma isomer, Lindane)]
Chlordane
Endrin
Heptachlor and heptachlor epoxide (combined)
Hexachlorobenzene (HCB)
Lindane
Total endosulfan (alpha and beta isomers and sulphate)
Sum of PCB's

Organophosphates

Azinphos ethyl
Azinphos methyl
Chlorfenvinphos
Chlorpyrifos
Chlorpyrifos methy
Diazinon
Dichlorvos
Dioxathion
Ethion
Fenthion
Fenitrothion
Maldison
Methamidophos
Mevinphos
Monocrotophos
Parathion
Parathion methyl
Pirimiphos methyl
Trithion

Fungicides

Chlorthalonil
Dichloran
Iprodione
Procymidone
Vinclozolin

Appendix IV. Total vegetable imports (processed and fresh) for the financial year 1997-98, ranked according to value.

Processed and fresh vegetable imports	CIF ($) Volume (tonnes)
Potatoes, prepared or preserved (excl. those prepared or preserved by vinegar or acetic acid), frozen	**23,148,009** 15,674
Tomatoes, whole or in pieces, packed in liquid or in air-tight containers not exc 1.14 L (excl. those prepared or preserved by vinegar or acetic acid)	**16,291,341** 19,129
Frozen sweet corn, uncooked or cooked by steaming or boiling in water	**14,573,890** 7,323
Olives, provisionally preserved, but unsuitable in that state for immediate consumption	**14,111,094** 6,358
Dried vegetables, whole, cut, sliced, broken or in powder, but not further prepared (excl. potatoes, onions, mushrooms, truffles, herbs, sweet corn and tomatoes)	**11,195,916** 3,176
Veg. prep. or preserved other than by vinegar, acetic acid or sugar, packed in liquid or air-tight containers, not frozen (excl. capers, cucumber, gherkins, mixtures of veg., homogenised veg., potato, pea, bean, asparagus, olives, sweet corn)	**10,736,042** 6,263
Garlic, fresh or chilled	**9,421,038** 5,152
Tomatoes, whole or in pieces, packed in liquid or in air-tight containers exc 1.14 L (excl. those prepared or preserved by vinegar or acetic acid)	**8,632,213** 9,716
Mushrooms, packed in liquid or air-tight containers not exc 500 ml (excl. prepared or preserved by vinegar or acetic acid)	**7,791,459** 5,522
Tomato ketchup and other tomato sauces	**7,623,496** 6,741
Asparagus spears prepared or preserved otherwise than by vinegar, acetic acid or sugar, packed in liquid or in air-tight containers, in packs not exceeding not exceeding 1.14 L, not frozen	**7,267,337** 2,660
Vegetables, fruit, nuts and other edible parts of plants, prepared or preserved by vinegar or acetic acid (excl. cucumbers, gherkins, onions, olives and pickles)	**7,055,878** 2,965
Asparagus prepared or preserved otherwise than by vinegar, acetic acid or sugar, not packed in liquid or in air-tight containers, not frozen	**6,370,443** 1,933
Black olives, other than pitted or stuffed black olives, prepared or preserved otherwise than by vinegar, acetic acid or sugar, not frozen	**6,308,425** 3,822
Dried, shelled peas (*Pisum sativum*)	**5,736,443** 3,502
Frozen mixtures of vegetables, uncooked or cooked by steaming or boiling in water	**5,982,025** 3,641
Veg. and mixtures of veg. prep. or preserved other than by vinegar, acetic acid or sugar, not packed in liquid or in air-tight containers, not frozen (excl. homogenised veg., potatoes, peas, beans, asparagus, olives and sweet corn)	**5,628,723** 3,226
Frozen shelled peas (*Pisum sativum*), uncooked or cooked by steaming or boiling in water, in packs exc 500 g	**5,271,666** 2,728
Frozen vegetables (excl. potatoes, leguminous vegetables, spinach, sweet corn), uncooked or cooked by steaming or boiling in water	**4,867,632** 2,522
Tomatoes in packs not exc 1.14 L (excl. whole or in pieces or prepared or preserved by vinegar or by acetic acid)	**4,772,642** 4,814
Tomatoes in packs exc 1.14 L (excl. whole or in pieces; or prepared or preserved by vinegar or acetic acid)	**4,407,947** 3,727
Cucumbers and gherkins in packs not exc 1.14 L, prepared or preserved by vinegar or acetic acid	**4,240,964** 3,481
Green olives, stuffed, prepared or preserved otherwise than by vinegar, acetic acid or sugar, not frozen	**4,209,645** 2,309
Shelled beans prepared or preserved otherwise than by vinegar, acetic acid or sugar, packed in liquid or in air-tight containers, not frozen	**3,950,819** 3,544
Dried, shelled, beans (excl. kidney, white pea, Adzuki and beans of the species *Vigna mungo* (L.) Hepper or *Vigna radiata* (L.) Wilczek)	**3,918,295** 3,122
Frozen green (French) beans (*Vigna* spp., *Phaseolus* spp.), uncooked or cooked by steaming or	**3,592,370**

Processed and fresh vegetable imports	CIF ($) Volume (tonnes)
boiling in water	3,760
Dried tomatoes, whole, cut, sliced, broken or in powder, but not further prepared	**3,393,345** 643
Frozen spinach, New Zealand spinach and orache spinach (garden spinach), uncooked or cooked by steaming or boiling in water	**3,315,087** 2,322
Onions, fresh or chilled	**3,246,688** 3,843
Peas (*Pisum sativum*), fresh or chilled	**3,130,921** 679
Sweet corn, canned, prepared or preserved otherwise than by vinegar, acetic acid or sugar, not frozen	**2,911,141** 2,772
Pitted black olives, not stuffed, prepared or preserved otherwise than by vinegar, acetic acid or sugar, not frozen	**2,733,888** 1,445
Asparagus, fresh or chilled	**2,720,458** 357
Frozen shelled peas (*Pisum sativum*), uncooked or cooked by steaming or boiling in water, in packs not exc 500 g	**2,494,521** 2,728
Vegetables, fresh or chilled (excl. artichokes, asparagus, aubergines, celery, mushrooms, truffles, capsicum, *Pimenta*, spinach and vegetables from 0701 to 0708)	**2,443,394** 707
Vegetables and mixtures of vegetables (excl. tomatoes, mushrooms, truffles or potatoes), prepared or preserved otherwise than by vinegar, acetic acid or sugar, frozen	**2,416,533** 838
Arrowroot, salep, jerusalem artichokes and similar roots and tubers with high starch or inulin content, fresh, chilled or dried, whether or not sliced or in the form of pellets; sago pith, fresh, chilled or dried, whether or sliced or pellets	**2,355,541** 1450
Dried mushrooms, whole, cut, sliced, broken or in powder, but not further prepared, in packs exc 1 kg	**2,178,303** 296
Mushrooms, fresh or chilled	**1,982,749** 358
Dried, shelled kidney beans (incl. white pea beans (*Phaseolus vularis*)) not for cultivation	**1,920,446** 1,855
Beans (excl. shelled beans), prepared or preserved otherwise than by vinegar, acetic acid or sugar, packed in liquid or in air-tight containers, not frozen	**1,633,278** 1,606
Dried herbs, whole, cut, sliced, broken or in powder, but not further prepared	**1,627,787** 618
Gherkins, provisionally preserved, but unsuitable in that state for immediate consumption	**1,605,209** 2,825
Dried, shelled small red (Adzuki) beans (*Phaseolus* or *Vigna angularis*)	**1,508,363** 1,375
Dried mushrooms, whole, cut, sliced, broken or in powder, but not further prepared, in packs not exc 1 kg	**1,488,069** 177
Dried, shelled lentils	**1,188,864** 1,409
Frozen beans (*Vigna* spp., *Phaseolus* spp.), (excl. green (French) beans), uncooked or cooked by steaming or boiling in water	**1,077,127** 1,686
Pickles, prepared or preserved by vinegar or acetic acid	**967,416** 502
Mushrooms, packed in liquid or air-tight containers exc 500 ml (excl. prepared or preserved by vinegar or acetic acid)	**941,882** 720
Green olives (excl. stuffed) prepared or preserved otherwise than by vinegar, acetic acid or sugar, not frozen	**932,020** 862
Mixtures of vegetables, prepared or preserved otherwise than by vinegar, acetic acid or sugar, packed in liquid or in air-tight containers, not frozen	**900,915** 340
Cucumbers and gherkins, prepared or preserved otherwise than by vinegar, acetic acid or sugar, packed in liquid or in air-tight containers, not frozen	**866,067** 500

Processed and fresh vegetable imports	CIF ($) Volume (tonnes)
Dried, shelled beans of the species *Vigna mungo* (L.) Hepper or *Vigna radiata* (L.) Wilczek	**774,012** 285
Dried, shelled kidney beans (incl. white pea beans (*Phaseolus vularis*)) for cultivation	**761,384** 271
Vegetables (excl. onions, olives, capers, cucumbers and gherkins), mixtures of vegetables, provisionally preserved, but unsuitable in that state for immediate consumption	**754,252** 712
Capers, prepared or preserved otherwise than by vinegar, acetic acid or sugar, packed in liquid or in air-tight containers, not frozen	**709,788** 355
Manioc (cassava), frozen	**688,907** 676
Frozen potatoes (uncooked or cooked by steaming or boiling in water)	**604,382** 496
Homogenised vegetables, prepared or preserved (excl. those prepared or preserved by vinegar or acetic acid), not frozen	**601,735** 310
Beans (*Vigna* spp., *Phaseolus* spp.), fresh or chilled	**592,754** 7191
Mushrooms, prepared or preserved (excl. those packed in liquid or air-tight containers, or prepared or preserved by vinegar or acetic acid)	**557,006** 419
Fresh or dried ginseng roots, in packs not exc 1 kg	**554,663** 20
Ginger (excl. frozen ginger) prepared or preserved, whether or not containing added sugar or other sweetening matter or spirit	**553,137** 106
Arrowroot, salep, Jerusalem artichokes, and similar roots and tubers with high starch or inulin content, frozen; sago pith, frozen	**464,598** 166
Thyme; bay leaves	**459,289** 253
Beans (excl. shelled beans), prepared or preserved otherwise than by vinegar, acetic acid or sugar, not packed in liquid or in air-tight containers, not frozen	**447,868** 272
Dried sweet corn, whole, cut, sliced, broken or in powder, but not further prepared	**419,321** 41
Asparagus tips prepared or preserved otherwise than by vinegar, acetic acid or sugar, packed in liquid or in air-tight containers, in packs not exceeding 1.14 L, not frozen	**408,231** 273
Capers, provisionally preserved, but unsuitable in that state for immediate consumption	**406,623** 142
Peas prepared or preserved otherwise than by vinegar, acetic acid or sugar, packed in liquid or in air-tight containers, not frozen	**401,117** 272
Cucumbers and gherkins in packs exc 1.14 L, prepared or preserved by vinegar or acetic acid	**393,985** 399
Sweet corn, not canned, prepared or preserved otherwise than by vinegar, acetic acid or sugar, not frozen	**385,642** 33
Frozen unshelled peas (*Pisum sativum*), uncooked or cooked by steaming or boiling in water, in packs exc 500 g	**312,112** 2,061
Shallots, fresh or chilled	**308,525** 112
Tomatoes, whole or in pieces, prepared or preserved (excl. packed in liquid or in air-tight containers or prepared or preserved by vinegar or acetic acid)	**296,703** 255
Dried, shelled leguminous vegetables (excl. peas (*Pisum sativum*), chickpeas, beans (*Vigna* spp., *Phaseolus* spp.), lentils, broad beans, horse beans)	**260,731** 188
Onions, prepared or preserved by vinegar or acetic acid	**245,220** 169
Olives, prepared or preserved by vinegar or acetic acid	**243,113** 85
Stuffed black olives prepared or preserved otherwise than by vinegar, acetic acid or sugar, not frozen	**231,783** 96
Fresh or dried ginseng roots, in packs exc 1 kg	**231,632** 20
Peas prepared or preserved otherwise than by vinegar, acetic acid or sugar, not packed in liquid or in air-tight containers, not frozen	**224,326** 60

Processed and fresh vegetable imports	CIF ($) Volume (tonnes)
Tomatoes, fresh or chilled	**217,608** 82
Shelled beans prepared or preserved otherwise than by vinegar, acetic acid or sugar, not packed in liquid or in air-tight containers, not frozen	**156,123** 120
Truffles, fresh or chilled	**137994** 373
Potatoes, prepared or preserved (excl. those prepared or preserved by vinegar or acetic acid), not frozen	**137,402** 28
Dried, shelled chickpeas (garbanzos)	**119,240** 117
Truffles, prepared or preserved (excl. those prepared or preserved by vinegar or acetic acid)	**108,427** 32
Carrots and turnips, fresh or chilled	**98,836** 285
Frozen peas and beans (excl. peas (*Pisum sativum*) and beans (*Vigna* spp., *Phaseolus* spp.)), uncooked or cooked by steaming or boiling in water	**96,238** 107
Frozen unshelled peas (*Pisum sativum*), uncooked or cooked by steaming or boiling in water, in packs not exc 500 g	**67,206** 12
Manioc (cassava), fresh, chilled or dried, whether or not sliced or in the form of pellets	**51,239** 7
Fruits of the genus Capsicum or of the genus *Pimenta*, fresh or chilled	**46,778** 8
Leeks and other alliaceous vegetables (excl. onions, shallots and garlic), fresh or chilled	**44,898** 35
Sweet potatoes, frozen	**32,014** 9
Vegetables and mixtures of vegetables (excl. beans, olives, sweet corn, peas (*Pisum sativum*) & asparagus), preserved by sugar (drained, glace or crystallised), not frozen	**25,070** 0.2
Dried truffles, whole, cut, sliced, broken or in powder, but not further prepared	**18,905** 0.04
Dried, shelled broad beans and horse beans (*Vicia faba* var.)	**17,247** 6
Salad beetroot, salsify, celeriac, radishes and similar edible roots (excl. carrots and turnips), fresh or chilled	**15,806** 23
Spinach, New Zealand spinach and orache spinach (garden spinach), fresh or chilled	**14,479** 10
Frozen leguminous vegetables (excl. peas and beans), uncooked or cooked by steaming or boiling in water	**13,242** 0
Asparagus prepared or preserved otherwise than by vinegar, acetic acid or sugar, packed in liquid or in air-tight containers, in packs exceeding 1.14 L, not frozen	**9,956** 44
Sweet potatoes, fresh, chilled or dried, whether or not sliced or in the form of pellets	**8,932** 2
Cucumbers, provisionally preserved, but unsuitable in that state for immediate consumption	**8,703** 19
Cucumbers and gherkins, fresh or chilled	**4,575** 1
Beans, olives and sweet corn preserved by sugar (drained, glace or crystallised)	**2,683** 0
Aubergines (eggplants), fresh or chilled	**1,448** 0
Lettuce (*Lactuca sativa*) (excl. cabbage lettuce), fresh or chilled	**1,429** 0
Cabbages, kohlrabi, kale and similar edible brassicas (excl. cauliflower, broccoli and brussels sprouts), fresh or chilled	**1,318** 0.8
Leguminous vegetables (excl. peas and beans), fresh or chilled	**414** 0
Globe artichokes, fresh or chilled	**244** 0

Processed and fresh vegetable imports	CIF ($) Volume (tonnes)
Vegetables and mixtures of vegetables (excl. beans, olives, sweet corn, peas (*Pisum sativum*) & asparagus) preserved by sugar (drained, glace or crystallised), frozen	23 0.05