NSW DEPARTMENT OF
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Maximising returns from water in the Australian vegetable industry

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Maximising returns from water in the Australian vegetable industry: New South Wales

Mark Hickey and Robert Hoogers

August 2006

NSW DEPARTMENT OF
PRIMARY INDUSTRIES

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Maximising returns from water in the Australian vegetable industry: New South Wales

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Note that some references within this report are to information and research generated by NSW Agriculture. NSW Agriculture became part of NSW Department of Primary Industries on 1 July 2004.

Disclaimer

The information contained in this publication is based on knowledge and understanding at the time of writing (August 2006). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of New South Wales Department of Primary Industries or the user's independent adviser.

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CONTENTS

FIGURES

TABLES

EXECUTIVE SUMMARY

This report is one in a series on vegetable industry water use at state and national levels, and has been funded by Horticulture Australia Ltd (HAL) and AUSVEG. This series outlines how water is used in the major vegetable production regions in Australia, and details the current irrigation practices, water use efficiencies and economics of the vegetable-growing industries in each state.

The vegetable sector is the largest segment of the horticultural industry in Australia. The most recent ABS survey (2000/01) revealed the vegetable industry had a gross value of around $ 2.1 billion, derived from some 2.9 million tonnes of produce. Export value of Australian fresh and processed vegetable products in 2004/05 was in excess of $192 million. The major crop types were potatoes (1.2 million tonnes from 36 800 ha), tomatoes (414 000 tonnes from 8300 ha), carrots (283 000 tonnes from 7000 ha) and onions (247 000 tonnes from 5300 ha).

The 2000/01 ABS survey reported 5300 vegetable establishments (with estimated value of agricultural operations worth $5000 or more) Australia-wide, directly employing 15 621 people. These farms were typically run by single unit farming families who specialise in vegetable production. Average farm size is about 25 hectares, from which produce worth $230 000 per annum at first point of sale is generated.

Water is an essential input to sustainable vegetable production. The ABS report *Water use on Australian farms 2003–04* (ABS 2005b) stated that, in 2003/04, the vegetable industry accounted for 477 136 megalitres (ML) or just 4.6% of the total water used for irrigation. The report also estimated that average water use per hectare was 4.1 ML/ha, compared with the estimated overall application rate for water across all crops of 4.3 ML/ha. The value return from vegetable production per megalitre increased from $1762/ML in 1996/97 to $3207/ML in 2000/01 (ABS 2002b).

The rate of irrigation technology improvements in the vegetable industry since the mid-1990s has been significant, and has come at a time of increased publicly funded incentive programs (such as WaterWise on the Farm, in NSW and the Rural Water Use Efficiency program in Queensland) for improving irrigation efficiency on-farm. This series of reports details the investment made in technology to ensure maximum output and product quality from every megalitre used in vegetable production and processing.

The productivity increases achieved by the vegetable industry can be largely attributed to the increased use of water-efficient delivery systems such as drip irrigation, increased use of recycling on-farm, wide scale adoption of irrigation scheduling and soil moisture monitoring and increased use of whole farm planning and soil mapping. Although more difficult to measure, some part of that increase in product value and quality is most likely to be the direct result of improved irrigation practices.

VEGETABLE WATER USE IN NEW SOUTH WALES

This report provides a summary and analysis of water use in the vegetable industry in New South Wales as of March 2006.

While the New South Wales vegetable industry had its origins in the Sydney Basin, the major production areas are now spread across a range of climatic zones from the coast to the Tablelands and Central West to the Murrumbidgee and Murray valleys in the south. The Murrumbidgee, which includes Griffith, Hillston and Hay, has the largest concentration of vegetable production with 41% of the area (9695 ha), and 32% of the total value ($102 million) for NSW (ABS 2001). The Sydney Basin is the second largest producer of vegetables by value, with 26% of the total value ($79 million).

The crop types grown in the regions vary significantly. A high proportion of market garden crops such as lettuce, cabbages and leafy brassicas, and hydroponic cucumbers, tomatoes and lettuce are grown close to the major markets in the Sydney Basin. Many of the mechanically harvested processing crops such as tomatoes, sweet corn, potatoes and gherkins are grown and processed in the broadacre inland irrigated regions.

In 2000/01, the NSW vegetable industry was valued at over $305 million at the farm gate annually, and directly employed 3100 persons. Water use in the vegetable industry was estimated at 96 000 ML, or the equivalent of 4.12 ML/ha. Recent studies in Queensland (CDI Pinnacle Management, Street Ryan & Associates 2004) have shown that downstream industries and operations add 100% on the farm gate contribution.

This equates to $6.3 million of regional output and 32 jobs for every 1000 ML of water used in production of vegetables.

Recommendations for future research from analysis of information in this report include:

- Obtaining more quantitative data on the product quality improvements which can be achieved through the use of highly efficient irrigation systems such as subsurface drip. Assuming these improvements translate into better product prices in the market, this will be a strong driver for the adoption of highly water-efficient delivery systems in the vegetable industry.
- Undertaking more extensive benchmarking of water use in the major crops, as present data are inaccurate, or relevant only to specific regions. Encouragement for growers to install flow meters on their pressurised water delivery points to farm and crops would be an excellent start.
- Developing a detailed study of the threshold cost of water beyond which vegetable growing becomes uneconomic. For instance, in the Lachlan in 2004/05, it was 'guesstimated' that up to $400/ML could be paid for temporary water before it became unfeasible to grow vegetables.

SECTION 1 – INTRODUCTION

Vegetable production in New South Wales extends from the humid, subtropical North Coast to the peri-urban region of the Sydney Basin, across to the cooler temperate tablelands and to the dry hot inland irrigation districts. In 2001 the Australian Bureau of Statistics (ABS) recorded over 23 265 hectares of vegetables grown in NSW, worth more than $305 million.

While the New South Wales vegetable industry had its origins in the Sydney Basin, the major production areas are now spread across a range of climatic zones from the coast to NSW Tablelands and Central West to the Murrumbidgee and Murray valleys in the south. The Murrumbidgee, which includes Griffith, Hillston and Hay, has the largest concentration of vegetable production with 41% of the area (9695 ha), and 32% of the total value ($102 million) for NSW (ABS 2001). The Sydney Basin is the second largest producer of vegetables by value with 26% of the total value ($79 million).

The major crops and production areas are potatoes (Murrumbidgee, Murray, North and Central Tablelands), melons (Murrumbidgee and Central West), processing tomatoes (Murrumbidgee and Murray), lettuce (Sydney Basin, Central West and Murrumbidgee) and sweet corn (Central West and Murrumbidgee). Highly intensive, small scale operations in the Sydney Basin produce around 40% of NSW's fresh market perishable vegetables.

The crop types grown in the regions vary significantly. A high proportion of market garden crops such as lettuce, cabbages and leafy brassicas and hydroponic cucumbers, tomatoes and lettuce are grown close to the major markets in the Sydney Basin. Many of the mechanically harvested processing crops such as tomatoes, sweet corn, potatoes and gherkins are grown and processed in the broadacre inland irrigated regions.

Production methods also vary according to region. Inland production systems are characterised by large area, furrow-irrigated farms with a high degree of specialisation, while the coastal districts are small, intensive operations, spray or drip-irrigated and usually producing several crop types each season. The Central West and Tablelands are predominantly spray-irrigated (centre pivot, fixed spray) medium size farms.

Highly intensive, small scale operations in the Sydney Basin produce around 40% of NSW's fresh market perishable vegetables.

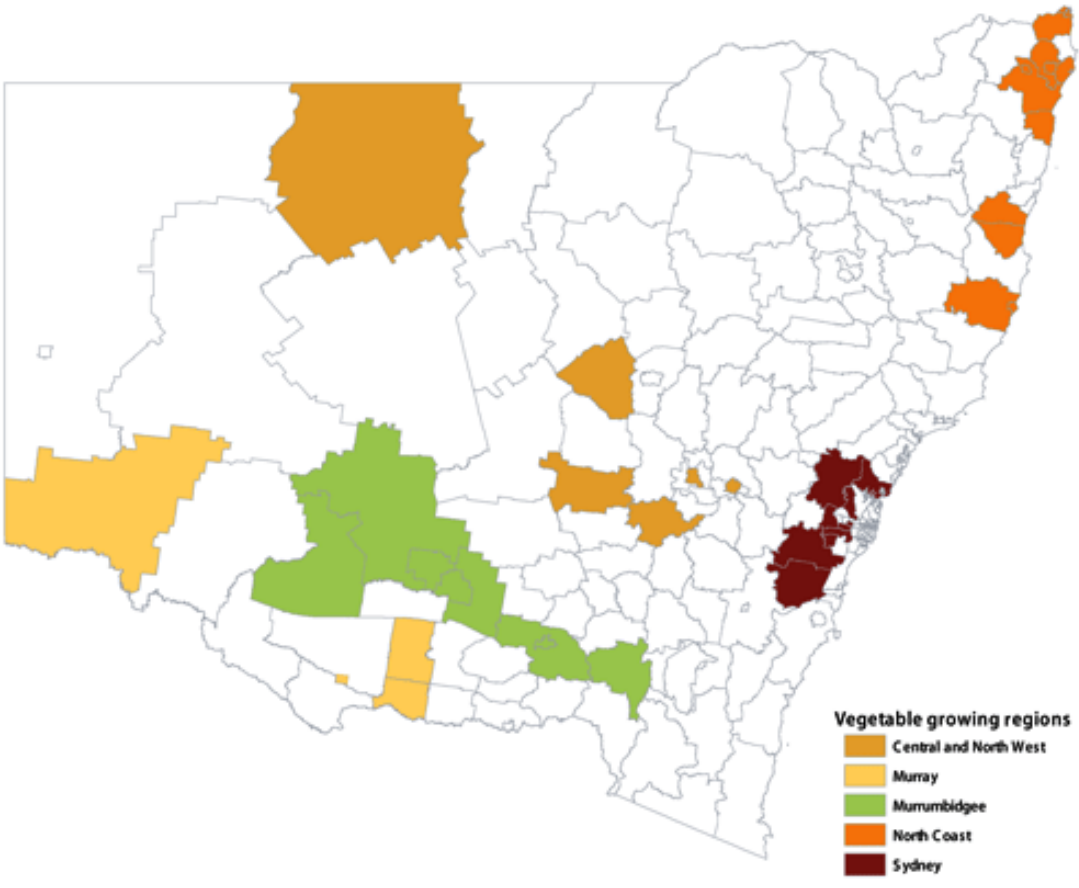
Broadacre row crops and large operations are typical of south-west NSW and the Riverina.

The NSW vegetable production regions covered in this report are included in the statistical regions based on ABS survey results as shown in Table 1.

Table 1 – New South Wales Statistical Areas and Divisions

Report regions	Statistical Local Area Compilation	ABS Statistical Division
Sydney	Baulkham Hills, Holroyd, Fairfield–Liverpool, Camden, Gosford, Windsor, Richmond, Penrith, Wingecarribee, Wollondilly	central western Sydney, north-western Sydney, Canterbury–Bankstown, outer western Sydney, outer south-western Sydney
Central and North West	Cowra, Bathurst, Forbes, Narromine, Bourke, Orange	Lachlan, Macquarie–Barwon, Central Macquarie, Upper Darling, Bathurst–Orange, Central Tablelands
North Coast	Tweed, Richmond Valley, Lismore, Ballina, Bellingen, Nambucca, Hastings	Richmond–Tweed, Clarence, Hastings
Murrumbidgee	Hay, Carrathool, Griffith, Leeton, Narrandera, Wagga Wagga, Tumut, Maclean	Lower Murrumbidgee, Central Murrumbidgee
Murray	Berrigan, Jerilderie, Deniliquin, Wentworth	Central Murray, Murray Darling, Upper Murray

Figure 1 – Vegetable regions within New South Wales Statistical Areas



SECTION 2 – VEGETABLE CROPS IN NEW SOUTH WALES

2.1 – MAJOR VEGETABLE CROPS IN NSW

The largest concentration of vegetable production in New South Wales (Table 2) is in the south-west and Riverina regions along the Murrumbidgee and Murray valleys. Characteristic of vegetable production in this region are broadacre, furrow-irrigated row crops on laser-levelled fields. The irrigation system is by and large gravity-fed from both the Murrumbidgee and the Murray, and a minimum of pumping is required to transport water to the field. There are relatively few vegetable growing operations in this region, and these farms are large (average farm in excess of 600 hectares).

Table 2 – Major NSW vegetable crops by area (ha)

	NSW total	Sydney	Central & North West	North Coast	Murrumbidgee	Murray
Potatoes	6 851	213	221	843	2 608	2 131
Melons	1 628	75	183	109	1 065	95
Tomatoes (processing and fresh)	1 626	97	16	64	556	847
Lettuce	1 046	337	100	14	409	2
Onions, white and brown	969	2	13	86	742	120
Sweet corn	3 508	181	1093	35	2 138	6
Pumpkins (incl. butternuts)	1 753	57	208	96	726	156
Cabbages	461	284	111	5		6
Carrots	1 032	21	na	246	642	6
Cauliflower	486	164	267	4	na	1
Asparagus	284	na	41	na	15	117
Zucchini	215	66	6	75	na	18
Broccoli	757	38	155	6	12	6
Beans, french and runner	560	20	36	174	200	30
Cucumbers	506	44	2	22	410	10
Total, all vegetables	**23 265**	**2 099**	**2 646**	**2 162**	**9 695**	**3 642**

Source: ABS 2001

By contrast, in excess of 1500 growers produce vegetables in the Sydney Basin. Most of these operations are less than 30 ha in size, highly intensive, and include approximately 260 greenhouse/polyhouse growers (growing cucumbers, tomatoes, and lettuce). ABS census data demonstrate the greater intensification of production, recording Sydney as producing:

- 12% by volume of all vegetables in the state
- on only 9% of the land used for vegetables
- by 34% (ABS 2001*)* of the growers in the state.

When the lower value broadacre crops such as potatoes, melons, pumpkins and carrots and processing crops such as tomatoes are deducted, produced mainly on lower value land outside Sydney, the ABS rates the value of production of high value fresh market perishable vegetables as 40% of the state's production. This data is understated, as not all small farms and production are included. This production region is within an hour's drive of Sydney Wholesale Produce Markets at Flemington, Australia's largest produce market.

Other regions are smaller, more specialised production districts including the Lachlan and Macquarie valleys in the Central West (sweet corn, brassicas, potatoes), the North Coast from Kempsey to Murwillumbah (beans, potatoes, hydroponic lettuce), the South Coast including Cooma (broccoli, lettuce) and Bourke in the North West (melons).

Trends in vegetable crop production

Extremely dry weather conditions and low water allocations during the 2002–05 period contributed to a decline in production of certain vegetable crops, particularly in regions heavily reliant on irrigation. For instance, potato production in the Murray Valley has seen a shift over the last five years away from fresh market to processing crops, and some growers have left the industry altogether. The combined effects of greater market competition in the fresh potato market and the drought contributed to this decline.

In the Lachlan Valley, general security water allocations were 3% in 2002/03, then 0% for the 2003/04 and 2004/05 seasons, resulting in a dramatic change in vegetable cropping. A proportion of the processed sweet corn production shifted to the Murrumbidgee Valley, and there was a rapid increase in high value crop systems such as seedless watermelon production under drip irrigation and black plastic mulch.

Vegetable production on the NSW North Coast has gradually declined over the last 15 years with fresh market tomatoes and sweet potatoes shifting north to Queensland. The remaining production districts around Macksville, Dorrigo and Murwillumbah have seen a reduction in grower numbers and crop area, the exception being a steady growth in hydroponic crops such as lettuce in polyhouses.

The production estimates in Table 3, while not as accurate as the 2001 ABS survey results, provide an indication of the trends within the NSW vegetable industry.

In recent years the major shift has been within the potato industry, where production of processing potatoes for the french fry and crisping sector has increased at the expense of fresh market potatoes in the Riverina.

The tonnage of sweet corn has also fluctuated depending on processor demand. A contraction of production back to the Lachlan in the late 1990s was followed by several years of increased production in the Riverina during the drought of 2001–04. In 2005/06, plantings in the Riverina have again fallen due to reduced processor demand and higher transportation costs.

Table 3 – Vegetable production by crop, Australia and NSW, estimates for 2003/04

Crop	Australia total tonnes*	NSW total tonnes*	NSW production as % of Australian production
Potatoes	1 310 385	119 104	9
Melons (2002/03) - rockmelons	74 101	21 480	29
Melons (2002/03) - watermelons	99 665	11 117	11
Tomatoes (processing and fresh)	424 950	67 118	16
Lettuce	127 228	18 120	14
Onions, white and brown	233 364	30 602	13
Sweet corn (2002/03)	80 467	41 377	51
Pumpkins (including butternuts)	94 644	20 736	22
Cabbages (2002/03)	76 093	18 993	25
Carrots	302 560	34 823	11
Cauliflower	78 281	11 512	15
Asparagus	10 366	842	8
Zucchini (2002/03)	15 231	2 239	15
Broccoli	51 539	5 582	11
Beans, French and runner	31 119	486	1.5
Cucumbers (2002/03)	14 390	5 262	37

* Estimates have a relative standard error ranging from 10% to 50%.

Source: ABS2002

2.2 – EMPLOYMENT IN THE VEGETABLE INDUSTRIES

Employment figures reflect those jobs directly associated with production of vegetables, that is, vegetable growers and their farm workers (Table 4).

Table 4 – Employment in vegetable growing, Australia and NSW

	Australia total	Sydney	Central & North West	North Coast	Murrumbidgee	Murray
No. persons employed	15 621	2 037	191	231	459	266

Source: ABS 2001

More than 5000 people are employed in vegetable growing and processing industries in New South Wales.

Employment figures for food processing and service industry workers (chemical, fertiliser and other inputs) and consultants are not listed separately, but the AFFA publication *Australian Food Statistics 2003* lists a combined employment figure for vegetable and fruit processing as 2485 persons in New South Wales in 1999, and a national figure in excess of 16 000 in 2001 (*Australian Food Statistics 2004*). Add to that the people employed in the supply chain at wholesale and retail levels and the figure would be substantially higher.

2.3 – GROSS VALUE OF NSW VEGETABLE PRODUCTION

According to the ABS 2001 census, New South Wales accounts for $305.6 million (10.4%) of the value of Australia's vegetable production (Table 5). NSW has the largest percentage of vegetable businesses, at almost 24%. The Murrumbidgee is the largest region (Figure 2) with $102.4 million (33%), followed by the Sydney Basin $79 million (26%), the Murray $39.4 million (13%) and the Central West $26.2 million (8.5%). In Figure 3, the gross value proportions of vegetables grown in NSW are indicated.

Processed sweet corn production has tended to move to the Murrumbidgee Valley.

Greater market competition in the fresh potato industry has seen shifts to processing crops.

Table 5 – Major vegetable crops by gross value*, 2001 and 2002

	2001	2002	2001				
	NSW total $ million		Sydney Basin $ million	Central & North West $ million	North Coast $ million	M'bidgee $ million	Murray $ million
Total, all vegetables	305.6	302.2	79.02	26.2	22.1	102.4	39.4
Potatoes	72.02	76.2	2.86	2.5	8.2	24.3	26.9
Melons	30.6	20.0	0.5	1.14	0.84	26.3	1.3
Tomatoes (processing and fresh)	26.9	22.1	12.2	0.65	2.26	4.47	6.05
Lettuce	25.3	26.6	9.0	1.13	1.9	8.9	0.02
Onions, white and brown	20.6	22.2	0.02	0.13	2.1	16.7	1.6
Sweet corn	12.7	9.6	0.35	5.76	0.06	6.4	0.08
Pumpkins (incl. butternuts)	9.7	8.8	0.36	0.95	0.08	5.7	1.16
Cabbages	9.2	5.4	5.83	2.25	0.01	na	0.04
Carrots	8.8	5.4	0.22	na	2.2	5.5	0.07
Cauliflower	6.6	6.4	2.27	3.85	0.01	na	0.01
Asparagus	3.2	2.9	na	0.38	na	0.13	1.31
Zucchini	2.3	na	0.75	0.07	0.8	na	0.217
Broccoli	2.2	3.7	0.26	0.62	0.01	0.08	0.02
Beans, french and runner	2.1	3.3	0.04	0.34	1.07	0.1	0.06
Cucumbers	1.6	6.3	0.58	0.01	0.02	0.62	0.08

Source: ABS 2001, ABS 2002

*Gross value is the estimated point of sale value. Regional values are estimated from volume figures and take into account the level of processing.

Processed vegetable production

While most vegetable products grown in New South Wales are sold on the fresh market, there is a proportion of crops which are predominantly processed or 'value added' in some form. Processing tomatoes, potatoes (crisps and french fries), sweet corn, gherkins, lettuce, onions, pumpkins, carrots and other vegetables are either factory-processed or value-added packaged for the 'ready to eat' market.

Much of the processing vegetable production is located in the Murrumbidgee, Murray and Lachlan valleys. The larger farm size (average 600 hectares), reliable water supply and suitable soil types make these regions highly suited to production of the major processing

Figure 2 – Vegetable crops, NSW, value ($ million) by region, 2001

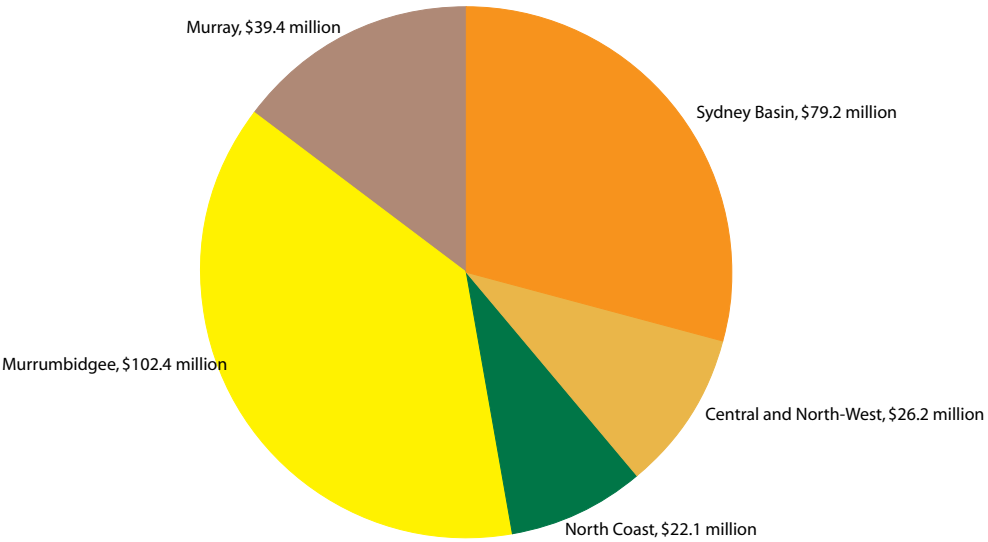
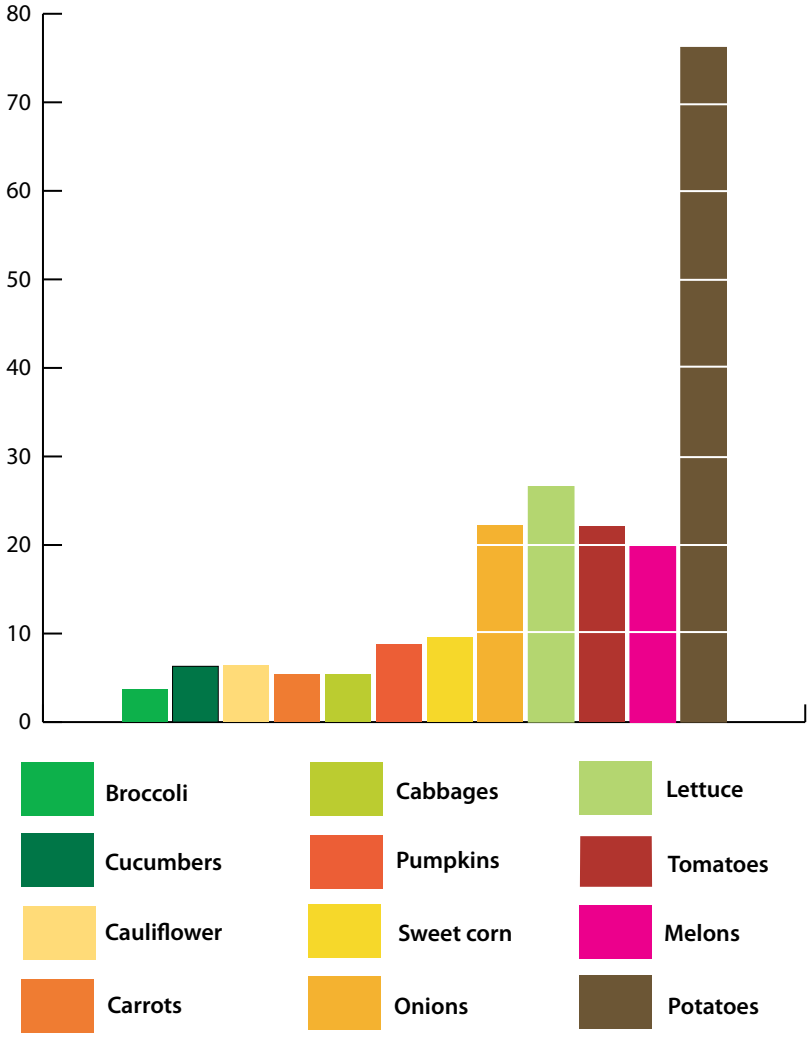


Figure 3 – Vegetable crops, NSW, value ($ million), 2002



crops: potatoes, sweet corn, gherkins, carrots, processing tomatoes and beetroot (Table 6). Processing opportunities are also emerging for crops such as onions and broccoli for the food service industry.

Table 6 – Processing vegetables, NSW, production (t) and value ($)

Crop	Where processed	Tonnes processed 2004/05	Estimated value at farm gate ($)
Processing tomato	Darlington Point (dried) Jerilderie (pasta sauces, diced) Victoria (paste, diced, whole peel, juice)	96 000	9 120 000
Potato	Sydney, Melbourne, Shepparton, Brisbane (crisps), Ballarat, Ulverstone (french fries), Cowra (canned), South Korea (fresh potatoes for processing)	41 350	8 890 250
Sweet corn	Bathurst	35 000	6 370 000
Lettuce	Sydney	3260	1 696 500
Gherkins	Griffith	2 960	1 376 000
Carrot	Juice (Griffith) for export	6 000	840 000
Onion	Sydney (sliced, diced), Riverina (small scale pickling)	1 500	375 000
Beetroot	Cowra (canned)	1 100	121 000

Source: NSW Department of Primary Industries 2005, estimates

2.4 – EXPORT VALUE OF NSW VEGETABLES

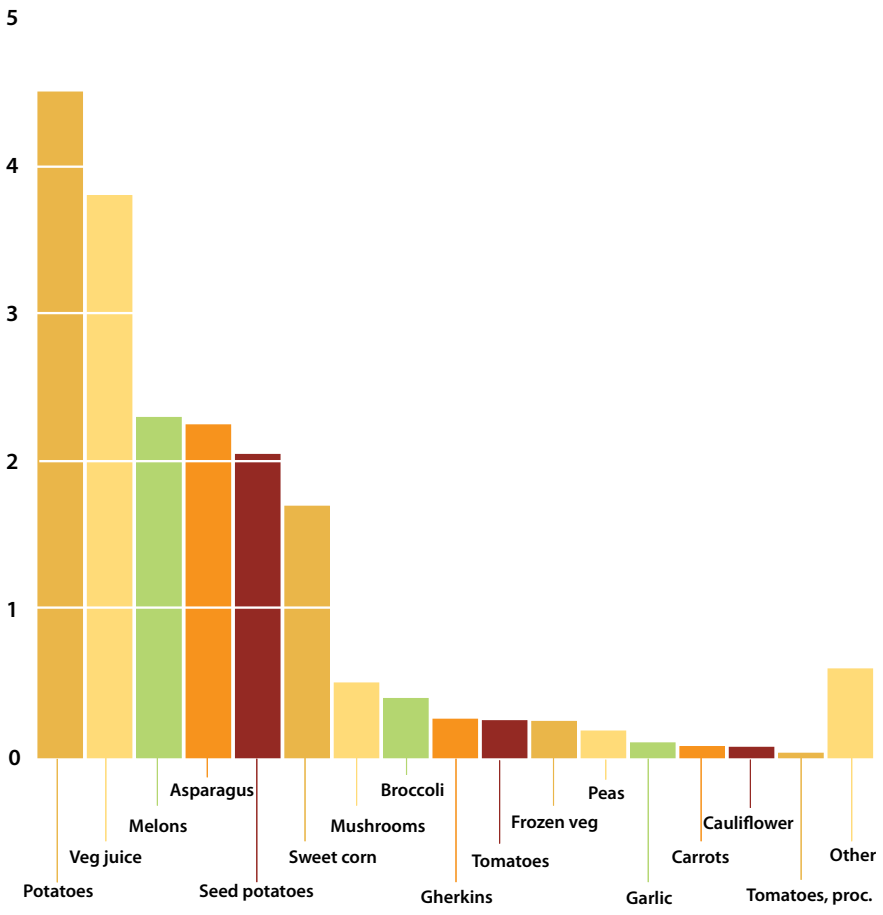
While not a major exporter of vegetables, New South Wales produces niche products for specialty markets in the northern hemisphere. Recent examples include carrot juice for the Japanese market and fresh Atlantic potatoes for the South Korean crisping potato industry. A substantial volume of melons are also exported through the Sydney Markets. The Sydney Markets also account for a sizeable business in re-export of products such as garlic to the Pacific and smaller export markets.

Melons and sweet corn are two important vegetable exports from NSW.

With over 60% of NSW vegetable production in excess of 300 km from the nearest port facility, high freight transport costs have constrained development of a large scale vegetable export industry. Access to the large markets of Sydney, Melbourne, Brisbane and Canberra provide a substantial domestic market opportunity for NSW vegetable growers.

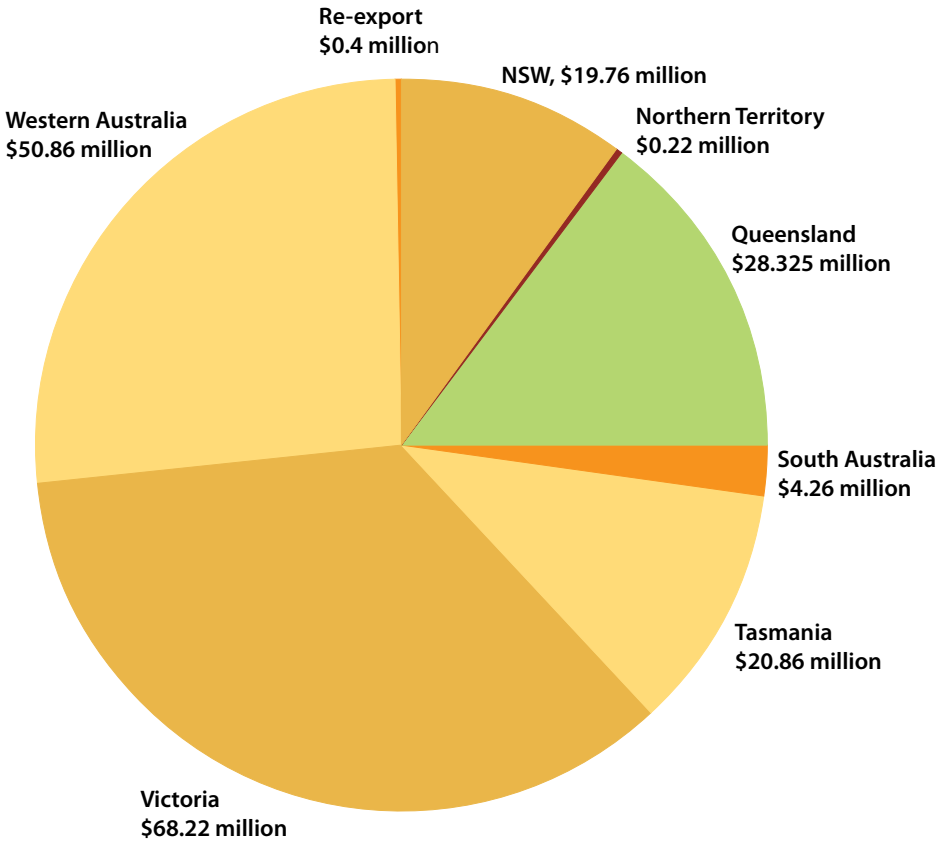
Figure 4 shows the most recent export data for New South Wales, while Figure 5 gives a perspective of the NSW export industry in relation to other Australian states.

Figure 4 – NSW vegetable crop exports ($ million)



Source: ABS

Figure 5 – Vegetable crop exports, value, Australia by state, July 2004 to June 2005



Source: ABS

The average net return across the major vegetable crops in NSW in Table 7 is $357/ML.

Table 7 – Estimated gross returns ($/ML/crop) for 13 major NSW vegetable crops, by irrigation type

Vegetable crop	Average NSW yields	Gross return* ($m)	Net return** ($m)	Estimated irrigation use (ML/ha)	Calculated total water used (ML)	Farm gate return ($/ha)	Nominal net return ($/ML)
Potatoes (sprinkler)	25 t/ha	65	5.1	4.0	27 404	744	186
Melons (furrow)	1600 cartons/ha (rockmelons)	17.7	3.1	4.8	7 814	1 612	339
Tomatoes, fresh (drip)	5000 half cartons/ha	10.1	6.3	6.0	1 344	5 320	886
Tomatoes, processing (furrow)	80 t/ha	10.2	4.8	8.0	11 216	3 468	433
Lettuce (furrow)	2200 cartons/ha	18.4	2.8	2.2	2 301	2 750	1 250
Onions, white and brown (furrow)	2000 bags/ha	7.8	0.95	4.7	4 554	932	198
Sweet corn (sprinkler)	18 t/ha	7.9	2.8	6.0 (Riverina) 4.5 (Lachlan)	16 663	826	127
Pumpkins (furrow)	25 t/ha Jarrahdale	10.9	2.7	6.5	11 394	1 556	239
Cabbages (sprinkler)	20 000 head/ha	5.9	0.6	4	1 844	1 379	344
Carrots (furrow)	600 cartons/ha plus 900 bags/ha	10.5	1.3	4.2	4 334	1 247	296
Cauliflower (sprinkler)	1200 cartons/ha	5.2	2.06	4	1 944	1 345	336
Asparagus (spray)	5275 kg/ha	6.3	0.53	8	2 272	1 883	235
Zucchini (spray)	1500 half cartons/ha	3.2	0.61	6	1 290	2 798	466
Broccoli (furrow)	800 cartons/ha	8.5	1.7	6	4 542	2 250	375
Total		187.6					

Source: Based on 2001 ABS figures; from *Farm budget handbook: NSW vegetable crops 2001*, NSW Agriculture 2001.

* Gross return is based on farm gate value of the crop multiplied by the 2001 NSW crop area.

** Net return is the estimated gross margin for the total NSW crop.