

Sustainable Horticultural Crop Production in Australia

Jared Cutting

Undergraduate Student,
Hort 3002W, Sustainable Horticulture Production (Greenhouse
Management),
Dept. of Horticultural Science, University of Minnesota,
1970 Folwell Ave.,
Saint Paul, MN 55108 U.S.A.

I. Study Country

Australia was selected as the country of choice for many reasons. It has an interesting history and landscape, temperate areas that are much like Minnesota, and the horticulture industry in the country has many of the same issues surrounding sustainability as the United

States such as

water usage.

Australia is the world's smallest continent, yet the country is the 6th largest country in the world consisting of 7,741,220 square kilometers (CIA – The World



<http://www.thecommonwealth.org/YearbookHomeInternal/138122/>

Fact Book, 2010). Its climate is mostly arid to semiarid and contains temperate areas to the south and east with a tropical north. The landscape consists of mostly low plateaus and deserts with a fertile plain in the southeastern part of the country. The elevation extremes in the country range from 15 meters below sea level at Lake Eyre to 2,228 meters at the peak of Mount Kosciuszko (The Australian Continent, Unknown a). Arable land makes up a small 6.15% in which 17 million hectares of cultivated grassland is included. Permanent crops make up a slim

0.04% of the total land of the country. As of 2003, there were 25,450 square kilometers of irrigated land. In 2000, the water consumption per capita was 1,193 cubic meters per year and total water consumption for the country was 24.06 cubic kilometers per year. Of the total consumption, 75% was used in agriculture. Agriculture pulls in 3.8% of the capital in Australia and 3.6% of the population works in agricultural fields. The top agricultural products of the country are wheat, barley, sugarcane, fruits, cattle, sheep, and poultry (CIA – The World Fact Book, 2010).

II. Sustainability

The Australian government has realized that steps must be taken in a proactive direction to preserve the landscape of the country and its citizens' wellbeing for the future. One step that the Australian government has taken is define sustainability as “using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased” (Ecologically Sustainable Development, 2008b). This was derived from the popular definition “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Ecologically Sustainable Development, 2008b). This seems to be a common definition for governments to take and modify, as the United States Environmental Protection Agency has done the same thing with a very similar definition of sustainability (Basic Information/Sustainability, 2010). There are several advantages that one can take away from its government producing a definition of sustainability and where they would like the country to be in the future. One advantage that can come from it is that people and industries can have something to aim for and try to get themselves there as a personal goal for

the pride of their country. It is also important that the definitions are not too general so they are able to be clearly understood and implemented. If the definitions are not able to guide what needs to be worked on, then nobody has any idea what they need to do to make the environment around them better for all.

III. History of Agriculture in Australia

Australia has an interesting history surrounding its agricultural background. In the 1800s, as the country was being settled the native vegetation in the landscape was being clear cut of its trees and shrubs to make room for farmland. What the settlers did not realize was that the land that they were going to try to grow crops on was quite infertile and much of the country is prone to drought conditions. Because of the difficulty that they had establishing crops, the settlers, still looking to make a living for themselves, decided that they could produce high quality wool. Producing this high quality wool and some wheat were the most dominant forms of agriculture in Australia until the 1900s (Australian farms and farming communities, 2008).

In the 1900s, Australia's farmers continued to solve the most inhibitive aspect of producing crop, their lack of water. The irrigation systems continued, and still continue to this day, to push more water where water was not readily available (Australian farms and farming communities, 2008). With the additional water that the farmers were now experiencing they were able to produce a much wider spectrum of crops.

The historic practices of farming in Australia have very little sustainability once the irrigation systems started to expand. Once a farm had water available the watering would not be done as carefully. The animals that they once raised would not be needed for income now so they eliminated livestock from their farms, which was also a producer of fertilizer.

IV. Horticulture in Australia

The horticulture industry in Australia employs 130,000 people and has 30,000 growers nationwide. Horticulture is also the fastest growing and second largest segment of agriculture in Australia (Horticulture Australia Council, 2009). The main production areas for horticultural crops in Australia are the Goulburn Valley in Victoria, the Sunraysia district of Victoria and New South Wales, the Murrumbidgee Irrigation Area in New South Wales, the Riverland area of South Australia and northern Tasmania and southwest Western Australia, and along the coast in northern New South Wales and Queensland. Much of the nursery production is located closer to capital cities. A large quantity of the produce that is grown in the southern states goes to processing. The produce from Queensland is sent to the southern states during the colder months as fresh produce (Australian Horticulture Fact Sheet, 2008a).

Table 1 and Table 2 list the major crops that are grown for export purposes in Australia. The tables show how much income the crop produces from exports for each growing season.

Table 1 shows, from 2000 to 2005, the economical impact of the fresh horticultural crops that are produced and exported from Australia. The table shows the amount of capital brought into the country as a result of exportation of the country's largest fresh crops. Oranges have been one of the country's biggest crops in terms of money made from exports, and is the only one to have brought in over 100 million dollars between years 2000 and 2005. Macadamias and grapes have also been very large income crops.

Table 1. Fresh Australian Horticulture Exports

Commodity	2000-2001 Value (\$m)	2001-2002 Value (\$m)	2002-2003 Value (\$m)	2003-2004 Value (\$m)	2004-2005 Value (\$m)
Oranges	150	153	146	107	118
Macadamias (shelled and in	78	110	88	106	146

shell)					
Grapes	72	136	96	85	109
Mandarins	37	40	49	43	41
Carrots	40	49	48	39	37
Cut flowers/nursery	36	44	40	31	36
Potatoes (incl. seed)	14	19	24	27	26
Onions	19	28	25	24	21
Asparagus	43	40	34	22	27
Apples	46	34	41	20	17
Almonds (shelled and in shell)	7	20	13	18	29
Melons (incl. watermelon)	18	20	17	15	16
Cauliflowers	30	28	24	13	6
Plums	25	22	26	13	16
Pears	24	20	23	12	12
Nectarines	16	27	23	12	15
Broccoli	14	15	13	10	9
Other	114	124	125	104	119
Total	783	929	855	701	800

(Australian Horticulture Fact Sheet, 2008a)

Table 2 shows the processed horticultural crops and their economical impact that were exported from Australia between 2000 and 2005 (Australian Horticulture Fact Sheet, 2008a).

The table shows that horse beans and peas are the most valuable crops that get processed and exported from Australia.

Table 2. Processed Horticultural Exports

Commodity	2000-2001 Value (\$m)	2001-2002 Value (\$m)	2002-2003 Value (\$m)	2003-2004 Value (\$m)	2004-2005 Value (\$m)
Sultanas	15	12	15	12	14
Pears (prepared or preserved)	30	28	29	23	17
Peaches (prepared or preserved)	20	19	31	18	9
Fruit salad (canned or bottled)	20	20	23	17	16
Orange juice	22	17	17	14	18
Grape juice	12	13	12	13	12

Apple juice	13	10	12	11	9
Jams, jellies, spreads, etc.	10	10	10	14	16
Tomato sauces	11	18	12	9	10
Dried, shelled broad and horse beans	91	88	66	56	37
Dried, shelled peas (split & not split)	92	133	37	52	33
Potatoes (prepared or preserved)	7	10	13	22	13
Other	171	191	190	173	183
Total	514	569	467	434	387

(Australian Horticulture Fact Sheet, 2008a)

V. Current Production Practices

Australia grows most of its crops out in the field. However, almost all of the peppers (*Capsicum spp.*), cucumbers (*Cucumis sativus*), and tomatoes (*Lycopersicon esculentum*) are grown in greenhouses (Greenhouse Vegetables, Unknown d). There is somewhere around 600 greenhouse growers of these crops in South Australia. They grow these crops for the country and very few will be exported. Many of these greenhouses range from low to medium in terms of technology and are covered with either glass or poly (Greenhouse Vegetables, Unknown d). The majority of greenhouse growers in South Australia have between 20 and 40 greenhouses with the average 2.1 hectare plot of land able to contain between 30 and 40 greenhouses. The choice of producing a moderately sized crop comes as a result of wanting to save on shipping costs which saves on fuel consumption.

Australia's nursery sector of horticulture is becoming more and more focused on the need to be "green." The nursery associations in Australia are becoming more and more active with new programs on how to become more environmentally friendly. One of the nursery associations is the Nursery and Garden Industry Australia (NGIA). They are developing training

workshops on new skills that will help to benefit the environment in the long run. The NGIA has also developed a project called the National Environmental Policy Manager. One of the main goals of this is for the “manager” to develop and review policies that deal with the environment that nurseries must follow. This “manager” will make recommendations base on what they gather if the policies are effective or if something newer would be even better and encourage nurseries to adopt the new practices (Horticulture Australia, 2009). The “manager” will also try to encourage the lawmakers to create regulations on some practices that they feel are going to make huge positive impacts on the industry and the environment as a whole.

Many of the edible crops that are grown in Australia are field grown. Oranges (*Citrus sinensis*), mandarins (*Citrus reticulata*), macadamias (*Macadamia integrifolia*), potatoes (*Solanum tuberosum*), carrots (*Daucus carota*), grapefruit (*Citrus paradisi*), lemons (*Citrus limon*), apricots (*Prunus armeniaca*), cherries (*Prunus cerasus*), peaches (*Prunus persica*), apples (*Malus spp.*), and pears (*Pyrus communis*) are all grown out in the field (Save The Murray, Unknown b). The growing practices are similar to that of the United States. The major trends in the field grown crops is to develop equipment that is faster, more reliable, less expensive, and more fuel efficient. The equipment being developed in some situations are using alternative fuels. Tractors are the major piece of equipment being used in the production of the field grown plants as they are able to do many things with different attachments. Many of the methods of growing these plants have changed little over the years. For tree crops the use of intercrops has become more widespread. They use them for building up organic material in the soil and for erosion controls (Horticulture Australia, 2009). Intercrops can also be used to reduce weed numbers. Using intercrops is a sustainable way of conserving the soil. Overall field grown

crop production is not the most sustainable practice as the use of pesticides and other chemicals that are harmful to the environment are still often used.

The growing of macadamias is a good choice of crop production for many regions of Australia as they are the largest producer of macadamia nuts in the world (Australian macadamia nut industry, Unknown c). This is probably one of the best choices for crop selection, as the trees do not need much work once established. The nuts also do not need machinery, therefore fuel, to get the nuts from the tree with a shaker. They do need to be collected with machines though. As far as many nuts go it is half as much machinery work and fuel cost/usage.

VI. Integration of New and Historic Production

The old and new practices of crops are not all too different from one another. The major difference that can be seen is in the yield of the crops. The new crops produce much more usable product than the older crops were able to creating a more sustainable environment. In both areas of production the major worry is getting water to the crops. The water problem is only going to get worse, unfortunately, as droughts are also still a major concern for the country.

It will be wise for Australia to continue producing the fruits and vegetables that they consume, as the transportation costs of the food will be much less and will help to decrease the cost of food in their country if they use less fuel for shipping purposes. The crops that are grown in already standing greenhouses should continue to be grown in the greenhouses so that the produce can still be grown during the cooler months when production out in the field slows. Construction of new greenhouses may be excessive, as a hoop house may be able to produce the same results in some areas of the country that do not get too cold during the cool periods of the year. The hoop house is less expensive and it will address the water concern better than a

greenhouse as water is not able to evaporate the area within the hoop house as easily as it would in a greenhouse. The warmer areas of the country should continue with field production of their crops as a greenhouse or hoop house will not benefit growth of the plants in any significant fashion.

The country should concentrate their efforts on the production efficiency of the trees producing nuts or fruits, such as macadamia. Australia, as you may remember, is the largest producer of these nuts.

VII. Finalized Sustainable Development Strategy

One of the largest challenges that the macadamia industry will be charged with is increased yields. If yield can be increased on each tree more nuts can be sold throughout the world and it will have space advantages and higher income for the grower by having more trees producing high volumes of nuts. To achieve these high yielding trees breeding can be done to find a tree that produces large amounts of fruit. If the trees were dwarfed and producing the same amount of fruit as the large trees the growers will also be way ahead as they can fit more trees per hectare. This may be able to be done with dwarfing rootstocks. There may also be better ways and more efficient ways to prune the trees to encourage them to fruit in higher yields. Another thing that could be examined is better ways to harvest the nuts from the trees. Some questions that need to be answered could be: Is a tree shaker be better than harvesting the nuts from the ground? Is harvesting from the ground is the way to approach it? Is there something that could be placed on the ground to make harvest more efficient?

In order for all of this to take place the growers are going to need to make a large effort to show that they really want to have better yielding trees and may need to start some of the breeding efforts themselves.

VIII. Design a Future Sustainable Production Facility

The place to test the macadamias is in the Nambucca Valley in New South Wales, as it is home to some of the highest quality macadamia nuts produced in the world. The Nambucca Valley has very little change in temperature throughout the year. The region experiences daily high temperatures of 18 degrees Celsius in the winter and 26 degrees Celsius in the summer. The region is also on the edge of where the native macadamias once grew (Australian macadamia nut industry, Unknown c).



The testing facility would consist of a few hectares of land. The trees would be grown out in the field as they are in current production. Of the experiments to be conducted (Hill, 2007) would be a higher yielding tree, pruning methods, and harvest methods. The higher yielding tree would consist of finding a tree that out produces the average tree significantly on a regular basis. The pruning methods would consist of trying out new ways to prune the trees to see if something will trigger a tree to become mature earlier in its life cycle or if a new way will allow the tree to produce more fruit. The harvesting methods would consist of finding a more efficient way to harvest the nuts whether it be straight out of the tree or off the ground.

The testing for the macadamia trees is not going to be different than doing research on most trees where several years or even decades could be needed to find a tree that is going to meet the requirements of the researchers.

Literature Cited

- Australian farms and farming communities. (2008) Retrieved May 8, 2010. <
<http://www.cultureandrecreation.gov.au/articles/farms/>>.
- Australian Horticulture Fact Sheet. (2008a). Retrieved February 15, 2010.
<http://www.daff.gov.au/data/assets/pdf_file/0003/196662/hort_factsheet_dec_2005.pdf>
- Australian macadamia nut industry. (Unknown c). Retrieved March 24, 2010.
<<http://www.macnuts.com.au/industry.htm>>.
- Basic Information/Sustainability/US EPA. (2010). Retrieved February 16, 2010.
<<http://www.epa.gov/sustainability/basicinfo.htm>>.
- CIA – The World Fact Book – Australia. (2010). Retrieved February 15, 2010.
<<https://www.cia.gov/library/publications/the-world-factbook/geos/as.html>>.
- Commonwealth Secretariat. (Unknown e). Retrieved May 12, 2010.
<<http://www.thecommonwealth.org/YearbookHomeInternal/138122/>>.
- Ecologically Sustainable Development. (2008b). Retrieved February 16, 2010.
<<http://www.environment.gov.au/esd/>>.
- Greenhouse Vegetables. (Unknown d). Retrieved May 8, 2010.
<http://www.pir.sa.gov.au/data/assets/pdf_file/0010/55675/Greenhouse_Vegetable_Overview_Latest.pdf>.
- Hill, Craig. (2007) NSW non metro –Travel Australia. Retrieved May 12, 2010.
<<http://www.australiafound.com/nsw-non-metro/>>.
- Horticulture Australia. (2009). Retrieved March 24, 2010. Industry Annual Reports. <
http://www.horticulture.com.au/reports/industry_annual_reports.asp#a_25>.
- Horticulture Australia Council. (2009). Retrieved February 15, 2010. <<http://www.hac.org.au/>>.
- The Australian Continent. (Unknown a). Retrieved March 26, 2010.
<<http://australia.gov.au/about-australia/our-country/the-australian-continent>>.

Save The Murray. (Unknown b). Retrieved March 24, 2010. <
<http://www.savethemurray.com/industry/horticulturecrops>>.