

# Consumers perception of aquaponics in Australia: A survey

## Abstract

Aquaponics, an integrated system with both hydroponic plant production and aquaculture fish production, is an expanding alternative agriculture system. Many key questions about the overall feasibility of aquaponic systems remain unanswered. Of particular concern for start-up and established producers alike are consumer perceptions and willingness to pay for aquaponic produce and fish. This study reports results and analysis of a consumer survey about perceptions and preferences for aquaponic-grown products that was conducted in Melbourne Metropolitan Area (MMA), Australia. The results represent a first step toward building knowledge about the potential consumer base for aquaponics, which is a critical piece in the system's potential overall profitability. It appears that consumer education and marketing will be key for the expansion of the market.

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## Introduction

Aquaponics is the integration of recirculating aquaculture and hydroponics in one production system. In this regard it is necessary to know what the real meaning of hydroponics and aquaculture are. The most common method of soil-less culture is hydroponics, which includes growing plants either on a substrate or in an aqueous medium with bare roots.<sup>1</sup> As stated by Somerville et al (2014),<sup>1</sup> hydroponics can in fact control soil-borne pests and diseases by avoiding the contact between plants and soil, and because soil-less media can be sterilized and reused between crops. Moreover, most soil-less culture methods use a fraction of the water necessary for traditional soil-based production because the nutrient solution is recycled. On the other hand, aquaculture is the captive rearing and production of fish and other aquatic animal and plant species under controlled conditions. Many aquatic species have been cultured, especially fish, crustaceans and molluscs and aquatic plants and algae. Aquaculture, the aquatic counterpart of agriculture, has grown rapidly in recent decades, and today it produces almost as much fish and shellfish as fisheries.<sup>2</sup>

It is, however, still a technology in its infancy. The first reviewed paper was released by Jim Rakocy (1981), with the onset of aquaponics attributed to Mark McMurtry from NC State University in the mid-eighties to early-nineties.<sup>3</sup> However, more systemic and regular research didn't occur until the early 2000s, with the release of a paper by Graber and Junge.<sup>4</sup>

In this integrated system there is a symbiotic relationship between fish and plants.<sup>5</sup> Publications on the sustainability of aquaponics<sup>6-11</sup> give a broad perspective on the technology and conclude that these systems can be sustainably managed only with a thorough knowledge of the fish, bacteria, and plant components on both an individual and systems level. The fish produces ammonia effluent, which is then converted to nitrites, then to nitrates. This process is done by nitrifying bacteria. After this step, the plants take up the nitrates which fertilises the plant. While this occurs, the plant purifies and filters the water which benefits the fish. This type of recirculation system is a very sustainable and environmentally friendly way to produce high quality fish and plants for the market. Using an aquaponic system is also more appealing for buyers due to no pesticides or artificial nutrients used. This system uses only 1/10<sup>th</sup> of the water used in soil-based farming

and fish are not being taken out of the wild, so it is sustainable for environment.

The method of aquaponics has been round for many years but has not been used as much as it should be due to it being sustainable for growing of fish and plants. During the past 5-10 years, Aquaponics has grown in size and popularity. Even though aquaponics has been around since the 70's, as an industry it is still in its infancy with the overall feasibility still not completely known. Due to this, the way aquaponics is perceived by potential customers and more widely, the public can often be misinformed or based on assumptions rather than fact.<sup>12,13</sup> While aquaponics is an incredibly promising technology for those involved in it, there is the chance that those without proper knowledge might be led to believe that produce obtained from aquaponics is dirty or of inferior quality in comparison to traditionally grown crops (Miličić et al. 2017).<sup>14</sup>

The aim of this survey was to obtain an everyday consumers opinion of aquaponics, if any, and how they perceive aquaponics regarding other sustainable systems such as organic produce and local produce and if or how it affects their purchases.

## Materials and methods

The survey was distributed by the study authors with the help of their students in October 2018 by using chain sampling method (Naderifar, et al., 2017)<sup>16</sup> to increase the number of respondents. This survey was conducted in Melbourne Metropolitan Areas in, Victoria, Australia to assess the market potential for aquaponic products by gathering data on consumer awareness, receptivity of aquaponic products, and their preferred information sources (n=75). The survey was conducted by questionnaire provided to the respondents. Inclusion criteria stated that all participants must be at least 18 years old and visit restaurants and grocery stores or both or have interest for aquaculture or any kind of farming but are not employed at either type of establishment. Each participant was first asked if he/she had ever heard the term "aquaponics,". Then all participants were read a definition of the term and asked a series of questions regarding aquaponics based on what they had just heard. Several questions used the format of choosing a rating of agreement, credibility, or level of interest to statements regarding aquaponics on a scale of 1 to 5, where 1 means strongly disagree and 5 means strongly agree.

The survey contained a cover page providing an explanation of the study and a consent question that needed to be answered before participants could begin the survey. To ensure the anonymity of the respondents, personal identifiers such as name, e-mail address, physical address, and organization name are not presented in any reports using these data.

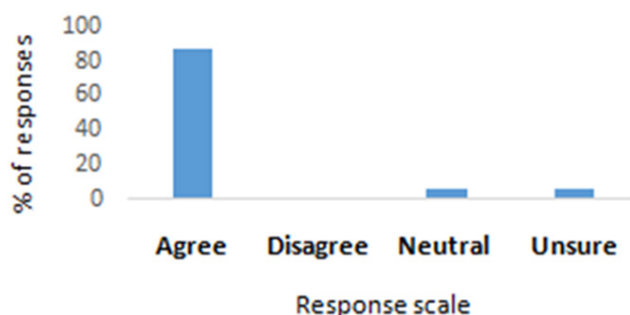
## Results

In this survey, total 75 consumers took part with varying demographic backgrounds including salesperson, businessperson, students, doctors etc. Gender of respondents was recorded, even though there was no question in the survey asking for this information. Respondents' gender was relatively evenly distributed between male and female.

Regarding the area of knowledge of aquaponics about 63% of respondents heard the term 'aquaponics'. Respondents had a generally positive attitude towards aquaponics with 87.5% agreeing that aquaponics is a safe and clean method of raising fish and growing vegetables simultaneously (Figure 1), and that it impacts the environment in a positive way (Figure 2). About 75% agreed that aquaponics grew products with a high nutritional value (Figure 3). In response to whether aquaponics is a humane method of raising fish, less than half agreed this was the case, with 43.75% of respondents agreeing with the statement, while the remainder were either neutral, or unsure. When it came to whether people would be interested in learning more about aquaponics, 50% indicated they would like to learn more, whereas 50% were neutral. Respondents had average to no knowledge of urban farming techniques, with the results relatively evenly split across the three lowest rated responses, and none recorded against anything above average.



**Figure 1** Aquaponics is a safe and clean method of raising fish and growing vegetables simultaneously.

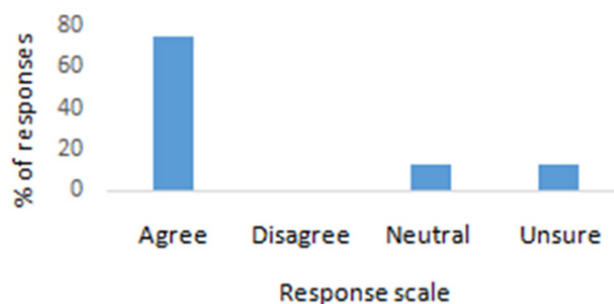


**Figure 2** Aquaponics operations impact the environment in a positive way.

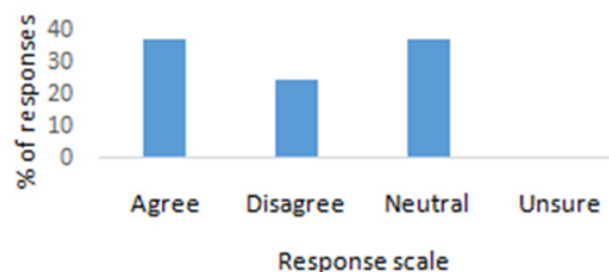
Question 5 had a slightly lower response rate of 87.5%, compared to the response rate of 100% of previous questions. The major response to the type of relevant knowledge was "Other", with a response of 57.14%, while agriculture had 21.43% of responses, followed by fisheries, biology and chemistry on an even 7.14%. In

response to whether they had any experience in practising agriculture, hydroponics, aquaculture or aquaponics, 87.5% answered negative, while interest in actually undertaking an aquaponics system was split 50/50.

In the second part of the survey, respondents were asked about their personal tendency to buy organic or locally produced produce. About 37.5% actively looked for ways to buy from local farmers, while 25% disagreed with the statement, and 37.5% were neutral (Figure 4).



**Figure 3** Aquaponics operations grow products with high nutritional value.



**Figure 4** Actively look for ways to buy from local farmers.

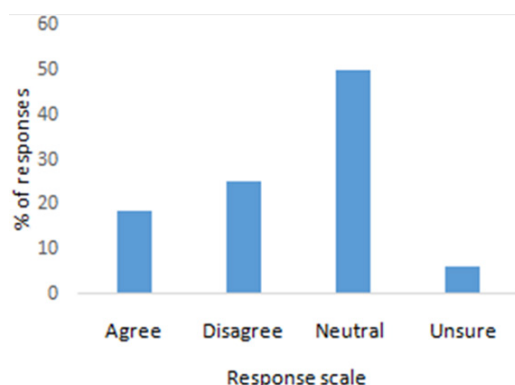
Price is a key motivator for buying food, with 43.75% indicating it was the most important factor. About 31.25% of respondents disagreed, while 25% neither agreed nor disagreed. Following this, 62.5% of surveyed people indicated that they would not be likely to purchase organic produce if it was twice as expensive as non-organic produce. About 25% indicated that they would, while 12.5% were neutral about this. There was a more even distribution of responses when it came to buying fish, and whether respondents were more inclined to pay more for organically produced fish. One third indicated they would be happy to pay more.

The final closed ended section of the survey centred on people's attitude towards aquaponics. The first question asked whether the respondent would be inclined to buy aquaponically grown vegetables next time they are out shopping for produce (Figure 5). Just over half (56.25%) were either neutral or unsure about whether they would. About 25% responded negative, while 18.75% indicated that they would buy. On indicating a preference between aquaponically-farmed, and conventionally farmed fish, one fourth of the respondents indicated that they would prefer to buy the former.

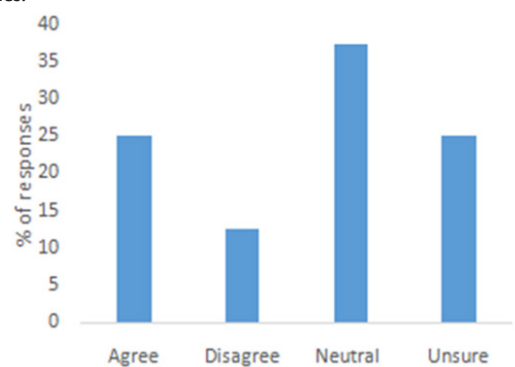
Ascertaining whether the fear around pesticides and herbicides was exaggerated, 56.25% of respondents didn't think so, 12.5% did, and 31.25% were either neutral or unsure. Returning to the impact of cost on produce, nearly half of the respondents indicated they would not choose aquaponically grown fish if it cost more, while only 12.5% said they would buy.

About 30% people did not answer these questions. Regarding the prospects of aquaponics technology in Australia some (40%) finds

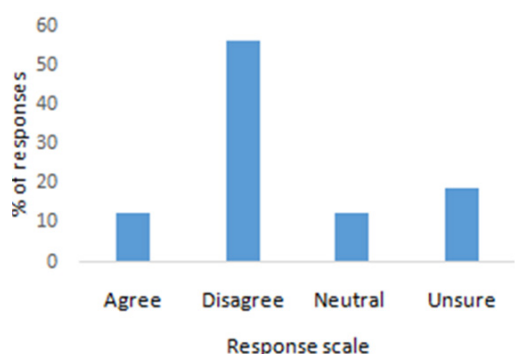
this as a sustainable farming with less water and land. Some considers aquaponics as alternative growing methods of the conventional farming techniques.



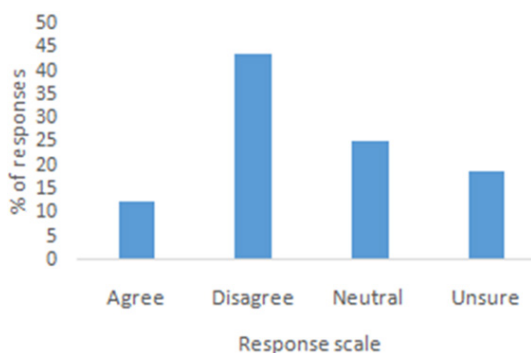
**Figure 5** Next time I will buy vegetables I will look for aquaponically grown vegetables.



**Figure 6** When deciding between conventionally farmed fish and aquaponically farmed fish I would choose aquaponic fish.



**Figure 7** Most of the scare about pesticides and herbicides is exaggerated.



**Figure 8** Choose aquaponics fish even if they would cost more.

The respondents mentioned different limitations of expanding aquaponics in Australia including lack of water, land cost and utility, insufficient funding, limited awareness and knowledge, consumers' ignorance and lack of proper education and so on. In addition, affordability would be a big factor in choosing products. Also there are concerns about the use of antibiotic in raising fish. As long as there are no chemicals used on the vegetables I would definitely buy. I only buy organic.

## Discussion

Based on the survey responses, it seems that consumers are generally aware of what aquaponics is, however for it to be properly compared to other farming techniques and allow consumers to make a more informed decision when it comes to purchasing produce, better information, more awareness and education are required.

Of those surveyed, more than half of the respondents said they had heard the term aquaponics and agreed that it is a safe and clean method of raising fish and growing vegetables, this response is higher than what has been found elsewhere (Love, et al. 2014, Tamin et al., 2015).<sup>13,16</sup>

In surveys conducted in America and Europe, just over 30% and 50% had heard the term aquaponics (Short et al. 20017 & Miličić et al. 2017).<sup>12,14</sup> Although the impact of aquaponics on the environment is less certain, Short et al. (2017) reported a positive trend of people's response to this issue while the sustainability of aquaponics is not guaranteed (Tyson et al. 2011).<sup>6</sup> The large majority of those surveyed believe the food grown is of a high nutrition value.

Aquaponic operations installed in urban areas can meet the demands of consumers and thus achieve premium prices, which in turn allow fast return on investment (Edwards, 2015).<sup>17</sup> People are aware that soil cultivation is not the only form of farming. In fact, in the verbatim responses people suggested that alternative forms of farming are required. Aquaponics is seen as a sustainable alternative, which better utilises resources, and is better suited to the unpredictability of climate change. Some respondents see aquaponics as a safe and clean method of growing vegetables, with the potential to impact the environment in a positive manner, without compromising on the nutritional value of the produce. Price might be a concern to many consumers as previous studies suggested (Narine et al., 2014; Savidov, 2004; Short et al., 2017).<sup>12,18,19</sup>

## Conclusion

Based on the responses of the survey, the public needed to be better educated on the technology, and its merits. In fact, based on the open-ended questions, a lack of knowledge is one of the major detractors of purchasing aquaponically grown produce. This correlates with the quantitative data, where the large number of responses that were in the positive, neutral, or unsure suggests there is no strong discussion against aquaponics, rather, people waiting for a reason to try it and be persuaded to. The perceptive challenges aquaponics face can be alleviated by properly informing the public. In an information age, people are well placed to find out as much information as possible before buying. Respondents are cautious of the dangers that herbicides and pesticides pose, and would be open to purchasing aquaponically grown produce, if it provided the benefits of organically grown food, however not at too steep a premium. At double cost, consumers would still opt for non-organically grown produce. However, to popularise aquaponics produce is no other way except using different forms of media to educate people about the technology.

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