

Ma Zhaotianyi Shijiazhuang Foreign
Language School Shijiazhuang, Hebei,
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Australia: Research and Countermeasures of Nuts' Health Value in Nut Industry

Chapter 1.Introduction

Food is essential to mankind. But there are still many people in some regions of the world suffering from hunger for various reasons. For some areas, food is surplus, but for other areas the food can be scarcely found. This phenomenon is also one of the reasons for the classifications of developed countries and developing countries.

Finding measures to tackle this problem efficiently has become a hot potato since it seems that growing food independently is no longer a suitable solution. From the author's view, growing cash crops is far more efficient than directly growing food crops. First of all, served as a staple food, food crops still have its dominant position. Secondly, besides being a supplementary food, cash crops also have their own value, which is generally greater than that of food crops (such as nutritional values). Besides, cash crops can not only create wealth (after equivalent exchange, it can be approximately equal to purchasing power and buy food crops), but also create research value.

Nuts, long regarded as food with high nutritional value, are not a staple food crop such as wheat and rice but a cash crop. Gradually with the improvement of people's living standards in many regions around the world and the development of economic globalization, more people began to grow, produce or buy products related to nuts. As a relative new industry, the nut industry still has some problems in planting and production, which will lead to the decline of nut quality, taste and the health value, even threaten people's health.

Nuts are fruit consisting of a seedcase and seeds. The seedcase is hard and does not crack when the nut gets ripe (indehiscent fruit). There is usually only one seed inside the fruit (a few have two) and the seed coat is separated from the seedcase. Nuts, which are generally rich in nutrients and contain high proteins, oil, minerals and vitamins, are the essential parts of plants. They play a positive role in the growth of human body, physical enhancement and disease prevention.

Studies have shown that eating tree nuts can lead to better cardiovascular health and reduce risk of obesity. Also, nuts such as walnuts have been shown to play a positive role in heart health and in reducing colorectal cancer. According to a new study from the University of Illinois ^[1], the way walnuts impact the gut microbiome -- the collection of trillions of microbes or bacteria in the gastrointestinal tract -- may be

behind some of those health benefits.

This thesis paper focuses on the topic of nuts producing in Australia and mainly deals with how all the components, from agricultural planting to commercial deep-processing, might affect the nutritional values of nuts along the planting and producing process. The paper also intends to illustrate what might be the rational and prospective solutions or policies to tackle the issues of biosecurity, genetic modification, water scarcity and processing.

Chapter 2. Country & Family

2.1. Facts about Australia and its Nut Industry

Australia, officially the Commonwealth of Australia, is the largest country in Oceania in the south hemisphere, comprising the mainland of the Australian continent, the island of Tasmania, and numerous smaller islands. The current population is 25,481,186 (based on Worldometer elaboration of the latest United Nation data, by June 9, 2020), of which 85.9% is highly urbanized. With the total land area of 7,682,300 km², approximately 136,000 agricultural businesses in Australia manage around 52% of the total land area^[2].

As for the world market scenario of the nut industry, Australia is getting in on the worldwide snacking boom with increasing walnuts and other nut supplies to satisfy health-conscious consumers.

2.2. An Australian Family

Prospecting the bright future and great potential of nut industry, many families in Australia began to develop nut planting as their own career. Thus, to better gain information about problems emerged in producing, the author of the thesis contacted and surveyed a typical family planting and selling walnuts in Leeton, which is a town in southern New South Wales, Australia.

The town is situated in one of the most productive farming regions in the state, where citrus, rice, cotton, grapes, walnuts and wheat farms can be found. With hot dry summers and cool winters, the town where the typical family located has a semi-arid climate (BSk). The typical family in the research mainly grows a walnut variety called Tulare, which is not the most popular one. The walnuts planted by the family are of 830 hectares, which flow mainly to the Chinese market.

Chapter 3. Challenges

3.1. Biosecurity

The biosecurity issues mainly focused on two points, pests and diseases. For tree crops like walnuts, Crown gall and black thread are two of the most serious bacterial diseases of roots and grafts. Once a tree has crown gall, it first reduces production and then causes the plant to die without cure. Phytophthora crown and root rot are two of the main causes of tree loss for most tree crops, including American almond.

Despite the biological risks when growing nut plants, the most recent video taken at local farms highlighted the importance of managing the biosecurity risks associated with people, equipment and vehicles, moving anything on or off a property, feral or wild animals and weeds ^[3].

3.2. Genetic Modification

The development and use of genetic modification are issues deeply concerned by Australian nut-growers. On the theoretical level, the Genetically Modified (also called as GM) grains are believed to tackle weeds and other pests. But on the political level, only when planting rapeseed and cotton do the local governments permit these kinds of technology being used and the product being put into the market. The untapped technique has made many farmers feel discontented.

3.3. Water Scarcity

3.3.1 Droughts & Bushfires

Many regions and growers are suffering from the recent bushfires. The bushfire issues have threatened a lot more nuts producers in the Australian bushfire season 2019–2020. According to media reports, over 18 million hectares of land have been burned and more than 5,900 buildings as well as agricultural facilities have been destroyed. The regrowth and recovery of scorched pasture and razed vineyards are likely to stretch water resources already challenged by drought. In some dryland areas (including Australia) in desertification, land surface air temperature and evapotranspiration increased while precipitation decreased ^[4].

Natural disasters, such as droughts and bushfires, have ineffective influence on water scarcity, however, information transparency and incompleteness in the mechanism of Australian water trade have also led to high cost in irrigating nut plants. Water systems can be divided into aboveground water and groundwater. In Australia, groundwater is a tradable national resource, and aboveground water is privately operated and managed.

3.3.2 Water Trade

The regions where many Australian farmers choose to grow nuts, many of which are located in Australia's vast inland, have tropical desert climate and subtropical steppe climate. Due to the climate conditions with less precipitation, agricultural irrigation in these areas mainly depends on the Great Artesian basin and the Murray-Darling Basin.

Water trade allows for the efficient redistribution of water and is an important mechanism for managing the Murray-Darling Basin's scarce water resources. There are two main types of water rights traded in the Basin entitlements and allocations. Water access entitlements are rights to an ongoing share of the total amount of water available in a system. Water allocations are the actual amount of water available under water access entitlements in a given season ^[5].

3.4. Processing

Processing procedure and the following international trade now are in the face of some harsh issues, to be specific, immature technologies, and unhealthy deep-processed products, etc.

During the processing, long shelving and storage time may lead to the breeding of aflatoxin, which is commonly found on objects that are easily affected by being damp. This mold is related to the process and quality of processing in the factory and can cause acute liver damage and cancers.

In addition, processed nut products such as dried fruit snacks usually apply food additives and condiments to gain an appealing taste, which may lead to excessive salt intake and related food safety problems caused by these additives.

3.5. Impacts

The previous challenges in perspectives of biosecurity, genetic modification, water scarcity and processing have affected the output and the quality of the nuts, which will presumably have an effect on the nutritional value of the nuts. On the downside, the ineffective control of pests and diseases will lead to the tree loss and subsequently, the nuts. Also, the ban of using genetic modification restrains the development and innovation in producing nuts. On the upside, the deep-processed nut-containing products have increased the demand for healthy products containing nuts and propelled the nut consumption market in the upcoming future.

Chapter4.Solutions & Recommendations

4.1. Biosecurity

The future of plant health in Australia is looking brighter with a new opportunity for international collaboration in research on pests and diseases which are common threats. To tackle the issue concerning the local farmers, many measures have been taken and programs have been launched respectively.

The present solutions include face-to-face meetings on topics of plant health or biosecurity, the experience accumulated by farmers through practicing on the field and newly designed programs.

Plant Biosecurity Research Initiative (PBRI) of Australia has just signed a memorandum of understanding with the European Phytosanitary Research and Coordination network (Euphresco), which signals the sharing of knowledge between countries on common threats to agriculture. In spite of international collaborations, Australia has also held Plant Health Australia (PHA) meetings in the nuts industry with great effort ^[6].

With the communication and collaboration nationally and internationally, various kinds of programs and organizations have been set up to conquer the biosecurity problems. *The Farm Biosecurity Program*, for an example, which is run by Plant Health Australia and Animal Health Australia, takes the advantage of digital platforms to give information to farmers in a large extent area across the nation. Through the program's website, practical advice and information to assist producers to implement biosecurity on-farm is available, including monthly videos (featuring producers who use simple steps to improve biosecurity in their activities on a daily basis), e-newsletter, biosecurity manuals and templates for records ^[3].

To improve the implementation process of the above measures, the author's suggestions are as follows. When inviting official organizations in the industry, such as the Australian Walnut Industry, farmers and scientists from different regions should also be invited, thus, the implementation and of the measures formulated for discussion can be used. As for practical on-farm practices, having the awareness of training staff, biosecurity planning and keeping records are relatively essential.

4.2. Genetic Modification

With grafting used as a genetic technique, the government should go out its way to advocate genetic extraction for research and comparison. Author of the present thesis advises the governments and scientists to compare the genotypes of rootstocks and their seedlings, and to develop some new genotypes that have been generated by scientific programs. For example, one of the current measures specific to walnuts is the Walnut Improvement Program at UC Davis ^[7]. Also, the problem of pests can be solved

by genetic research and experiments to grow new resistant trees.

4.3. Water Scarcity

Department of Agriculture, Water and the Environment is working across the Australian Government to support bushfire-affected primary producers, investing up to \$75,000 to help with the cost of clean-up, reinstatement and emergency measures. And for eligible primary producers as well as small businesses in drought and bushfire-affected areas, the governments now provide free financial counseling to help them understand their options and apply for support. In the *Commonwealth Basin Plan 2012*, all Basin States must comply with and rules in state water planning or water sharing instruments such as water allocation plans in South Australia and water sharing plans in New South Wales ^[5].

For these solutions, author of the present thesis suggests the government should pass regulations and laws, which would operate together to govern water trade in the southern-connected Murray-Darling Basin, reduce restrictions on trade, improve transparency and access to information and improve market confidence through a more effective water market.

4.4. Processing& International trade

Over the past few decades, the nut producing and trade have made great progress, with innovative products being put into the market. Plant-based dairy products made from nuts have targeted and expanded its market due to the rising awareness regarding health benefits of nuts among consumers. To be specific, nut milk with rich phytochemicals are appealing to those who suffer from lactose intolerance and who cannot intake full amount of protein. And nut cheese provides an option for vegetarian consumers who have an appetite for eating cheese. Moreover, nuts like walnuts are generally used in cookies, chocolates, and cakes.

However, some problems still remain, thus the author's suggestions are as follows. When processing, the factory should pay attention to the temperature and the humidity of the storage place and ventilate in time. About the highly processed food, the food producer should pay attention to the amount of additives and condiments being added, and research the products' nutritional composition structure in detail, and then make a diagram attached to the package of the product.

What's more, highly processed nut products should reach the preference of those health-conscious consumers through improving the taste and making full use of the nutrients of nuts. Some well-received product in China may have indications on solving

the issue. Producers can learn from Lulu, Six Walnuts and other beverage brands, innovating various food forms, such as nut cheese, nut yogurt, nut milk, etc., and then invest in markets that pursue health value of food (such as the UK, China, and the United States) to improve the competitiveness of Australian market.

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