

## Re-Thinking Organic Food and Farming in A Changing World

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**Abstract:** With a large population and a great demand for food production, China is known as the largest consumer of agricultural chemicals in the world. However, the excessive use of pesticides and other agricultural chemicals jeopardizes people's health, especially for children, and immediate measures are needed to promote agricultural sustainability and safety. Therefore, this paper aims to investigate how pesticide control reflects current producer and consumer patterns where local farmers are losing their competitiveness in the market in Guangdong province. In order to study this problem, multiple methods are adopted, including online research, data survey, field research and experiment. Two surveys are carried out, which are targeted at consumers' shopping habits and preferences for food respectively. Apart from this, local farmers from Ping Shan are also interviewed to study the demand for food produced by small local farmers as well as the use of pesticides in their products.

### 1. Introduction

China has long been considered the world's largest consumer of agricultural chemicals, using more than 30% of global fertilizers and pesticides on only 9% of the world's cropland (Hannink, 2018). Being one of the most populous countries, there is a strong incentive to produce more to feed the massive population. An overuse in agricultural chemicals results from this desire to increase yields, of which the problem is exacerbated through the economic challenges faced by small farmers who have no choice but to choose profit over health (Chen, 2020), leading to severe local, regional, and global consequences including non-point source pollution, eutrophication, and human health hazards. Serious pesticide pollution has been documented in almost all of China's major rivers, and chemical contamination of groundwater has led to severe health risks that put the local population at stake. The environment is also heavily impacted, where entire ecosystems can be destroyed.

The Chinese government has taken steps to alleviate excessive and unsustainable pesticide use, for example, the 2015 "zero-growth" action plan, yet they weren't entirely successful as seen with persisting pesticide overuse. This can be attributed to complex factors that were ignored in this policy implementation, including the cost problem for local farmers when substituting to a more chemical-free approach, the industrializing agriculture sector that aggravates the cost problem by eliminating local farmers' opportunities in the market, and lack of accurate understanding of agricultural chemicals in both the consumers and the producers.

Given the severity of the issue, immediate and integrative steps should be taken to promote sustainability and safety of agriculture in China, especially when the public is growing ignorant towards pesticide harm that jeopardizes their health and their environment. This paper attempts to examine how pesticide control reflects current producer and consumer patterns where

local farmers are becoming less competitive in the market of Guangdong province. Seeing that there was relatively low demand for local food markets, we first hypothesized that the laxer regulations and implementation of regulations for pesticides result in this decreased demand. Literature Review

Excessive pesticide consumption is detrimental to health, with risks such as sterility, genetic change, nerve disorders, asthma, depression, anxiety, unbalanced hormones, thyroid tumors, and decreased sports ability. More severe consequences include: seizures, change in heart rate, and sometimes even coma and death (Curejoy, 2018). Consumption at the older age increases risk of

diseases such as cancer, Parkinson's, and Alzheimer's. (Hilal Elver, 2017) The chemical principle that leads to this issue could either be due to the highly reactive substances in the pesticide that destroys our body chemical configuration or insoluble chemicals that block and cease the biological function of the human body (such as respiration circulation and emission of hormones) (Curejoy, 2018).

Children are often exposed to pesticides through external exposure or inhale. According to NPIC, the National Pesticide Information Center, the principle that pesticides cause more harm to children than adults is primarily due to their physical body features; the children are still developing their bodies, and their respiration has a higher frequency than adults. These conditions make children have more sensitive reactions and responses to pesticides because they require more food to eat, raising the possibility for children to be exposed to pesticides. (NPIC,2019) Further harms include causing low birth weight, preterm birth, childhood cancer, asthma, ADHD, autism, cognitive deficits, and lower IQ (Catherine J. Karr, MD, PhD., 2012).

In February 2015, the Chinese government adopted the “zero-growth” action plan of reducing fertilizer and pesticide use by 2020. As the name suggests, China was aiming to reduce the growth of agricultural chemical usage to zero through promoting safe-use alternatives, increased testing, stricter regulations, and unified control; yet, illegal pesticides are still being used (Pan, 2020), and pesticide export volume increased by 28.77% after Covid-19 (“China’s Pesticide”, 2020). Farmer’s misuse of pesticides can be evidently seen through multiple news reports. For instance, in 2018, Longhu Town, Xinzheng City, Henan Province, a local food market was tested and penalized for exceeding the national pesticide residue standards (RenMingRiBao). To specify, they were fined 51000 yuan, and it demonstrates the severity of the pesticide misuse with the local farmers.

Further evidence also proves that China's more popular supermarkets are tested to have exceeded the national pesticide residue standards, namely, Walmart and Yong Hui in China. In 119 samplings conducted in the Jia Le Fu market, 10% of the food has exceeded pesticide remains that do not meet the standard. All of these contain banned pesticides, and 66.67% of them contain ten or more kinds of pesticides remains on them. This result illustrates that pesticides are indeed something to consider in consumption of produce (GreenPeace, 2016).

Despite making some progress, this action fell short as there was a complex mix of factors that were not taken into account; both the producers and consumers are fundamental when tackling the problem. Small farmers are the pillars of China’s agriculture, with more than 90 percent of all farms being less than 2.5 acres. Studies have shown that these small farms strongly affect agricultural chemicals' use and intensity, therefore making them the key contributors (Chen, 2019). Reducing the use of these chemicals has proven too expensive to sustain, especially when China’s shifting to a more industrialized agriculture (national geographic), causing small farmers to be outcompeted in the agricultural industry. Small farmers also have insufficient knowledge about agricultural chemical application, making them dependent on information from profit-driven pesticide dealers and traditional thinking of ‘the- more-the-better’ (Jin, 2018). Furthermore, there were demonstrations of consumers lacking trust in so-called organic food due to fixed but inaccurate ideas about organic products, including appearances, leading to high doubts when organic produce does not fit their expectations (Chen, 2019).

Pesticides, at their core, are designed to benefit the crops of farmers, resulting in less crop infections and decay, more yield for the farmer, which results in a lower price of food for all consumers. Pesticides are considered a necessity in many farmlands, and appropriate use of pesticides and its alternatives are the key to stopping many devastating food shortages and to maintain food security for all (Pesticidefacts).

However, it is not clear if consumers would pay more attention to the aesthetics of the product or the number of agricultural pollutants on the food. Every year, tons of safe fruits and vegetables are discarded because of their aesthetics (Suher et. al, 2017), which raises concerns about if consumers are mostly concerned about aesthetics when purchasing foods.

## 2. Methodology

The research methods we used are online research, data survey, field research, and experiment. Online research is useful to gather data due to accessibility of resources. Websites from various countries that promote “Eat Local” were taken into consideration and data regarding the national standard set by the government on pesticide was found. It renewed the perception of the presence and effects of harming pollutants in food. Some unique data could be retrieved through academic articles written by scientists. However, a flaw in conducting online research is the availability of data. Many of the data (such malicious hiding of overuse of pesticide from big corporations) cannot be retrieved, due to sensitivity. Therefore, it is essential to have other research methods.

Two data surveys were made through Tencent Questionnaire. The surveys were distributed to consumers through Wechat and received a total of 330 responses. Several questions in the first survey were about understanding the consumer’s habits in order to confirm whether local markets are being replaced by online platforms or large shopping centers. Other questions include inquiring consumer preferences for food (whether they rank hygiene, cost, taste, brand first), to demonstrate their view on the importance of food safety and whether they have taken pesticide and heavy metals concentration into account. From this survey, the consumer’s inclination to purchase either imported or local goods can be found. This survey was randomly distributed to groups of people including teachers, students and parents, who are all readily purchase food. Through enabling access to consumer location while they are answering the questions, it can be used to use to find out whether these results differ in distinct geographical regions. The second survey was made to test people’s knowledge on the extent to which pesticides and heavy metals can damage the body. These two surveys are effective because they are reliable and reflect consumer preferences and knowledge.

The field research was conducted by interviewing the farmers at PingShan. PingShan, as compared to Futian district or Nanshan district, is regarded as rural place in ShenZhen and many traditional markets exist. In PingShan, local farmers were interviewed at two distinct markets.

The first place was the PingShan Old Market. There were local people selling fresh vegetables, meat and fruits which is beneficial because the diversity of food more accurately contributes to data collection. Each of the people interviewed have an average of 10 years’ experience of selling at the market, and many are family businesses which indicates that there is access to information from the past and present. During our interview, we asked them to introduce their products, along with questioning them whether they are informed of the presence of food pollutants like pesticides. Also, we tried to understand if their businesses were affected by COVID, along with knowing their consumer types. We also wanted to evaluate the extent in which the farmers were interested in joining online platforms to boost their sales. The purpose of interviewing both the old market and new market is to see if there are any differences in the selling strategies, the number of customers and whether they shared similar interview responses. This field research differs from online research in ways including exposure to new knowledge and getting access to first hand resource. It is difficult to locate the various producers through Wechat, therefore there is a necessity to conduct field research. The field research exposed what the local markets were like and how those markets maintained the traditional method of sale.

Moreover, through interviewing and understanding the farmer’s stance on online platforms, the reasons why local farmers were reluctant to establish online marketing can be addressed, where solutions can be formulated to solve the problem for local markets.

Finally, with access to own resources, a scientific experiment investigating soil content was conducted. There was access to a science lab with the assistance of HuaBao Tech Institute, and along with other scientists, the soil content was investigated. This is crucial because through the scientific data, the exact concentration of pesticides and heavy metals are determined. The experiment report included PH value, heavy metals concentration and common chemicals found in pesticides. Combined with prior knowledge learned in AP Human Geography and Environmental Science about farming and soil content, these data are applicable. The high or low concentration of those food pollutants will yield

helpful results to determine how harmful the products are, and help gain a clearer understanding of the status quo.

Overall, data is incorporated from the various stakeholders involved. Multiple perspectives were covered, including those from the consumers, producer and environmental perspective. Therefore, the research method is detailed, and results are accurate.

### 3. Research Findings and Analysis

Two surveys were conducted regarding consumer preferences about food. In the first survey, 80 responses were gathered to six questions.

Question one asks about where people purchase their food: whether in big supermarkets, local markets, online platforms, elsewhere, or some combination of those. Most (approximately 59%) usually purchase their food in large supermarkets, whereas only 41% chose to purchase food from local markets.

This shows that current consumer trends favor shopping in supermarkets and online platforms as opposed to local markets, and the popularity of local markets (a place where people bought their food in the past) is waning and giving way to more contemporary platforms.

The second question asks consumers to list which factors are the most important when purchasing food; the options include: sanitation, taste, brand, price, transportation, and appearance of food. The highest ranked quality was sanitation with 32.5% of the consumers classify it as most important for choosing what food to buy. On the other hand, the appearance of the food appears least important with more than half of the people (58.8%) ranking it last.

Table 1. Shopping statistics table

Factor/Ranking	AverageRanking	1	2	3	4	5	6
Cleanliness	2.225	26	18	30	4	2	0
Taste	2.4	20	33	10	10	6	1
Brand	3.5125	11	9	13	28	13	6
Cost	3.525	19	9	12	10	11	19
Convenience	4.35	2	4	10	19	38	7
Aesthetics	4.9875	2	7	5	9	10	47

The third question asks about how important agricultural pollutant concentrations are when purchasing food, and asked respondents to respond on a scale of one to ten, with ten being the most important. More than fifty people considered agricultural pollutant concentrations to be of relative importance ( $\geq 8$ ). It is noted here that there was a mistake involved in the making of the survey, where it was not made clear whether one, or ten, was the “most important” rating. Such discrepancy may explain the sudden peak at 1. The result is that most people, at least 62.5% of people surveyed, believe that pesticidal concentrations are relatively important when they consider buying food.

Results from question three correlates with responses from question six, which asks about if people take pesticidal and pollutant concentrations into account when shopping. 68.8% of people, slightly greater than the 62.5% in question 3, responded that they do take pesticidal and pollutant concentrations into account when shopping. The insight gained here is that about 70% of the population care about pesticidal and pollutant concentrations when purchasing food, and the purchasing choices of these people will be influenced by the number of agricultural pollutants in their food, amongst other factors. Something more alarming is that 30% of the population do not take agricultural pollutant concentrations into consideration when purchasing food.

Question number four asked about if people prefer local or imported food. 66.2% of respondents indicated a preference for local foods.

Question number five inquired about the awareness of consumers of the possibility of their food being grown in a contaminated environment. 35.1% of people think that their food is

grown in a contaminated environment, 27.3% of people think it is not, and 37.7% of people have not given thought about it. This echoes with

The about 30% of people who do not consider pesticidal contents when purchasing food.

A conflict arises when the data is analyzed. Most people, according to our survey, care about pesticidal and pollutant

#### **4. Do you think that your food is grown in a contaminated environment?**

Concentrations in their food. A consistent pattern is that 60-70% of the people rate it as an important consideration when purchasing food, while the other 40-30% do not care or do not know about pesticidal and pollutant waste in their food. According to the first question, more people shop in bigger supermarkets and online platforms than local markets, where pesticidal and pollutant concentrations are a serious problem for some produce (2016 Investigation of Pesticide Residues in Vegetables in Six Supermarkets). Furthermore, people expressed a preference for locally grown food, yet only 41% indicated that they shop at local food markets. This may be because when confronted directly, people will say that they know and care about the effects of agricultural pollutants and farming pollutants, but in the real world, people are still being deceived by the packaging and environment of many big supermarkets. Another possible explanation is that people are simply not aware of the fact that big supermarkets also contain agricultural pollutants, or that people have a stereotypical view that local markets contain more agricultural pollutants than bigger supermarkets.

Moreover, around 30-40% of the population do not even care or know about agricultural pollutants when purchasing food, putting themselves at risk to the adverse effects of long-term exposure to agricultural pollutants.

The second survey investigated further into how much people know about the harm of agricultural pollutants, specifically pesticidal and heavy metal residue on fresh produce. There were 250 responses.

Questions number one and four asked respondents how much they know about the harm of pesticidal and heavy metal residue to the human body. All respondents expect one responded that both pesticidal and heavy metal residue are harmful to the human body, but about 90% responded that they were not aware or fully aware of how pesticidal or heavy metal residue caused harm to the human body. More than 35% of respondents were only aware that pesticidal and heavy metal residue causes harm, but knew little more than that. The role of pesticides and the acquisition of heavy metal pollutants in the environment is a drastically more niched topic than simply harmful or harmless, as pesticides are crucial in agriculture and heavy metals are naturally present in the environment and are a byproduct of industry. Both are harmless in certain quantities and only become harmful past a certain dose, and different pesticides and metals have different effects on the body.

The second question inquired people as to how they prepare their fresh produce. The options were: rinse/soak in water, rinse/soak in vinegar, rinse/soak in saltwater, or other. An overwhelming percentage (82.4%) would rinse/soak in water and 32.8% of people would

rinse/soak in saltwater and only 2% of people used vinegar. Thus, at least 47.6% of people only use clean water to rinse/soak their fresh produce. While if done diligently (such as looking out for crevices and scrubbing), washing with clean water is able to remove 70-80% of pesticidal residue, saltwater and vinegar mixtures are much more effective in removing pesticidal residue, but are not able to remove pesticidal residue completely (Hills, Furthermore, anecdotal evidence suggests that most people simply rinse or soak their produce, reducing the amount of pesticidal residue that is removed.

The third question echoes the third question in the first survey, and asks people to rate how important food safety is. Most responded that it is very important (people typed in their responses).

The fifth question is about whether or not people think that their produce will still contain agricultural pollutants residue after washing. Around 70% of respondents correctly responded that there will still be residue after washing. Some responses were timid, saying that maybe there will/will not be residue left, signifying uncertainty about this topic. On the other hand, around 30% of people think that thorough cleaning is enough to remove all pesticidal residue. There is always a chance that after cleaning that pesticidal residue remains on the surface or has already sunk into the produce (Hills, Furthermore, heavy metal residue remains inside plant (as heavy metals are brought into the

plant through water), and cleaning the surface will not remove them. Unless the fresh produce is grown in a clean, organic setting, there are no guarantees that it will not contain harmful residues.

The sixth question is about whether or not people pay attention to pesticidal and heavy metal residue in the food they buy. 43.6% of people said they do not pay attention to the pesticidal and heavy metal residue in the food they buy, while the rest say that they do.

In our interview with the local producers in the old market in Ping Shan, our questions mainly focused on their products, the demand for food produced by smaller local farmers, as well as the use of insecticides in the products. Six producers have been interviewed, and some answers are considered useful to our topic.

The first question is asking them to introduce their products. All the answers are fresh produce, some examples are celery, green vegetables, cherry, and cantaloupe.

The second question inquiries about the access to food, whether they grow it themselves or on a wholesale basis. Five out of six mentions that their items come in from the wholesale market, and one person gave the response that he obtains his products from a rural farming area.

With an average of ten years of operation in the market, they were asked that if their business is affected by COVID. All respondents said the outbreak had an undesirable impact on their business. Due to COVID, people's incomes are negatively affected, and people are afraid of going out because of safety reasons, which causes the demand of buying food in the small local markets to decline, and strengthens the trend towards online markets. The epidemic has increased the number of people shopping online; by the time people find out the convenience of

using online platforms, this will gradually become a habit; even after the epidemic is over, people will still buy food online. Consequently, local markets have fewer customers, resulting in reduced incomes and some financial burdens.

Apart from that, the questions related to the online sales platform were also asked. All interviewees were asked whether they had joined the online sales platform and whether they sold through any online marketing channels. The answers were quite consistent, none of them have joined an online platform or sold their products online. A few of them didn't even think of making use of such methods at all. One of the interviewees pointed out that the old people account for a large proportion of the customers, while the old people are not good at using online platforms because they are complicated, as a result, it is not necessary for them to do it online.

Nevertheless, it is from the side that indicates their lack of young customers, which are the consumers of the future and vital for business to continue. The lack of an online platform to sell their products is a major reason why these local farmers are not capturing a younger market.

In the time featured by varied lifestyles, it is well known that the Internet is dominating our world, and the reality that online shopping becomes the mainstream among young people is perceptible. To keep up with the changes and trends of the times, the service industries need to be flexible enough to make changes as they detect business opportunities. Business models have changed dramatically in the context of the Internet, from real to virtual. One interviewee mentioned that she is willing to use different ways as long as she can earn money, Profit is always a priority. To a certain degree, if these local producers want to make more money, to join the online selling market can be a wise choice. Since it allows them to have more demand and consumers. In the face of a large number of people's demands, opening a new sales channel will undoubtedly increase their profits, thus reducing economic pressure. This is one of the solutions to the declined demand of the old market.

The question of pesticide content in fruits and vegetables was also raised. While it is necessary to use pesticides in fresh produce, some of the respondents reckoned that after washing, the fruits and vegetables are clean and free of pesticide residues. However, according to our experiences and knowledge, washing does not remove the insecticides completely. This demonstrates an ignorance towards pesticides and other pollutants on the produce that they are selling, and they pass on that ignorance to the consumers. Moreover, one vendor mentioned that she has no idea about the pesticides inside her products, which reveals the issue of ignorance of the usage of pesticides.

From the interviews in Ping Shan with local farmers and vendors, we can conclude that local farmers are facing a decreased demand, and that some producers, just like some consumers, are

ignorant about the agricultural pollutants in their products. Combining results and conclusions from both surveys and the interview, multiple larger conclusions can be constructed.

Firstly, people are transferring more and more of their food shopping online, as supported by question one of survey #1, which shows the growing prevalence of online platforms, which were unheard of years ago. This trend, and the growing demand for imported foodstuffs of the growing well-off middle class (Connect Americas), are likely to negatively impact demand for local markets. Furthermore, the COVID lockdown and subsequent fear surrounding outdoors have prompted many to transfer shopping online, and most major supermarkets now have online stores, where it is more convenient for customers to purchase food. All of these factors combined, have led to a decrease in the demand of local farmers, who have reported lower demand but have not begun the transition toward online markets. However, our hypothesis is not supported by our data. While we do not have data surrounding pesticidal and heavy metal residue in fresh produce in local markets, many major supermarkets, where more than half of the people surveyed in survey one shop in, have been reported of excessive residues on fresh produce not up to safety standards. Furthermore, food in supermarkets might be more focused on packaging and aesthetics in order to attract more customers, and to appear cleaner to customers, thus satisfying consumer preferences for cleanliness of food. Furthermore, around 40% of the people surveyed in both survey one and two are unaware or do not pay attention to agricultural pollutant residue in their food, which means that stricter pesticidal control does not matter to these 40% of people, and thus cannot explain the increased demand in supermarkets.

Something outside of our hypothesis but is, in the author's opinion, a societal problem is the general lack of understanding of agricultural pollutant residue. Some do not understand it completely, while others are unaware or choose to not bother. According to both our surveys, about 40% of people fall into this category. Producers and vendors are also unaware of such problems in their foods. Some speculate that food is clean after washing, and they also have an incentive to put profit over health. Food being something so close to our daily lives and health, the fact that four out of ten people are unaware or choose to be unaware of the potential harms of agricultural pollutants, and the misconceptions surrounding agricultural pollutants in producers coupled with the incentive to put profit over health, is a problem more prevalent and bigger than the lowered demand of food in local markets.

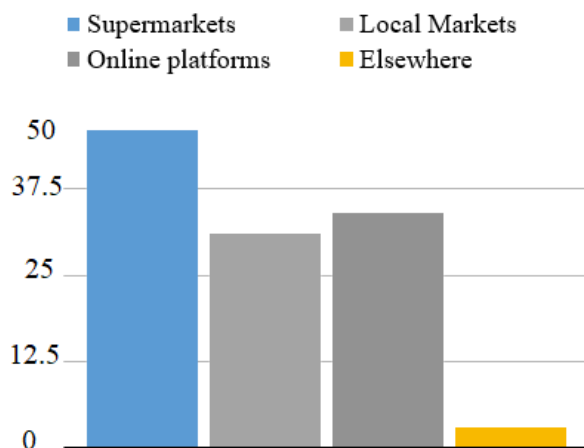


Fig.1 Where do people usually shop

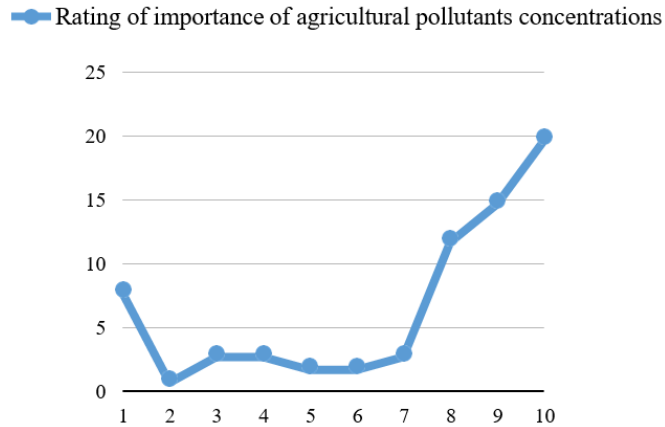


Fig.2 Rating of importance of guttural putts concentrations

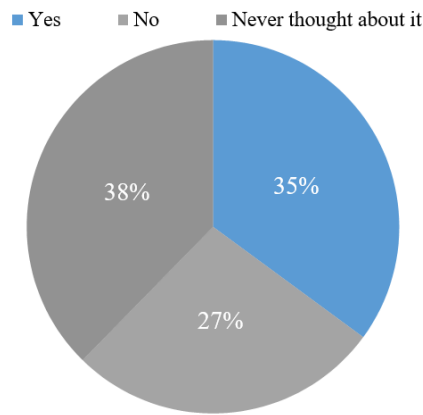


Fig.3 Do you think that your food is grown in a contaminated environment?

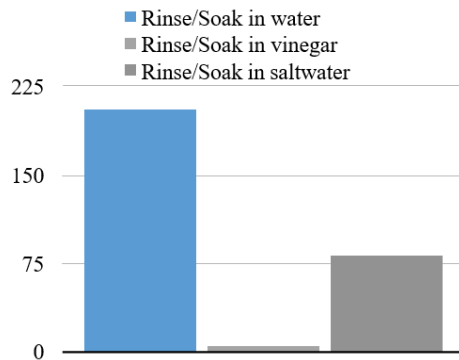


Fig.4. How do people clean their food

## 5. Conclusion

The research finding based on empirical and anecdotal evidence suggests that first, people are ignorant of the harm caused by pesticides and heavy metals. Both producers and consumers do not know the appropriate way of preventing food pollutants from damaging the body, and they are unaware of the severity of the problem. These results are obtained through the interview, online survey, and experiment. Second, consumer demand for food products sold in local markets is gradually being replaced by large supermarkets and online platforms. This result is obtained through an online survey.

However, the bias for our results includes the online survey may not be totally accurate. The reason is that of the small number of people surveyed, and most of the people who did the survey were from Shenzhen; therefore, it would not be the best representation of data for the entire Guangdong Province.



In addition, the interviews we did were only on six local farmers located in PingShan. Ideally, it would be better if more interviewees could be located in different geographical regions. If we were to do this project again, we would work harder on distributing the surveys. If more time were allowed, our group would travel to other distinct places around Guangdong Province, and not just the rural areas in Shenzhen. Also, we would go to different shopping centers in Guangdong Province and record the pesticide content limit for food in markets to compare the different results.

A proposed explanation for consumers for not considering pesticide content when buying food includes their lack of knowledge on the harms caused by pesticides. However, other explanations also tie to their ignorance and their reluctance. For example, the consumers might not care about pesticide concentration because they do not realize the immediate destruction, and they might be unwilling to check because they are too lazy or do not care.

If our team had more time, we would go to interview more local farmers around Guangdong Province. We would also measure more samples of soil content to find out in which districts of Guangdong are the most detrimental soil contents.

The questions that remain to be answered include whether the current consumer preference for purchasing food from large supermarkets compared to local traditional markets fluctuated with time. We need to figure out the consumer preference for shopping in the past, compared with their current preference. This can validate whether local markets are gradually being replaced (because our current results show that local markets are less popular but do not show the change in the trend based on time). Another question which remains to be answered is the average amount of local products in large supermarkets. We are uncertain whether the vegetables sold in large supermarkets include those from traditional farmers, and if so, how much profit the farmers obtain when compared with direct selling food at local markets.

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