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Environmental and Health Impact of Agriculture Chemicals: Paraguat, Chlorpyrifos and Glyphosate in Thailand

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ABSTRACT

Nowadays, Paraquat and Chlorpyrifos are banned in Thailand and there is a limit on the use of Glyphosate in the country by the government to control the use of these toxic chemicals. These are some of the most commonly used agricultural pesticides. Even though, the chemicals are beneficial for the plants but they are not so much for the health of the farmers and people involved in the production and execution of the chemicals. Thailand is a very progressive agricultural country and there is a huge chunk of the whole population that is related with the agricultural industry. Agriculturing provides a lot of financial benefits to the country through its import and export throughout the year. To maintain the quality of all the plants and crops, the use of chemicals has become more frequent and prominent in Thailand. Vegetables like Chinese cabbage, collards, basil leaves, red chili and cabbage respectively have a high amount of pesticide residue. Similarly, fruits like Tangerine, rose apple, guava, grape and papaya respectively also have the remains of these toxic pesticides. Using organic vegetables and fruits is highly recommended because they are safe from chemicals and pesticides. Harmful agricultural chemicals also effect human health in several ways: skin irritation, nausea, abdominal pain, diarrhea, brain damage, negative impact on pregnant women and coma/death. In the country, 73% are aware of the effects of pesticides on human health which is a positive indicator that more people will try to control the use of these chemicals. The government of Thailand is also performing its job very effectively regarding the regulation of pesticides in the country, that is why most of the people in the country are satisfied with the laws and regularity of toxic agriculture chemicals in Thailand.

Key words : *Agriculture Chemicals, Paraquat, Chlorpyrifos, Glyphosate*

Introduction

There are currently around 7 million farm households in Thailand and most of these farms are operated by uneducated farmers and laymen. Due to no formal education and former experience the use of toxic agriculture chemicals is regularly done by the farmers. This misuse of chemicals can lead to poisoning known as agrochemical poisoning, which is one of the primary causes of deaths and diseases among people in the world (Aggarwal, 2006). Even in farms that are controlled by public organizations, the use of these chemicals is encouraged and they are not seen as a potential threat. During the rainy season, there is an evident increase in farming activities and in Thailand the season of rain is present almost throughout the year. Therefore, there is no halt in the farming operations and in the flow of agriculture chemicals used in the process of farming and growing crops and fields. The reason behind the dominant use of pesticides in Thailand is the huge number of insects posing a major threat to the crops.

Thailand has suffered a 50% loss of crops and farm products due to insects attacking and destroying the fields, in the past. To prevent such losses the agricultural chemicals are used in the industry. One of the most harmful chemicals, Paraquat is the one most commonly used in Thailand. It has numerous adverse effects on human health. It can cause skin problem known as dermal absorption and it can also lead to fetal deaths (Konthonbut *et al.,* 2018). Paraquat can enter the body by three different means: inhalation, ingestion and physical skin contact. That is why it is the most toxic agricultural chemical. Another chemical that is widely used in Thailand in the agriculture industry is chlorpyrifos. Despite having a number of harmful effects on health, chlorpyrifos is used all over the world to protect the crops against the pests. This toxic chemical can increase the risk of tumor and as well as breast cancer (Ventura *et al.,* 2019). People using this chemical can get exposed to it by the same means as Paraquat. The combination of chlorpyrifos and paraquat can also cause Parkinson's disease (Freire *et al.,* 2012). Glyphosate is another herbicide that is used in Thailand to fight against the pests. Just like chlorpyrifos, it can also increase the risk of breast cancer by catalyzing the growth of breast cancer cells in the body at a steady rate (Thongprakaisang *et al.,* 2013). It can also cause liver disease and reproductive issues. Despite such toxicity, this herbicide is commonly used in agricultural industry. All the above mentioned three agricultural chemicals are used dominantly in Thailand to increase the crop production and export. These chemicals have helped in increasing the agricultural export of Thailand, but it is slowly and painfully deteriorating the health and lives of the farmers and the people involved with these toxic chemicals. Almost all the agricultural chemicals that are used in Thailand are imported from various countries. It was deduced that 33% of the imported chemicals lie under the dangerous category of WHO (Tawatsin *et al*., 2015). With this figure it can be safely hypothesized that the imported herbicides, pesticides and other agricultural chemicals are not supervised or regulated. Proper measures must be taken immediately by the governing authorities of Thailand to monitor the agricultural chemicals otherwise these toxic substances will continue to cause harm and terrible health issues. The financial benefits caused by the agricultural chemicals must be ignored because the disadvantages associated with their use clearly overshadow all the benefits.

Materials and Methods

The survey was carried out in 10 provinces of Thailand to monitor the effect of pesticides on environment and human health. The surveyed provinces were: Bangkok, Pathum Thani, Ratchaburi, Rayong, Chanthaburi, Chiang Mai, Chiang Rai, Udonthani, Sakaeo and Songkhla. 6 kinds of vegetables and fruits were tested and 20 samples of each kind were taken for the study. In total, 120 samples of vegetables and 120 samples of fruits were tested, with 12 samples from every province. For the detection of pesticides residue in the collected vegetables and fruits, the GPO TM kit test was carried out. This test is used to detect the presence of two pesticides: Organophosphate and carbamate. In 2020, the population of Thailand is around 64.5 million; For questions and opinions, 400 people were interviewed during the research. Yamane formula was implemented to yield out the sample size for the survey at the confidence level of 95% and the tolerance level of 5% as assumed (Yamane., 1967). All the interviews were carried out with the people present in the surveyed markets. The farmers and/or agriculturalists were asked that, whether they are aware of the negative effects of pesticides or not. They were also asked to give their opinion on the performance of the government controlling pesticides and harmful agricultural chemicals. A conclusion was made from a generalization based on the responses.

Results and Discussion

Table 1 and 2 present the risks of pesticide residue in vegetables and fruits. Next, table 3 shows the harmful health effects of pesticides. In table 4 and 5 the awareness of people and people's opinion on the regularity of pesticides in the country is showcased.

The five tables below present and depict the results calculated from the research.

Table 1 shows 6 kinds of vegetables from last year that are most vulnerable to the risk of pesticide residue. Many vegetables were tested,but only those were selected which had the most pesticide residue. In almost all the vegetables, organophosphate compounds (Ops) were found but Paraguat and Chlorpyrifos were not found because of the ban from the government. Chinese cabbage is at the most risk with 42 % of getting affected by pesticide

Table 1. Risk of Pesticide Residues in Vegetables

Vegetables	Percent
Chinese Cabbage	42
Basil Collards	40
Cow-pea Basil	36
Collards Chili	28
Cabbage	26

residue. These cabbages are available in large quantities all over Thailand because of their dominant use in Thai food. The reason Chinese cabbage is at the top of the list is that these cabbages get infected by pesticides and other bacterium in warm and moist conditions. And Thailand's climate is mostly warm and moist due to frequent rains which catalyzes the growth of pesticides residues. The second at the list is Basil collard with 40 %. Basil collards are extremely popular in Thailand because they are used in almost every dish in the country, that's why they are cropped at huge amounts by every farmer. Large quantity and lush green color of the collards attracts a lot of pests which increases the risk of pesticides residues. The third on the list is Cow-pea basil with 36% which is another item which is commonly used in Thai dishes and cropped by many farms all over the country. The last two vegetables are collards chili and cabbage with 28% and 26% risk of pesticides residue. All the above vegetables are most prone to the danger of pesticides in the country.

Table 2. Risk of Pesticide Residues in Fruits

Fruits	Percent
Tangerine or Orange	48
Rose Apple	44
Guava	38
Grape	38
Papaya	28

Not only vegetables, but fruits are also damaged by pesticides residue. Table 2 depicts some of the major fruits that are on heavy risk of pesticides. Orange/tangerine is leading the list with 48% of risk of pesticide residue. Many farmers use pesticides on oranges to prevent getting mold on them and in doing so a lot of pesticide residue is left on the orange peels. The residue does not only get on the peels but it also spreads to the inside of the orange. That is why orange is at the most risk. Rose apple is at the second position with 44%. Apples get easily rotten, that is why farmers use pesticides to inhibit the rotting process. This causes a lot of pesticide residue to damage and infect the apples. Guavas and grapes come next with 38% on the table. Lastly, papaya is at 28% risk of getting affected by pesticide residue. Papaya has a strong outer layer which lessens the effects of pesticide residue to some extent.

Table 3 showcases the various effects on human health of harmful agricultural chemicals and pesticides. There are some immediate and long-term effects of pesticides on human health. Some effects that can occur immediately when contacted with pesticides are skin irritation, nausea, abdominal pain, diarrhea, vomiting and hypotension. Not all effects occur immediately, some take long time before they harm the human body. Pesticides can eventually cause brain damage if a person is constantly in contact with them. Harmful chemicals can also increase the risk of Parkinson's disease. They can also have damaging impact on pregnant women. High dosage of pesticides can lead to coma and death. Some people even use pesticides to commit suicides. Skin infection or impetigo is at the top of the table as 88% of affected persons will get it in case of contact with pesticides. Squeamish, nausea, vomiting, abdominal pain and diarrhea are situated at the second position with 82% people getting affected by it due to the toxic chemicals and substances. Around 24% will suffer with hypotension as a result of getting affected by pesticides. 20% people suffer with long term effects such as brain damage, Parkinson's disease and negative impact during pregnancy. 0.5% might actually go into a coma or even face death. These results clearly show that pesticides and other agricultural substances are extremely dangerous for human health.

Table 3. Effects of Agriculture chemical and substance

No.	Effect on	Percent
1	Skin or Impetigo	88
2	Squeamish or Nauseous Vomiting Abdominal Pain Diarrhea	82
3	Hypotension	24
4	Long term effect -Brain Damage -Increased risk for -Parkinson's Disease (PD) -Impacts on Pregnant Women	20
5	Coma or Death	0.5

Table 4. Awareness of effects on human health

Awareness	Frequency	Percent
Yes	292	73
No	108	27
Total	400	100

Table 4 presents some optimistic results. Out of the 400 people surveyed, 73% were aware of the effects that pesticides have on human health. Mostly agriculturalists were aware of all the effects. This is a great sign for Thailand as the citizens are not oblivious to the adversity of the pesticides and its residue. There are many countries where most people are not aware of the effects of pesticides and the farmers continue to practice unadvised use of the pesticides. If more people in Thailand get aware of the effects, they can be monumental in restricting the use of pesticides in the country. Only 27% were not aware of the harmful effects, but still efforts must be made to spread awareness among more people in Thailand.

Table 5. Laws/Regularity in Government Thailand

Level of Satisfaction	Frequency	Percent
Satisfied	285	71.25
Neutral	10	2.5
Dissatisfied	105	26.25
Total	400	100.00

Table 5 shows the different levels of satisfaction the people of Thailand are on, regarding the regularity of pesticides in the country by the government. 71.25% respondents were satisfied with the performance of the government in governing the use of pesticide in the country. It was found that 26.25% respondents were dissatisfied with the government's performance on the matter and 2.5% had a neutral reaction. From the result, it can be clearly deduced that most of the people are satisfied with the laws and regularity of pesticides in the country.

Conclusion

The research concludes that pesticides and harmful agricultural substances impacts the environment and the human health in a strongly adverse way. Paraquat, Chlorpyrifos and Glyphosate are the most damaging pesticides in Thailand, and also the most commonly used in the country. In vegetables, Chinese cabbage is at the most risk of pesticide residue along side collards, basil leaves, red chili and cabbage respectively with different percentages and among fruits, oranges lead the way among rose apple, guava, grape and papaya respectively with different values. Human skin is affected the most by pesticides due to the direct physical contact by farmers and other people involved in farming. Even though, mostof the respondents are aware of the detrimental effects of pesticides on human health, they cannot protect themselves from getting affected. Campaigns must be carried out to encourage people to eat organic vegetables and fruits. Use of bio organic fertilizers and organic farming system must also be promoted. This is where the role of government comes in the equation. Most of the respondents were satisfied with the government's performance on the matter, as the government imposed a ban on two toxic chemicals, Paraquat and Chlorpyrifos, and also imposed a limit on the use of Glyphosate on the request of Thai people. This shows that the government is governing the application of pesticides effectively. To protect Thailand from the adverse effects of pesticides, the government must continue to regulate the herbicides and harmful chemicals. Government should also spread awareness to make sure that most of the citizens of Thailand are aware of the injurious effects of pesticides. If all these measures are carried out rightly, the situation of pesticides might improve in the country.

References

Aggarwal, Anil. 2006. Agrochemical Poisoning. *J Forensic Pathology Reviews.* 4: 261-327.

Konthonbut, Pajaree. 2018. Paraquat Exposure of Pregnant Women and Neonates in Agricultural Areas in Thailand. *J Environment Research and Public Health.* 15: 1-14.

Ventura, C. 2019. Effects of the pesticide chlorpyrifos on breast cancer disease. Implication of epigenetic mechanism. *J The Journal of Steroid Biochemistry and Molecular Biology.* 186 : 96-104.

Freire, Carmen. 2012. Pesticide exposure and Parkinson's disease: Epidemiological evidence of association. *J Neuro Toxicology.* 33 : 947-971.

Thongprakaisang, Siriporn. 2013. Glyphosate induces human breast cancer cells growth via estrogen receptors. *J Food and Chemical Toxicology.* 59: 129-136.

Tawatsin, Apiwat. 2015. Pesticides Used in Thailand And Toxic Effects to Human Health. *J Medical Research Archives.* 3 : 1-10.

Yamane, Taro. 1967. *Statistics, An Introductory Analysis,* 2nd Ed., New York: Harper and Row.