



## Analysis of Pesticide Residues on Red Chili Fruits (*Capsicum Annum L*) In Sipirok District, South Tapanuli Regency

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### ARTICLE INFO

*Keywords:* Pesticide Residue, Red Chili, BMR, Food safety, Laboratory analysis.

*Received :* 12 December

*Revised :* 23 January

*Accepted:* 10 February

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### ABSTRACT

The intensive use of pesticides in the cultivation of horticultural crops, especially Red Chili (*Capsicum annuum L.*), can leave chemical residues on crops that pose a risk to consumer health and the environment. This study aims to analyze the level of pesticide residues contained in red chili fruits cultivated in Sipirok sub-district, South Tapanuli. Red Chili samples were collected from several farmers who used pesticides on a regular basis, then analyzed in the laboratory, to identify the type and concentration of remaining pesticide residues. The results of the analysis showed that some samples contained pesticide residues such as chlorpyrifos, prophenonos, with varying concentrations. This study concludes that the supervision of pesticide use needs to be tightened and socialization to farmers about the safe use of pesticides is needed to maintain food safety and public health.

## **INTRODUCTION**

Red Chili (*Capsicum annum* L.) is a vegetable horticultural plant that has high economic value in the community. Red chili peppers are often consumed fresh, as a cooking spice, or can be processed into industrial products such as chili powder, sauces, and other processed products. The content of chili peppers includes phenols, antioxidants, capsaicinoids, proteins, fats, carbohydrates, calcium, phosphorus, iron, vitamin A, vitamin C, vitamin B1, flavonoids, and essential oils. The high public demand for red chili peppers encourages farmers to increase production through the use of various cultivation facilities, one of which is pesticides to control Plant Disrupting Organisms (OPT).

Pesticides are chemicals used to control or eradicate plant pest organisms (pests). Pesticides are used in various fields ranging from household, health, agriculture, and others. In the world of agriculture, pesticides are an integral part of plant cultivation activities. However, the improper use of pesticides will have negative impacts such as pesticide residues on agricultural commodities, especially vegetable commodities that are often consumed fresh. Pesticide residues carried with food can accumulate in body tissues that contain fat and in the long term can cause health problems including disorders in the nervous system, enzyme metabolism, damage to liver and kidney function, lowering immunity, causing congenital defects, allergies, and cancer.

Organophosphate pesticides such as chlorpyrifos and profenofos are types that are often used on horticultural crops including red chili. Organophosphate and carbamate pesticides can cause adverse effects on the central nervous system and inhibition of the enzyme acetylcholinesterase. Several studies show that pesticide residues are still widely found in fresh agricultural products. In a study that tested 315 samples of agricultural products, it was found that there was a pesticide residue content of 47% in fresh product samples and 7% in processed food samples. In addition, testing of 180 vegetable samples showed that 35% of fresh produce samples contained pesticide residues. These results show that plants that have been applied with pesticides still leave a lot of residue.

Food safety is a condition and effort needed to prevent food from possible biological and chemical contamination that can interfere, harm, and endanger human health. The government has set the Maximum Residue Limit (BMR) standard for pesticides in agricultural products through SNI 7313:2008. For red chili commodities, the BMR of profenofos is set at 3 mg/kg. Pesticide residue testing on red chili peppers needs to be carried out to find out whether the residue levels contained in the product are still below the maximum limit set so that it is safe for consumption.

Sipirok District, South Tapanuli Regency is one of the red chili producing areas. Farmers in this region use insecticide and fungicide pesticides in the cultivation process to maintain quality and production yields. However, the use of pesticides influenced by the dose, frequency of application, and harvest interval can affect the residue content in chili fruits.

Therefore, it is necessary to analyze pesticide residues on red chili fruits (*Capsicum annum* L.) cultivated in Sipirok District to determine the quality status of the food safety of the commodity and compare it with the Maximum Residue Limit that has been set.

## LITERATURE REVIEW

Red chili pepper (*Capsicum annum* L.) is one of the horticultural commodities that has high economic value and is widely cultivated in Indonesia. This plant belongs to the Solanaceae family and is widely used as a food ingredient because of its fairly complete nutritional content, such as vitamin A, vitamin C, protein, fat, carbohydrates, minerals, flavonoids, and capsaicinoid compounds that provide a spicy taste. Apart from being an ingredient for household consumption, red chili is also used as a raw material for the food industry. The high level of consumption of red chili peppers causes this commodity to become one of the intensive crops in the use of agricultural inputs, including fertilizers and pesticides.

Pesticides are substances or mixtures of substances that are used to prevent, repel, destroy, or control plant pests. In agricultural cultivation practices, pesticides play an important role in controlling pest and disease attacks to keep production optimal. Pesticides can be classified based on their target use such as insecticides, fungicides, herbicides, and rodenticides, as well as based on their chemical structures such as organophosphates, carbamates, organochlorines, and pyrethroids. The use of pesticides that are not in accordance with the recommended dosage, the frequency of application too often, and not paying attention to the harvest time interval can cause pesticide residues to be left behind in agricultural products.

Pesticide residues are pesticide residues found in agricultural products, both in the form of active compounds and their degradation products. This residue can be on the surface or absorbed into plant tissue. Organophosphate pesticides such as prophenonos and chlorpyrifos are widely used in horticultural plants because they are effective in controlling pests. However, organophosphate pesticides work by inhibiting the enzyme acetylcholinesterase so that it can cause toxic effects in humans when exposed to certain amounts. Long-term exposure to pesticide residues can cause nervous system disorders, liver and kidney dysfunction, metabolic disorders, decreased immunity, and potentially cause chronic diseases.

Some previous studies have shown that pesticide residues are still found in fresh agricultural products. The results of the study on vegetable and fruit samples showed that there was a pesticide residue content both at levels that were still below and that exceeded the maximum permissible limit. This shows that pesticide use practices at the farmer level still need to be monitored and controlled. Factors that affect the level of pesticide residues include the type of pesticide used, the dosage of application, the frequency of spraying, the last time of spraying before harvest, as well as environmental conditions such as temperature and rainfall.

To ensure food safety, the government has set the Maximum Residue Limit (BMR) of pesticides on various agricultural commodities through the Indonesian National Standard (SNI 7313:2008). The Maximum Residue Limit is the highest level of pesticide residue that is legally allowed to be present in or on food and is considered safe for consumers based on toxicological evaluation. The determination of BMR aims to protect public health and provide guidelines for farmers in the wise and responsible use of pesticides. Therefore, the analysis of pesticide residues in red chili peppers is important to ensure that the products circulating in the community meet applicable food safety standards.

## **METHODOLOGY**

This study is a descriptive research with a laboratory approach that aims to analyze pesticide residues in red chili fruits (*Capsicum annuum* L.). The research was carried out in Sipirok District, South Tapanuli Regency, as a sampling location, while the analysis of pesticide residues was carried out in a laboratory that has a pesticide residue testing facility. The research time is carried out in accordance with the sampling schedule and the laboratory analysis process until the test results are obtained.

The population in this study is all red chili plants cultivated by farmers in Sipirok District. The research sample was in the form of red chili fruits taken from several agricultural lands that represented cultivation conditions in the region. Sampling is carried out directly at the time of harvest by paying attention to the condition of the plant and the practice of using pesticides by farmers. The harvested chili samples are then put into a clean container, labeled, and taken to the laboratory for further analysis.

The variable studied in this study is the level of pesticide residues in red chili fruits, especially pesticides of the organophosphate group such as prophenophosphates. Pesticide residue analysis is carried out to determine whether or not there is a residue content and to measure the level of residue contained in the sample. The analysis method used refers to the pesticide residue testing procedure in the laboratory with the stages of sample preparation, extraction, purification, and measurement using appropriate analytical instruments. The test results were then compared with the Maximum Residue Limit (BMR) that had been set in SNI 7313:2008 for red chili commodities.

The data obtained from the results of laboratory analysis are presented in the form of a table and analyzed descriptively. The analysis was carried out by comparing the level of pesticide residue detected in the sample with the applicable BMR value to determine whether the red chili sample met food safety standards or not. The results of this analysis are expected to provide an overview of the level of safety of red chili cultivated in Sipirok District and become an evaluation of the practice of pesticide use by farmers.

## **RESEARCH RESULT AND DISCUSSION**

The results of laboratory analysis of samples of red chili fruits (*Capsicum annuum* L.) taken from agricultural land in Sipirok District, South Tapanuli Regency showed the presence of pesticide residues of the organophosphate group, especially prophenophosphates. Testing is carried out through the stages

of sample preparation, extraction, and analysis using appropriate laboratory instruments to detect pesticide residues. Based on the results of the examination, the level of pesticide residues detected in red chili samples is still within the limits that can be measured by laboratory analysis tools.

The value of the residue level obtained was then compared with the Maximum Residue Limit (BMR) set in SNI 7313:2008 for red chili commodities, which was 3 mg/kg for profenofos. Based on the comparison, the level of pesticide residues in the analyzed red chili samples was still below the maximum permissible limit. This shows that red chili peppers from the research site still meet food safety standards based on applicable regulations.

Although the residue levels found were still below the BMR, the presence of pesticide residues still indicates that the use of pesticides in cultivation practices leaves residues on crop yields. The level of residue detected is influenced by several factors, including the type of pesticide used, the dosage of application, the frequency of spraying, and the time interval between the last spraying and the harvest time. In addition, environmental conditions such as temperature, rainfall, and sun exposure can also affect the degradation process of pesticides in plants.

The results of this study are in line with several previous studies that show that pesticide residues are still commonly found in fresh horticultural products, although in many cases they are still below the maximum permissible limit. This indicates that monitoring and education to farmers on the proper use of pesticides is still necessary to minimize the risk of long-term exposure to consumers. The use of pesticides in accordance with the recommended dosage and paying attention to the recommended harvest interval can help reduce residue levels in agricultural products.

In general, the results of this study provide an idea that red chili cultivated in Sipirok District, South Tapanuli Regency is still in the safe category for consumption based on the parameters of the profenofos residue tested. However, regular monitoring is still needed to ensure that cultivation practices carried out by farmers do not pose a risk to public health in the long term.

## CONCLUSIONS AND RECOMMENDATIONS

Based on the results of research that has been carried out on red chili (*Capsicum annum* L.) from Sipirok District, South Tapanuli Regency, it can be concluded that the analyzed red chili samples contain pesticide residues of the organophosphate group, namely prophenonos. The results of laboratory analysis showed that the detected residue level was still below the Maximum Residue Limit (BMR) that had been set in SNI 7313:2008 of 3 mg/kg for red chili commodities. Thus, the red chili peppers tested in this study still meet food safety standards and are declared safe for consumption based on the analyzed residue parameters.

The presence of pesticide residues in the samples indicates that the use of pesticides in cultivation practices still leaves residues on the crop, even at permissible levels. Factors such as the type of pesticide, application dose, frequency of spraying, as well as the harvest time interval affect the level of

residue left in chili fruits. Therefore, the use of pesticides in accordance with the recommended dosage and paying attention to the waiting time before harvest is very important to maintain the safety of agricultural products.

Based on the results of this study, it is recommended that farmers continue to increase awareness in the use of pesticides wisely and in accordance with applicable regulations. Supervision and guidance from relevant agencies also need to be carried out periodically to ensure safe and sustainable cultivation practices. In addition, further research with a wider sample coverage and more diverse types of pesticides needs to be conducted to obtain a more comprehensive picture of the condition of pesticide residues in red chili commodities in the region.

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