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# Detection of Pesticide Residue in Forages for Dairy Farms in Jember District, East Java

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**Abstract.** Forage feed plays an important role in providing energy and fiber sources for milk production in dairy cows. Lactation dairy cows require enough nutrition in quality and quantity. Dairy farms in Jember plant forage around agricultural land to reach the need for animal feed. The use of chemical pesticides on agricultural land is feared to contaminate the forage, which is also planted around it, causing residues in forage that can result in dairy products being produced. This study was conducted to analyze pesticide residues in forage dairy cattle in the Jember district. The forage samples were taken from the 2 largest dairy farmers in Jember Regency (Best Cow and Rembangan Dairy Farm). Residual levels were determined using GC based analysis. The data were analyzed descriptively whether there was contamination of pesticide residues in forage. The results showed that no pesticide contamination was found in the forage given to dairy cattle at the Best Cow and Rembangan Dairy Farm dairy farms. Dairy products (milk) produced from these farms are free from organophosphate pesticide residues.

## INTRODUCTION

Animal food products, both fresh and processed, serve as a source of high animal protein, which is important for the growth of body cells with a complete amino acid composition compared to protein products from other materials. Animal protein also plays an important role in the growth and development of a child's brain. So that it can create a young generation that is smart and creative for the development of the nation and state. The application of food safety systems in feeding livestock has not been widely carried out. The attention of farmers has been more focused on the success of the growth and health of livestock until the period of use. In fact, every feed ingredient consumed by livestock will support a metabolic process, some are hidden, and some are accelerated to accumulate in the animal's tissues. Seeing the importance of this food safety system in relation to the provision of feed to livestock that is part of the supply chain of livestock food products, it is necessary to control food safety hazards in feed production management [1]

Feed is one of the most important components in the livestock business which is very influential in supporting the success of livestock business. Agricultural waste can be used as a source of forage for animal feed, but it does not guarantee the health of the livestock that consume it. Efforts to increase food crop production in controlling pests still use pesticides. The use of pesticides has a negative impact, namely endangering non-target organisms, polluting the environment, the presence of residues in the crops/processed materials, and can cause poisoning and even death for contaminated humans/livestock [2;3]

In ensuring the safety of livestock food products such as milk, eggs, and meat, animal feed ingredients must be free of toxic residues [4]. Toxic residues can be generated from contamination of mycotoxin-producing fungi, microbial pathogens, and pesticides. These toxins can directly endanger livestock health in the form of poisoning or cause residues in livestock products [5]. Knowledge of food safety management systems and their application to the industry can form the basis for the safe management of feed production. The purpose of this study was to identify pesticide residues in feed products which were then used as a reference in recommending optimal conditions for food safety in the process of feeding livestock.

## MATERIAL AND METHODS

Samples were taken by purposive sampling from the two largest smallholder dairy farms in Jember Regency. A total of 500 grams of forage samples were taken from Best Cow and Rembangan Dairy Farm. This pesticide contamination test is a type of organophosphate pesticide based on the EN 15662:2018 method. The sample was weighed 15 g into a 50 mL Teflon tube (containing  $6.0 \pm 0.3$  g anhydrous  $MgSO_4$  and  $1.5 \pm 0.1$  g anhydrous Na-Acetate) then added 15 mL of 1%  $CH_3COOH$  in acetonitrile and 75 L of internal standard solution (cons. Istd 200 ng g<sup>-1</sup>) shake vigorously for 1 minute and centrifuge > 1500 relative centrifugal force (rcf) for 1 minute. The results of the centrifuge were transferred (1-2 mL) into a tube (containing 150 mg  $MgSO_4$  and 50 mg PSA per mL extract). The tube was closed then shaken for 30 seconds and centrifuged at a speed of > 1500 rcf for 1 minute. The solution was transferred to a GC vial and triphenyl phosphate (TPP) was added. The solution was injected into a GC apparatus (GC Clarus 580, Perkin Elmer, US). This type of research is an observational study with a descriptive approach.

## RESULT AND DISCUSSION

Local dairy farms in Jember Regency generally plant forage in the surrounding agricultural land. In addition to forage, fortification feed is also used to meet the energy and protein needs of rations such as concentrate, rice bran, pollard, and tofu dregs. The results of the analysis of the feed given to both farm locations have been analyzed and the results are presented in Table 1. Forage is given twice a day, in the morning at around 07.00 WIB and in the afternoon around 15.30 WIB. The concentrate is given in the morning or evening before the forage is given. Drinking water is given ad libitum. The use of additional feed is carried out as an effort to fulfill nutrient needs, especially protein which cannot be fulfilled from forage alone.

**TABLE 1.** Nutrient content of concentrate from the two largest dairy farms in Jember Regency

Farms	Dry Matter (%)	Ash content (%)	Crude protein (%)	Crude Fat (%)	Crude fiber (%)	GE (kcal/kg)	Ca (%)	P (%)
Best Cow	90.12	7.19	18.26	4.29	21.60	4016	1.12	0.66
Rembangan Dairy Farm	92.15	13.72	11.77	5.68	31.65	3881	0.45	0.24

One of the pesticides that is widely used by farmers in Indonesia is organophosphate group pesticides. The organophosphate is the most effective pesticide to eradicate pests and is easily available in the market [6]. Data from the Ministry of Agriculture in 2000 showed that the number of pesticides registered for agriculture reached 2,628 pesticides and 50% of them belonged to the organophosphate group [7]. The grass samples tested showed that the pesticide residue content was below the predetermined limit of detection (Table 2).

**TABLE 2.** Pesticide residue levels in forage in the two largest dairy farms in Jember Regency, East Java

<b>Pesticide types</b>	<b>Best Cow</b>	<b>Rembangan Dairy Farm</b>	<b>Limit of detection (mg/kg)</b>
Azinphos-methyl	Not detected	Not detected	0.0066
Chlorpyrifos	Not detected	Not detected	0.001
Chlorpyrifos methyl	Not detected	Not detected	0.0024
Diazinon	Not detected	Not detected	0.00037
Dichlorvos	Not detected	Not detected	0.01135
Dimethoate	Not detected	Not detected	0.00132
Disulfoton	Not detected	Not detected	0.01014
Etrimfos	Not detected	Not detected	0.001
Fenamiphos	Not detected	Not detected	0.001
Fenitrothion	Not detected	Not detected	0.001
Fenthion	Not detected	Not detected	0.01333
Malathion	Not detected	Not detected	0.00372
Methacrifos	Not detected	Not detected	0.002
Methidathion	Not detected	Not detected	0.001
Methyl pirimiphos	Not detected	Not detected	0.001
Monocrotophos	Not detected	Not detected	0.00091
Phosalone	Not detected	Not detected	0.0026
Phosphamidon	Not detected	Not detected	0.001
Profenofos	Not detected	Not detected	0.00098
Cis-Mevinphos	Not detected	Not detected	0.00302
Methamidophos	Not detected	Not detected	0.001
Triazophos	Not detected	Not detected	0.0006
Acephate	Not detected	Not detected	0.001
Terbufos	Not detected	Not detected	0.03364

Many pesticides were identified but only organophosphate has been described, and which are the pesticides include in organophosphate group (Table 2). To avoid organophosphate pesticide residues in dairy products produced from dairy farms in Jember Regency, testing of pesticide residues from the feed is necessary. Negative results (Table 2) or no pesticide residue detected can be expected because of the nature and characteristics of organophosphate pesticides which are easily degraded in nature and are not bio accumulative [6]. In ruminants, cases of pesticide contamination in feed generally pose a relatively small risk of toxicity compared to monogastric livestock [8]. The metabolic process of feed contaminated with organophosphate pesticides in the rumen tract will undergo detoxification then the elimination process can be through urine, feces, and respiration [9].

However, pesticides have potential hazards to human health and non-target animals. The level of poisoning depends on the toxicity of the pesticide and the duration of exposure. Pesticide toxicity is generally grouped into two parts, namely acute toxicity, and chronic toxicity. Acute toxicity is the ability of toxic chemical compounds to cause damage to body tissues in humans or animals, generally with a single dose and lasts for a short time (1-3 days). Chronic toxicity persists over a long period with repeated low doses. Chronic toxicity generally causes immunosuppression and is carcinogenic [10].

Symptoms of poisoning due to organophosphate pesticides are irreversible, namely conditions that cannot return to normal and are acute. To avoid livestock from feed containing pesticide residues, it is better if the feed is processed first before being given to livestock, this is to reduce the pesticide residue [11]. The main effect of organophosphate pesticide poisoning is to inhibit the activity of the cholinesterase enzyme, causing impaired nerve transmission and neurological symptoms in moderate to severe poisoning [11,12]. Mild symptoms begin with weakness, headache, dizziness, nausea, vomiting, sweating, salivation, stomach cramps, and diarrhea. Symptoms of moderate poisoning follow mild symptoms and are followed by immobility, extreme weakness, inability to speak and move muscles, and pupillary contractions. Clinical symptoms will continue to become symptoms of severe poisoning including unconsciousness, excessive secretions from the mouth and nose, difficulty breathing, and followed by death [14].

A monitoring system in the use of pesticides by farmers and the importance of vigilance in handling the safety of animal feed products are needed. The misused of pesticides or their unwise management can have a negative impact, either directly or indirectly, on human health, livestock, and the environment. It is undeniable that pesticides are one

of the results of modern technology and have an important role in increasing agricultural yields. Therefore, its use appropriately and safely is an absolute must, considering that pesticides are toxic materials. In nature, pesticide residues can be lost or decomposed, through evaporation, leaching by rainwater, the influence of sunlight, and weathering. Surface residues can also be lost due to washing (rinsing), rubbing, and hydrolysis [15,16]. Low levels of pesticide residues in food, obviously will not cause chronic or acute poisoning, but can cause subtle effects, namely long-term long-term effects that occur at low doses many times. Subtle effects can be in the form of histological and pathological changes, carcinogenic, tumorigenic, metagenic, and tetragenetic effects in humans [17].

## CONCLUSION

The forage used by the two largest dairy farmers in Jember Regency does not contain pesticide residues, especially the organophosphate group, so that the dairy products produced are safe from contamination with pesticide residues.

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