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The Effect Of Cassava Leaf Meal (*Manihot Esculenta*) Supplementation In Feed On The Internal Organ Weights Of Quails (*Coturnix Coturnix Japonica*)

Abdullatif R. Nurkamiden[1], Suparmin Fathan[2], Nibras Karnain Laya[3], Ellen J. Saleh[4], Sri Suryaningsih Djunu[5]

[1,2,3,4,5]Department of Animal Science, Faculty of Agriculture, Universitas Negeri Gorontalo, Bone Bolango, Indonesia

Corresponding Author: nibraslaya@ung.ac.id

Abstract

This study aimed to determine the effect of cassava leaf meal (Manihot esculenta) supplementation in the diet on the percentage of internal organ weights in quails (Coturnix coturnix japonica). The study was conducted from April to June in Helumo Village, Suwawa District, Bone Bolango Regency. Five treatments were applied: T0 (100% commercial feed), T1 (96% commercial feed + 4% cassava leaf meal), T2 (94% commercial feed + 6% cassava leaf meal), T3 (92% commercial feed + 8% cassava leaf meal), and T4 (90% commercial feed + 10% cassava leaf meal), with four replications for each treatment. The observed variables included live body weight and the percentages of liver, heart, lungs, and gizzard weights. The data were analyzed using analysis of variance (ANOVA) to determine the effects of the treatments. The results showed that the inclusion of cassava leaf meal at levels of up to 10% had no significant effect (P>0.05) on the percentages of liver, heart, and lung weights. However, the inclusion of cassava leaf meal had a significant effect (P<0,05).

Keyword: Cassava Leaf Meal, Quail, Internal Organs, Relative Organ Weight, Gizzard.

INTRODUCTION

One of the livestock sectors with considerable development potential and strong public interest is poultry farming. This is due to the flexibility of its business scale, which can range from household-level operations to commercial enterprises. One type of poultry farming with

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potential for further development is quail farming (*Coturnix coturnix japonica*). The growing public interest in quail farming is supported by population growth, which has contributed to an increasing demand for employment opportunities and business prospects. Furthermore, quail farming is considered a promising alternative business because it requires relatively little land, is comparatively easy to manage, and offers a relatively short production cycle and a rapid return on investment. Therefore, quail farming represents a viable business option for communities seeking to develop productive economic activities.

The Japanese quail (*Coturnix coturnix japonica*) is one of the poultry species with considerable potential for development as a source of animal protein, both through egg and meat production. Quail are widely raised because of their relatively small body size, rapid growth rate, short production cycle, and low land requirements for rearing. Furthermore, quail have relatively good production efficiency, making them a potentially valuable poultry commodity with considerable economic prospects. The success of quail production is influenced by several factors, one of the most important of which is the quality and availability of feed provided throughout the rearing period.

Quail can be classified into several types based on their feather color characteristics. In farming practices, farmers generally classify quail into three types: local quail, characterized by brown feathers; Bangkok quail, which have black feathers; and crossbred quail resulting from crosses between Bangkok and local quail, which exhibit a combination of brownish-black feather colors. In Indonesia, the types of quail most commonly raised by farmers are Bangkok quail and Bangkok-local crossbred quail.

Feed is one of the primary factors determining the success of livestock production because it provides the nutrients required to support growth, development, health, and productivity. The availability of feed with a balanced nutritional composition is essential to ensure that metabolic processes in the body function optimally. However, the high cost of commercial feed is one of the major constraints in poultry farming. Therefore, efforts are needed to identify alternative feed ingredients that are readily available, have nutritional value, can be sourced locally, and can help reduce dependence on conventional feed ingredients.

One alternative feed ingredient with potential for use in poultry diets is cassava leaf (*Manihot esculenta*). Cassava is an agricultural commodity widely cultivated in Indonesia, and its vegetative parts, particularly the leaves, can be utilized as livestock feed ingredients. Cassava leaves contain crude protein, minerals, vitamins, and various bioactive compounds that may contribute to meeting the nutritional requirements of livestock. Processing cassava leaves into

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leaf meal provides an alternative approach to utilizing locally available feed resources while increasing the value of agricultural plant by-products.

Internal organs play an important role in supporting the physiological and metabolic processes of quail. The internal organs commonly used as indicators in poultry nutrition studies include the liver, heart, and gizzard. The liver functions in nutrient metabolism, energy storage, and the detoxification of potentially harmful substances entering the body. The heart pumps blood to distribute oxygen and nutrients throughout the body tissues, while the gizzard is responsible for mechanical digestion through the grinding of feed. Therefore, changes in internal organ weight may provide an indication of the physiological responses of livestock to the quality and composition of the feed consumed.

The inclusion of cassava leaf meal in quail diets is expected to potentially influence the development and weight of internal organs. Its relatively high crude fiber content may affect the activity of the digestive tract, particularly the gizzard, while its protein content and antinutritional compounds may influence metabolic processes within the body. The liver, as the primary organ responsible for metabolism and detoxification, requires particular attention because certain compounds in feed ingredients may increase its metabolic activity. However, such responses do not necessarily result in increased organ weight, as they are influenced by the inclusion level of the feed ingredient, nutritional quality, age, physiological condition, and the animal's ability to adapt.

Based on the above considerations, research on the effects of cassava leaf meal (*Manihot esculenta*) supplementation in the diet on the internal organ weights of Japanese quail (*Coturnix coturnix japonica*) is necessary. This study is expected to provide scientific information regarding the responses of quail internal organs to the inclusion of cassava leaf meal in their diets, particularly in terms of liver, heart, and gizzard weights. Furthermore, the findings are expected to serve as a consideration in determining the potential use of cassava leaf meal as an economical and readily available alternative feed ingredient while taking into account the health and physiological condition of the birds. The results are also expected to contribute to the development of poultry nutrition and feed technology, particularly regarding the utilization of local feed resources.

METHOD

This research was conducted from April to June in Helumo Village, Suwawa District, Bone Bolango Regency.

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Equipment and Materials

Equipment

The equipment used in this research included:

1. Feed containers.
2. Drinking water containers.
3. Digital scales.
4. Writing utensils.

Materials

The materials used in this research included:

1. 140 Japanese quails (*Coturnix coturnix japonica*).
2. Commercial feed (BR21E Sinta).
3. Cassava leaf flour (*Manihot esculenta*).

Research Procedures

The research procedures were carried out as follows:

Housing Preparation

The cages used in this research measured 40 cm in length, 40 cm in width, and 50 cm in height. A total of 20 cage units were used, consisting of five treatments and four replications. Each cage was equipped with an incandescent lamp, a feed container, and a drinking water container.

Feed Preparation

The feed used in this research consisted of BR21E Sinta commercial feed supplemented with cassava leaf flour. The preparation of cassava leaf flour involved several steps. First, cassava leaves were collected and sun-dried until completely dry. The dried leaves were then ground and sieved to separate the fine particles from the coarse materials. The resulting fine cassava leaf flour was then ready to be used as livestock feed.

Quail Allocation

The quails were placed in the experimental cages, with seven birds assigned to each replication. The allocation of quails to the cages was carried out randomly, with the principle of standardizing body weight across treatments, using the following procedure:

a. At 0 days of age, the body weight of each quail was measured and recorded before the birds were allocated to experimental cage units 1 to 20.

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b. After the average body weight of the birds in each experimental unit had been determined, the quails were rearranged among the cages to obtain relatively uniform average body weights across all treatment groups.

Weighing

Weighing was conducted on both the feed and the quails. Feed was weighed at the beginning of the feeding period, and the remaining feed was weighed afterward. The difference between the initial feed weight and the remaining feed weight was considered the amount of feed consumed (feed intake).

Observed Variables

1. Live Body Weight
   Live body weight was determined by weighing the quails at 42 days of age using a digital scale prior to slaughter. After weighing, the quails were slaughtered, followed by the separation of carcass and non-carcass components.
2. Liver Weight, Gizzard Weight, Heart Weight, and Lung Weight
   The weights of the liver, gizzard, heart, and lungs were measured using a digital scale.

Research Design

This study employed a quantitative research design with a correlational approach, which aimed to measure the relationship between two variables without manipulating those variables. The treatments applied were as follows:

T0 = 100% commercial feed (without the addition of cassava leaf meal).
T1 = 96% commercial feed + 4% cassava leaf meal.
T2 = 94% commercial feed + 6% cassava leaf meal.
T3 = 92% commercial feed + 8% cassava leaf meal.
T4 = 90% commercial feed + 10% cassava leaf meal.

Data Analysis

The data obtained were analyzed using Pearson's correlation coefficient (r) to measure the linear relationship between body weight and body measurements, as well as carcass and non-carcass weights. A significance test (p-value) was used to determine whether the observed correlations were statistically significant.

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1. If the p-value is less than 0.05 ($p < 0.05$), the null hypothesis (H_o) is rejected, indicating a statistically significant correlation between body weight and body measurements, carcass weight, and non-carcass weight.
2. If the p-value is greater than or equal to 0.05 ($p \geq 0.05$), the null hypothesis (H_o) is not rejected, indicating that there is no statistically significant correlation.

$$r_{xy} = \frac{n\sum x_i\, y_i - (\sum x_i)(\sum y_i)}{\sqrt{\left(n\sum x_i^2 - (\sum x_i)^2\right)\left(n\sum y_i^2 - (\sum y_i)^2\right)}}$$

Notes:

- (r_{xy}) = correlation coefficient between (X) and (Y)
- (n) = number of samples
- (Xi) = the value of (X) for the (i)-th observation
- (Yi) = the value of (Y) for the (i)-th observation

RESULTS AND DISCUSSION

Organ weight is one of the physiological parameters that can be used to evaluate the effects of dietary supplementation on the health status and metabolic processes of livestock. Changes in organ weight are influenced by several factors, including nutrient content, crude fiber levels, and the presence of antinutritional compounds in the diet (Mistiani et al., 2020).

Table 1. Results of the Analysis of Variance (ANOVA) for Internal Organ Weights

Treatment	Liver	Heart	Lungs	Gizzard
	(%±SD)			
T0	3,90 ± 0,48	1,60 ± 0,40	1,30 ± 0,16	3,82^{a} ± 0,51
T1	4,06 ± 0,72	1,61 ± 0,35	1,29 ± 0,26	4,21^{a} ± 0,55
T2	4,62 ± 0,52	1,64 ± 0,38	1,34 ± 0,18	4,23^{a} ± 0,66
T3	4,92 ± 0,18	1,67 ± 0,39	1,30 ± 0,15	4,52^{ab} ± 0,36
T4	4,95 ± 1,22	1,74 ± 0,19	1,35 ± 0,20	5,09^{b} ± 0,49

Experimental Treatments

- T0: Commercial feed (control).
- T1: 96% commercial feed + 4% cassava leaf meal.
- T2: 94% commercial feed + 6% cassava leaf meal.

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- T3: 92% commercial feed + 8% cassava leaf meal.
- T4: 90% commercial feed + 10% cassava leaf meal.

Data are presented as means ± standard deviations based on four replicates. The data were analyzed using analysis of variance (ANOVA). Different superscript letters within the same column indicate statistically significant differences ($P < 0.05$).

Liver Weight

The analysis of variance showed that the inclusion of cassava leaf meal in the diet had no significant effect ($P > 0.05$) on the relative liver weight of quails. The relative liver weight in this study ranged from 3.90% to 4.95%. Descriptively, an increase in the mean liver weight was observed as the inclusion level of cassava leaf meal in the diet increased.

The increase in liver weight was presumed to be associated with the higher crude protein content in the dietary treatments containing cassava leaf meal. The crude protein content of the diets increased from 22% in treatment T0 to 22.22% in treatment T4. Cassava leaves are known to contain relatively high levels of protein, making them a potential source of nutrients that may support metabolic activities in body organs, particularly the liver, which plays a central role in nutrient metabolism. Artanti and Andriani (2020) reported that cassava leaves contain approximately 17.7–38.1% crude protein on a dry matter basis, indicating their potential as a protein source in livestock feed. This protein content may serve as one of the considerations in utilizing cassava leaf meal as an ingredient in diet formulation.

In line with these findings, Pastika (2025) reported that the inclusion of cassava leaf meal in quail diets at levels of 0%, 4%, 6%, 8%, and 10% resulted in differences in several production parameters, including live body weight and carcass percentage. The study also indicated that cassava leaf meal contained 24.24% crude protein. These findings further support the potential of cassava leaves as an alternative feed ingredient that can contribute to meeting the nutritional requirements of quails.

Although a numerical increase was observed, the absence of a statistically significant effect indicates that the inclusion of cassava leaf meal at levels of up to 10% remained within normal physiological conditions and did not cause any impairment of liver function. This condition is presumably due to the processing of cassava leaves into meal, which may reduce the concentration of toxic hydrogen cyanide (HCN). Devi and Diarra (2021) stated that drying, fermentation, and meal processing are effective methods for reducing HCN content in cassava leaves.

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The liver is one of the vital organs that plays an important role in nutrient metabolism, nutrient storage, bile secretion, and the detoxification of harmful compounds entering the body. The inclusion of cassava leaf meal (*Manihot esculenta*) as an alternative feed ingredient requires careful consideration because cassava leaves contain antinutritional compounds, particularly hydrogen cyanide (HCN), and have a relatively high fiber content. The presence of these antinutritional compounds may potentially affect metabolic processes and increase hepatic detoxification activity when consumed in excessive amounts. According to Angriani et al. (2025), the utilization of cassava leaf meal in poultry diets has several limiting factors, including hydrogen cyanide content, fiber content, and nutrient digestibility.

Heart Weight

Based on the results of the analysis of variance, the inclusion of cassava leaf meal (*Manihot esculenta*) did not have a significant effect ($P > 0.05$) on the relative heart weight of Japanese quail (*Coturnix coturnix japonica*). The relative heart weight in this study ranged from 1.60% to 1.74%. These results indicate that the inclusion of cassava leaf meal at the dietary treatment levels used in this study did not result in significant changes in the relative heart weight of Japanese quail.

The absence of significant differences suggests that the inclusion of cassava leaf meal in the diet did not induce substantial physiological changes in the heart. The heart is a vital organ responsible for pumping blood to distribute oxygen and nutrients throughout the body tissues. Heart weight can be influenced by physiological conditions, body size, metabolic activity, and the health status of the animals.

Furthermore, Djunu et al. (2024) reported that the inclusion of earthworm meal in Japanese quail diets resulted in relative heart weights ranging from 1.02% to 1.25%. These findings indicate that relative heart weight may vary depending on dietary composition and the physiological condition of the animals. The differences in relative heart weight between that study and the present study may be attributed to differences in feed ingredient types, diet formulation, age, and live body weight of the Japanese quail used.

The nutritional composition of the diets in the present study may also have contributed to the absence of significant changes in relative heart weight. Crude protein content increased progressively, whereas metabolizable energy decreased slightly from 2,900 kcal/kg to 2,838 kcal/kg. These changes in dietary nutrient composition may not have been sufficiently substantial to affect the energy requirements and physiological activity of the heart.

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The results of this study indicate that the inclusion of cassava leaf meal at levels of up to 10% can be considered safe for use in Japanese quail diets and did not induce physiological stress that could affect heart development. This finding is also supported by Harahap et al. (2020), who reported that the inclusion of cassava leaf meal at levels of up to 9% in Japanese quail diets did not have a significant effect on body weight gain or feed conversion ratio. Therefore, cassava leaf meal can potentially be utilized at certain inclusion levels as an alternative feed ingredient without necessarily causing significant changes in physiological parameters or livestock performance.

Lung Weight

The results of the analysis of variance showed that the inclusion of cassava leaf meal (*Manihot esculenta*) had no significant effect ($P > 0.05$) on the percentage of lung weight in Japanese quails (*Coturnix coturnix japonica*). The percentage of lung weight in this study ranged from 1.29 to 1.35%. These results indicate that the inclusion of cassava leaf meal at levels of up to 10% did not cause significant changes in the percentage of lung weight in Japanese quails.

The relatively uniform percentage of lung weight across treatments suggests that changes in dietary composition did not substantially affect the development of the respiratory organs. The lungs are the primary organs of the respiratory system, functioning as the site of oxygen (O_2) and carbon dioxide (CO_2) exchange. According to a study on the morphology and histology of avian lungs, the anatomical structure of avian lungs consists of primary bronchi, secondary bronchi, and parabronchi, which play essential roles in the gas exchange process. The condition and structure of these organs are closely related to respiratory function and the metabolic requirements of livestock.

The findings of this study can be associated with those reported by Rifai et al. (2025), who used cassava leaf meal inclusion levels of 0%, 4%, 6%, 8%, and 10%. Their results showed that the inclusion of cassava leaf meal had no significant effect ($P > 0.05$) on several non-carcass components, including blood, feet, and feather weights. These findings suggest that the responses of different body components in Japanese quails to cassava leaf meal supplementation do not necessarily exhibit significant changes across all measured parameters.

The absence of a significant effect on the percentage of lung weight may also be associated with the processing of cassava leaves into meal. Widyasanti (2019) explained that the drying process of cassava leaves can reduce their hydrocyanic acid (HCN) content. The study reported that the HCN content of cassava leaf meal dried at 30°C was 0.022%, equivalent to 220 ppm. This indicates that processing methods are an important factor in reducing the

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concentration of antinutritional compounds in cassava leaves. Therefore, processing cassava leaves before their inclusion in animal feed may help reduce the potential exposure of livestock to HCN.

Based on these findings, it can be inferred that the inclusion of cassava leaf meal at levels of up to 10% in the diet did not have a significant effect on the percentage of lung weight in Japanese quails. The relatively uniform percentages indicate that the dietary treatments did not result in changes in the relative size of the lungs. However, these findings cannot be considered direct evidence that respiratory function remained entirely unaffected, as this study only measured organ weight and did not include histopathological examinations or assessments of respiratory function.

Gizzard Weight

The results of the analysis of variance showed that the inclusion of cassava leaf meal had a significant effect ($P < 0.05$) on the relative gizzard weight of quails. The highest relative gizzard weight was observed in treatment T4 (5.09%), whereas the lowest was recorded in treatment T0 (3.82%).

These findings can also be related to the study by Devi and Diarra (2021), who reported that cassava plant by-products, including leaves, have relatively high fiber content, which may affect their utilization in poultry diets. High fiber content is an important factor to consider in diet formulation because it can influence digestive processes and nutrient utilization. Therefore, the increase in crude fiber content resulting from the inclusion of cassava leaf meal is presumed to be one of the factors contributing to the increased relative gizzard weight observed in this study.

The absence of significant differences between treatment T3 and all other treatments indicates that the increase in relative gizzard weight under this treatment was not statistically different from the other treatments. Although the relative gizzard weight in T3 reached 4.52%, this value did not differ significantly from those of the other treatments. This may be attributed to individual biological variation, the digestive tract's ability to adapt to changes in dietary composition, and data variability within each treatment. Therefore, treatment T3 can be categorized as showing a transitional response to the increased inclusion of cassava leaf meal.

Rifai et al. (2025), also investigated the inclusion of cassava leaf meal at levels of 0%, 4%, 6%, 8%, and 10% in quail diets. Their results indicated that cassava leaf meal inclusion had a significant effect on several non-carcass parameters in quails. Although their study did not

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specifically examine relative gizzard weight, the findings demonstrated that cassava leaf meal inclusion could elicit responses in the non-carcass components of quails.

Furthermore, Pastika (2025), investigated the use of cassava leaf meal at inclusion levels of 0%, 4%, 6%, 8%, and 10% in quail diets. The study reported significant effects on several production parameters, including live weight, carcass percentage, and thigh cut weight. These findings further support the evidence that the inclusion of cassava leaf meal in poultry diets can produce different biological responses depending on the parameters being evaluated.

Therefore, the increase in relative gizzard weight from 3.82% in T0 to 5.09% in T4 is presumed to be associated with the increased crude fiber content of the diet resulting from cassava leaf meal inclusion. This condition indicates an adaptive response of the digestive organ to the physical characteristics and fiber content of the feed ingredients. However, an increase in gizzard weight cannot be directly interpreted as an improvement in digestive efficiency or as evidence that all physiological functions of the organ are operating optimally. Further investigations, such as feed digestibility and digestive tract characteristics, are required to confirm these physiological responses.

CONCLUSION

Based on the research findings, it can be concluded that the inclusion of cassava leaf meal in the diet at levels of up to 10% had no significant effect ($P > 0.05$) on the relative weights of the liver, heart, and lungs of quails, indicating that its use did not cause physiological disturbances in these organs. However, the inclusion of cassava leaf meal resulted in an increase in the relative weight of the gizzard, with the highest value observed in treatment T4 (5.09%) and the lowest in treatment T0 (3.82%). The increase in gizzard weight was presumably associated with the higher crude fiber content in the diet, which increased the mechanical activity of the gizzard during feed grinding. Overall, cassava leaf meal inclusion at levels of up to 10% has the potential to be utilized as an alternative feed ingredient in quail diets without causing significant physiological disturbances to the internal organs.

REFERENCE

Angriani, R., Hermana, W., & Ridla, M. (2025). Pengaruh tepung daun singkong (*Manihot esculenta Crantz*) dengan suplementasi enzim dalam ransum terhadap organ dalam ayam broiler. Wahana Peternakan, 9(1), 56–66. https://doi.org/10.37090/jwputb.v9i1.1888

Artanti, O. W., Ridla, M., & Khotijah, L. (2019). Penggunaan Daun Ubi Kayu (*Manihot esculenta*) Dengan Pengolahan Berbeda Terhadap Performa Kambing Peranakan Etawa Jantan.

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Jurnal Ilmiah Peternakan Terpadu, 7 (2), 223–229. https://doi.org/10.23960/jipt.v7i2.T223-229

Devi, A., & Diarra, S. (2021). Factors Affecting the Utilisation of Cassava Products for Poultry Feeding [Review]. Egyptian Journal of Veterinary Sciences, 52(3), 387-403. doi: 10.21608/ejvs.2021.50090.1204

Djunu, S. S., Saleh, E. J., & Igirisa, A. (2024). Percentage of carcass and innards of quail (*Coturnix-coturnix japonica*) with the addition of Lumbricus rubellus flour to feed. Jambura Journal of Animal Science, 6(2), 137–144. https://doi.org/10.35900/jjas.v6i2.25179

Mistiani, S., Kamil, K. A., & Rusmana, D. (2020). Pengaruh tingkat pemberian ekstrak daun burahol (*Stelechocarpus burahol*) dalam ransum terhadap bobot organ dalam ayam broiler. Jurnal Nutrisi Ternak Tropis dan Ilmu Pakan, 2(1). https://doi.org/10.24198/jnttip.v2i1.26669

Pastika, A. A. G. (2025). Penggunaan tepung daun ubi kayu (*Manihot esculenta*) terhadap bobot karkas dan bagian-bagiannya pada burung puyuh. Jurnal Sains Ternak Tropis, 3(1), 1–13. https://doi.org/10.31314/jstt.3.1.1-13.2025

Pratama, Y., Harahap, A. E., & Ali, A. (2020). Performa burung puyuh (*Coturnix coturnix japonica*) periode grower yang diberi pakan berbahan tepung daun ubi kayu. Jurnal Peternakan Sriwijaya, 9(1), 16–25. https://doi.org/10.33230/JPS.9.1.2020.11510

Rifai, A., Fathan, S., Gubali, S., Zainudin, S., Sayuti, M., & Dako, S. (2025). Effect of substituting cassava leaf flour (*Manihot esculenta*) in commercial rations on the non-carcass weight performance of quail. Jambura Journal of Animal Science, 8(1), 12–22. https://doi.org/10.35900/jjas.v8i1.27890

Widyasanti, A. (2019). Pengaruh suhu pengeringan dan proses blansing terhadap mutu tepung daun singkong (*Manihot esculenta C*) dengan metode oven konveksi. Agrisaintifika: Jurnal Ilmu-Ilmu Pertanian, 3(1), 8–17. https://doi.org/10.32585/ags.v3i1.552

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