

Optimization of Cattle Livestocks Waste Into Organic Fertilizer as an Alternative to Support Sustainable Agriculture in Kasah Village, Nogojatisasi

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DOI:

Article Info

Article Info:

Received 01 June 2023

Revised: 18 June 2023

Accepted: 23 June 2023

Published: 30 June 2023

Keywords:

Cow dung waste

Organic Fertilizer

Community Empowerment

ABSTRACT

Hamlet Kasah, Nogojatisari Village is an area where almost every resident works as a farmer. Most of the residents in Dusun Kasah also have cattle farms that are managed traditionally. The manure from cattle farms has not been properly utilized by local residents, causing a buildup of abandoned cow manure around the stables. This service activity aims to provide education and empower the community in processing livestock manure into organic fertilizer that has economic value and can support the development of the agricultural and plantation sectors in Nogojatisari Village. The partners for this activity were the Sambeng District Agriculture Counseling Center, the Dusun Kasah Farmers Group, and the PKK Dusun Kasah Mother. The service is carried out using 3 approaches, namely counseling, simulation, and utilization. The results of this community service activity are expected to increase public awareness of the importance of processing livestock manure into organic fertilizer in order to minimize the use of inorganic fertilizers in order to preserve nature. Community awareness of the importance of maintaining environmental balance is expected to increase along with increased knowledge about the use of natural resources as organic fertilizer.

INTRODUCTION

Kasah Hamlet is one of the hamlets located in Nogojatisari Village, Sambeng District, Lamongan Regency. Kasah Hamlet has an area of agricultural land of around 105 hectares (Setyawan, 2022). Due to the large area of agricultural land in Kasah Hamlet, almost all of the people there work as farmers. In addition to the large area of agricultural land, the people of Dusun Kasah, Nogojatisari Village, also have private farms, especially cattle farms. Almost every head of household has at least 2 cows, so if the total population is calculated, there are approximately 250 cows in the hamlet. With this large number of cows, it produces around 8-10 kg of cow manure per day (Setyawan, 2022). The waste from cow dung has the potential to be used as organic fertilizer so that it can support the agricultural and plantation sectors in the surrounding environment. Previously, the community had utilized some of the accumulated cow manure waste as fertilizer for their agricultural land, but the cow manure waste was used directly without going through the previous process so that the resulting effect was less than optimal.

The use of cow manure waste as a source of organic fertilizer is of course very useful to support the agricultural and plantation sectors in Nogojatisari Village. However, the livestock waste produced has not been used optimally so that some of the waste will accumulate and just be wasted. If agricultural and livestock waste is not treated and utilized properly, it will certainly have an impact on the environment such as becoming a source of various diseases, contaminating soil, water and air, and can trigger an increase in methane gas, disturb the beauty and comfort of local residents, and even trigger global warming. (Nenobesi et al., 2017). Livestock waste produced in the form of animal manure contains nutrients that are very beneficial for the soil. This is because various livestock manures contain quite high levels of phosphorus and potassium (Pramana et al., 2017).

Livestock waste cannot be directly used on plants because it can cause plant death. Apart from focusing on fulfilling food needs, the livestock sector is also expected to be able to develop livestock waste processing to be used as organic fertilizer in an integrated farming system.

According to the Regulation of the Minister of Agriculture, No. 2/Pert/HK.060/2/2006 organic fertilizers are fertilizers sourced from animal parts, animal waste, dead plants, or other organic wastes that have passed the engineering stage and are undergoing a process of decomposition or weathering. (Directorate of Production Facilities, 2006). The process of making organic fertilizer (compost) can be done either aerobically or anaerobically. The composting process is a process of reducing the C/N of organic matter to be the same as the C/N of the soil. The advantages of this organic fertilizer are that it is environmentally friendly, can increase farmers' income, and can increase soil fertility by repairing soil physical damage due to excessive use of inorganic (chemical) fertilizers (Subekti, 2015). This organic fertilizer can be in liquid or solid form, can be added with microbes or mineral content which has benefits as an effort to increase nutrient content and soil organic matter and improve the biological, chemical and physical properties of the soil (Hartatik & Setyorini, 2011). Organic fertilizers have benefits in soil chemical properties as a supplier of macro nutrient composition such as Mg, S, Ca, N, P, K and micro nutrients such as Zn, Mo, Cu, Co, B, Fe, and Mn (Kasmawan, 2018). Organic fertilizers also have benefits on soil physical properties, one of which is to improve soil structure. The benefits of organic fertilizers on soil biological properties are as a source of food and energy for meso and soil microfauna (Nuro et al., 2016). Organic fertilizers are divided into manure and compost. Due to the various benefits of organic fertilizers, the use of organic fertilizers is increasingly encouraged to improve soil health and maintain the sustainability of agricultural businesses that pay attention to ecosystem balance. This opportunity can be utilized by the people of Nogojatisari Village to be able to produce organic fertilizer from livestock waste to be able to help improve the quality of agricultural products, plantations in Nogojatisari Village and even become a source of additional income for residents.

Based on the description of the background explanation, this service aims to help the residents of Nogojatisari Village in increasing the utilization of livestock waste, as well as developing community skills to process and produce organic fertilizer. This effort is expected to support the development of the agricultural and plantation sectors, as well as assist the community in their efforts to overcome environmental problems. With this activity it is hoped that the community's environment will become cleaner, healthier, and be able to reduce the amount of waste that is wasted. Education in this activity is through counseling to residents regarding the processing of livestock waste into organic fertilizer which is expected by the community to be able to develop and manage organic fertilizer properly so that it can provide economic benefits. In addition, the feasibility test of organic fertilizers that have been made can be applied by planting vegetable crops which can be easily carried out by residents so that counseling and simulations are also carried out related to these activities so that later the community can take advantage of the potential generated from the abundant cow manure waste.

METHOD

This service activity uses three approaches, namely counseling, simulation, and utilization. The counseling stage was carried out by providing material on making organic fertilizer by utilizing cattle waste and counseling on the importance of processing waste into organic fertilizer that can be used to overcome the low C/N ratio of land in Kasah Hamlet. The simulation phase is carried out by practicing the manufacture of organic fertilizer from cattle waste directly in the field by demonstrating how to make organic fertilizer using simple and effective technology through fermentation.

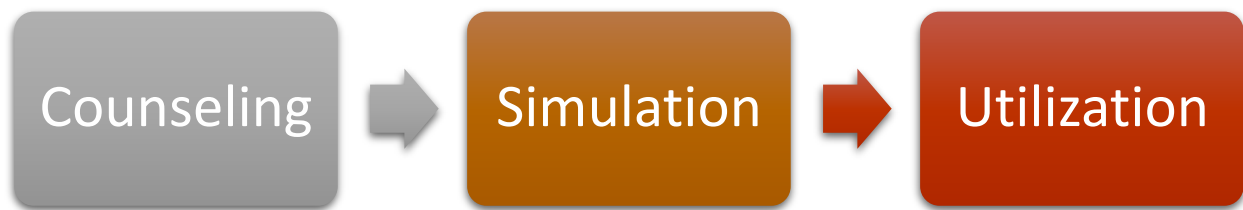


Figure 1. Chart of Implementation Methods

The three implementation methods were chosen because through the counseling method with clear delivery of material, the community will become more aware and understand what is conveyed and realized through simulations or practice so that the material that has been conveyed can be applied directly through manufacturing simulations. Then the use of organic fertilizer is carried out, namely by making it a planting medium for planting vegetable seeds including chilies, tomatoes and eggplants. This activity was attended by 32 participants who had the target aimed at farmer groups, PKK women, and youth groups so that later this empowerment could be applied in everyday life. The partner in this service activity is the Sambeng District Agricultural Extension Center, and this service activity is carried out from October to November 2022.

IMPLEMENTATION

This service activity is carried out from October to November 2022, with the following details:

Table 1. Service Implementation Stage

No	Implementation Stage	Execution time
1	Counseling and simulation of organic fertilizer production	October 10, 2022
2	Extension and simulation of planting vegetable seeds	November 03, 2022
3	Counseling regarding the care of vegetable seeds properly and correctly	November 29, 2022

Counseling Stage

The counseling stage was carried out as the initial stage of program implementation with the aim of (a) equalizing perceptions, (b) gathering information about the needs of the Kasah Hamlet community, and (c) changing the mindset of the Kasah Hamlet community. In addition to counseling, discussions were held to explore the problems faced by the Kasah Hamlet community and to find out how problems were managed around their environment. Counseling was held at the house of the Head of Kasah Hamlet, Mr. Rudi Setiawan. The implementation of counseling was carried out by delivering material by the Agricultural Extension Center and then discussions were held to find solutions to agricultural problems that occurred in Kasah Hamlet. Counseling material includes the definition of organic fertilizers, types of organic fertilizers, advantages of organic fertilizers, constraints on the use of organic fertilizers, elemental content in livestock manure, the process of making organic fertilizers, and characteristics of finished organic fertilizers (Nurhapsa et al., 2020).

Simulation Stage

The simulation stage is an applicable activity, namely the practice of making organic fertilizer from cattle waste directly. This simulation was carried out in the cowshed of the Head of Kasah Hamlet, Mr. Rudi Setiawan. The making of fertilizer was demonstrated by the Agricultural Extension Center and observed by the people of Kasah Hamlet who took part in the activity. The simulation is accompanied by a brief explanation of the use of tools and materials available in the partner area so that it is easy to apply. In addition, an explanation was also given regarding the measurements of the materials needed to make organic fertilizer, as well as how to apply it properly and correctly (Nurhapsa, 2020).



Figure 2. Process for Making Organic Fertilizer

Making organic fertilizer consists of several stages, the first stage is the provision of materials and tools. The materials used are cattle waste, decomposers, water, rice husks, and molasses. The tools used are plastic buckets, plastic drums, stirrers, hoes and tarpaulins. The second stage is the stage of the manufacturing process which involves the

participation of the Kasah Hamlet community. The following is a procedure for making organic fertilizer from cattle waste.

- a) Mix cattle waste and rice husk according to the dosage then stir until evenly distributed.
- b) Mix the molasses and decomposer in a bucket then stir until evenly distributed.
- c) Pour the molasses and decomposer mixture into the cattle waste mixture, then sprinkle it on top of the manure pile as high as 20 cm, then rearrange the cattle waste mixture on top and water it again with the decomposer solution so on until all the ingredients are used up provided that the maximum organic fertilizer height is 1 meter.
- d) Cover organic fertilizer with tarpaulin.

Utilization Stage

The utilization stage is a follow-up activity from the simulation stage, namely in the form of utilizing the results of organic fertilizer which is used as a mixture of planting media in the simulation of planting vegetable seeds in the form of tomatoes, eggplants, and chilies. This activity was carried out at the house of the Head of Kasah Hamlet, namely Mr. Rudi Setiawan, then continued at the Cattle Cages. The use of this organic fertilizer was demonstrated by the Agricultural Extension Center and was attended by the people of Kasah Hamlet who took part in the activity. Planting vegetable seeds that utilize organic fertilizers as a mixture of planting media is accompanied by a brief explanation from the Agricultural Extension Center on the benefits of using organic fertilizers, how to apply organic fertilizers, how to plant and care for vegetable seeds, and the importance of planting vegetable seeds in the yard.

RESULT AND DISCUSSION

The realization of the implementation of this service work program is carried out in 2 forms of activity, namely counseling and simulation. The counseling stage was carried out by providing material to the people of Kasah Hamlet, Nogojatisari Village, Sambeng District, Lamongan Regency regarding the utilization of cattle waste. Then, a Simulation Phase was carried out by demonstrating how to make Organic Fertilizer as a form of utilizing cattle waste using a simple and effective method. The following details the realization of the implementation of the community service program that has been carried out:

1. Implementation of Counseling on the Utilization of Cattle Waste

Implementation of counseling activities regarding the use of cattle waste in Kasah Hamlet, Nogojatisari Village, Sambeng District, Lamongan Regency began with field observations. This field observation was carried out to obtain information about the condition of the environment and the surrounding community. From the results of field observations, information was obtained that even though they are farmers, most of the people of Kasah Hamlet are known to have at least 2 cows as livestock. In addition, based on information obtained from Mr. Rudi Setiawan as the Head of Kasah Hamlet, Nogojatisari Village, Sambeng District, Lamongan Regency, it is known that the total number of cattle in Kasah Hamlet is approximately 250 heads. However, he also said that

even though every Dusun Kasah community has at least 2 cows, the community's awareness of processing livestock waste is still in a very low category. So that with these environmental conditions, it is necessary to hold activities for the utilization of the implementation of the community service program in the form of utilizing cattle waste as an alternative to support sustainable agriculture in Kasah Hamlet.



Figure 3. Counseling on the Utilization of Cattle Waste by BPP Sambeng

Counseling on the utilization of cattle waste in Kasah Hamlet was carried out in collaboration with the Sambeng District Agricultural Extension Center (BPP) and was carried out formally on Monday, October 10, 2022 by gathering farmer groups from Kasah Hamlet at the house of Mr. Rudi as the Hamlet Head. In this activity, the material was delivered directly by Ms. Dwi Estuning Hidayah, SP. as a representative from the Agricultural Extension Center (BPP) Sambeng District. The counseling material presented included Indonesian agricultural problems, understanding and types of organic fertilizers, the advantages of organic fertilizers in terms of physical function; chemistry; and biology, constraints on the use of organic fertilizers, elemental content in livestock manure, the process of making organic fertilizers, and characteristics of ready-to-use organic fertilizers. After the presentation of the extension material, the activity continued with a discussion to encourage active participation from the community. In this discussion activity, some people asked questions and the questions would be answered directly by the Agricultural Extension Center (BPP) of Sambeng District.

Implementation of counseling on the utilization of cattle waste was carried out once before the practical simulation of organic fertilizer production was carried out. However, community participation in participating in this activity is still quite lacking, it is evident that out of 30 laws only 12 people took part in this counseling activity. So that this is the main obstacle faced in the implementation of counseling as an initial activity in the service to be carried out.

2. Implementation of Organic Fertilizer Making Simulation

The simulation of making organic fertilizer was carried out with direct demonstration activities to the community and farmer groups of Dusun Kasah by the Agricultural Extension Center (BPP) of Sambeng District in the cattle barn owned by Mr. Rudi as the Head of Hamlet Kasah. The simulation for making organic fertilizer is carried out by utilizing cattle waste owned by the people of Kasah Hamlet. As previously known, there is quite a lot of cattle manure in Kasah Hamlet, but it is not utilized by the Kasah Hamlet community as organic fertilizer. Therefore, the practice in this activity is one of the solutions given as an answer to the environmental problems that exist in Kasah Hamlet. In addition, the simulation of making organic fertilizer is also carried out by applying simple and effective methods that have been adapted to the abilities of the surrounding community. Thus, the simulation process for making organic fertilizer is carried out in several stages, namely the first stage is the provision of materials and tools. The materials used are cattle waste, decomposers, water, rice husks, and molasses. The tools used are plastic buckets, plastic drums, stirrers, hoes and tarpaulins. The second step is to mix livestock waste and rice husk according to the dosage of 1:1 then stir it until it is evenly distributed. After that, moisten the mixture of livestock waste with rice husk once every 20 cm with a decomposer solution by sprinkling it on top. The third stage is to repeat the first and second stages continuously until the mixture of ingredients accumulates and reaches a height of 1 meter. Then, the final stage of making fertilizer is carried out by covering the piles of livestock waste and rice husks using a tarpaulin. After carrying out all stages of the simulation for making organic fertilizer, the next step that must be carried out is to check every week to observe the results of the organic fertilizer obtained.



Figure 4. Demonstration of Making Organic Fertilizer in Kasah Hamlet

According to Suherman & Kurniawan (2017), organic fertilizer that has been made initially will grow mushrooms and still smell strong due to the release of ammonia gas in the first week. Then, the organic fertilizer will be ready for use or ready for harvest if the fermentation process has been going on for 2 weeks - 1 month. Based on the information submitted by Mr. Said as a representative from the Agricultural Extension

Center (BPP) of Sambeng District who has been a guide for a simulation on making organic fertilizer in Kasah Hamlet which was carried out on Monday, 10 October 2022 right after counseling on the utilization of cattle waste, it was said that this type of Decomposers actually greatly affect the duration of the fermentation process in fertilizers. It is proven that the EM4 type decomposer is an example of a decomposer that can help the organic fertilizer fermentation process for 1 month. While the type of decomposer used in this simulation of making organic fertilizer is the Tangguh Decomposer which can actually help the organic fertilizer fermentation process for 2 weeks - 1 month.

After carrying out a simulation of making organic fertilizer, the next step is to make weekly observations on the organic fertilizer that has been made to determine the results of the fertilizer obtained. based on observations it is known that in the first week, fermentation of fertilizers has not occurred evenly. This proves that the fertilizer produced still has a pungent odor and the temperature is still quite high. Whereas in the second week of observations made directly with representatives from the Agricultural Extension Center (BPP) of Sambeng District, it was found that the organic fertilizer produced was ready to use or ready to be harvested. It is proven that the characteristics of the fertilizer produced are in accordance with the characteristics of mature organic fertilizer, namely the fertilizer constituent materials have been destroyed due to the composting process, the crumb texture is not sticky and not hot, the color is blackish brown, and does not smells. The following details the results of observations of simulation activities for making organic fertilizer:

Table 2. Observation of the results of the Organic Fertilizer Making Simulation Activity

No	Observation Time (Sunday)	Observation result
1	I	Organic Fertilizer still has a quite pungent odor, slightly high temperature (warm) and there are still clumped impurities and has not changed color
2	II	Organic Fertilizer is ready to use or ready to be harvested because some of the fertilizer ingredients have been destroyed due to the composting process, the texture of the crumbs is not sticky and not hot, the color is brown-black even though there is still some dirt that is lumpy and hasn't changed color, but it doesn't smell.
3	III	Organic Fertilizer is ready to use or ready for harvest because most of the fertilizer ingredients have been destroyed due to the composting process, the texture of the crumbs is not sticky and not hot, the color is brown-black even though there are still a few lumps of dirt that have not changed color, but it is not smells.

No	Observation Time (Sunday)	Observation result
4	IV	Organic Fertilizer is ready to use or ready for harvest because all the ingredients for the fertilizer have been destroyed due to the composting process, the crumb texture is not sticky and not hot, the color is brown-black and has no odor.

From the implementation of the above simulation activities, organic fertilizer is produced which is quite good. Even though in carrying out the activities, there were several obstacles experienced, namely the lack of participation of the Kasah Hamlet community in participating in the simulation activities due to unfavorable weather conditions, namely heavy rains right before the simulation activities were to begin, causing the road access to the cattle shed belonging to the hamlet head to be hampered. In addition, due to unpredictable weather conditions such as heavy rains, the main ingredient in the simulation for making organic fertilizer, namely cattle waste owned by Mr. Rudi as the Head of Kasah Hamlet, contains too much water. This is because the manure is stored outside the livestock barn, causing the livestock waste to become too wet. As a result, the organic fertilizer produced from this simulation activity contains too much water (too wet). included in the pretty good category.

3. Implementation of Utilization of Organic Fertilizers by Carrying Out Vegetable Seed Planting Simulation

The implementation of organic fertilizer utilization activities is carried out by using it as a mixture of planting media in planting vegetable seeds. This activity was carried out as a way to test the quality of the organic fertilizer produced during the previous organic fertilizer manufacturing simulation activity. In addition, this activity was also carried out to increase the awareness of the people of Kasah Hamlet regarding the importance of adopting an environmentally sensitive life and increasing public understanding of how to properly plant and care for plants. With this activity, it is hoped that the people of Kasah Hamlet will be more enthusiastic about planting vegetables independently in order to take advantage of the existing environmental conditions. This vegetable seed planting activity was carried out on Thursday, 03 November 2022 at the house of Mr. Rudi Setiawan as the Head of Kasah Hamlet. If previously, the target of activities that took part in a series of fertilizer production activities were gentlemen of the Kasah Hamlet Farmer Group, then in this vegetable seed planting activity the target of the activity was PKK women. This is done so that mothers are aware of the importance of planting vegetables on the land or yard in order to save expenses and preserve nature.

In the activity of utilizing organic fertilizer by carrying out a simulation of planting vegetable seeds, demonstrations and explanations regarding good planting methods were directly explained by representatives from the Agricultural Extension Center (BPP) of Sambeng District. In this vegetable seed planting simulation activity, there are 3 types of seeds used, namely chili seeds, tomato seeds and eggplant seeds. In its implementation, there are several stages that must be carried out, namely the first stage is preparing tools and materials. The tools needed in this vegetable seed planting simulation activity are Plastic Cups, Buckets, and so on. While the materials needed are

soil, rice husk, organic fertilizer and water. The second stage is to make the planting medium by mixing soil, rice husk and organic fertilizer with a ratio of 1:1:1. After that, the third step is to put the mixed planting media mixture into the plastic cup where the bottom has been perforated, then press down on the planting media to make it compact. The fourth stage is to add vegetable seeds, each cup containing 1 vegetable seed. After that, the last stage of planting is carried out, namely watering the seeds that have been put in a plastic cup that already contains the planting medium with full water. This full watering of water is carried out with the aim of accelerating the seed imbibition process so that seed germination can take place quickly. After all stages of planting have been completed, the next step that must be taken is to observe the growth of vegetable seeds every week.



Figure 5. Simulation of Planting Vegetable Seeds with PKK Women in Kasah Village

Vegetable seeds that have been planted will generally carry out the growth process from germination to leaf growth according to the type of each seed. It is known that chili plant seeds will germinate within 4 days, nurseries produce 4 leaves for 26 days and grow to bear fruit for 70-120 days. Meanwhile, tomato plant seeds will germinate within 3 days, nurseries produce 4 leaves for 26 days and grow to bear fruit for 90 days. Then the eggplant seeds will germinate within 4 days, nurseries produce 4 leaves for 26 days and grow to bear fruit for 70-80 days. Therefore, the following details the results of observing the growth of vegetable seeds that have been carried out.

Table 3. Observation of Vegetable Seed Growth Results

No	Observation Time (Sunday)	Observation result
1	I	• Chili and eggplant seeds have started to germinate on day 4 • Tomato seeds have started to germinate on day 3 and the plant cotyledons have been lifted from the soil surface

2	II	- Chili and eggplant seeds have started to experience early growth where the cotyledons of the plants have been lifted from the soil surface - Tomato seedlings have started to produce 1 leaf
3	III	- Chili and eggplant seeds begin to appear 1 to 2 leaves - Tomato seedlings have started to appear 3 to 4 leaves
4	IV	- Chili and eggplant seeds begin to appear 3 to 4 leaves - Tomato seedlings have started to appear 5 to 6 even leaves

From the results of the simulation of planting vegetable seeds as a form of organic fertilizer utilization, it is known that the organic fertilizer produced is proven to be an efficient planting medium for plant growth. Apart from that, by holding this seed planting simulation activity, the people of Kasah Village became more enthusiastic about utilizing cattle waste to become organic fertilizer and began to be interested in implementing independent living by growing vegetables in their home environment. It is proven that a series of community service activities carried out in Kasah Hamlet received active participation from the surrounding community.



Figure 6. Socialization of Planting and Distribution of Vegetable Seeds with PKK woman in Kasah village

Then, a series of community service activities in Kasah Hamlet were closed with the Socialization of Planting and Distribution of Vegetable Seeds which was carried out on November 28, 2022. In this activity, many PKK women who attended participated. In this counseling activity, material was presented on how to properly plant or transfer plant seeds to a larger place and how to properly care for plants, where the presentation of the material was delivered directly by the implementing committee from the Department of

Biology. After the material presentation was finished, the activity continued with joint discussions to encourage active community participation. In this discussion activity, there were several women who asked questions about how to deal with vegetable pests using natural pesticides that are not dangerous. After the discussion process was completed, the activity continued with the distribution of vegetable seeds that had grown to the Kasah hamlet community and the activity continued with the closing ceremony of a series of community service activities. The community service activity that was carried out in Kasah Hamlet was closed by distributing vegetable plant seeds to the Kasah Hamlet community with the aim that the Kasah Hamlet community could take the first steps to grow vegetables independently in their yards by utilizing cow manure waste as one of the growing media. effective as organic fertilizer.

CONCLUSION

Service activities in the form of counseling and simulations of making organic fertilizer from cow waste with this simple method can improve the quality of farmers in Kasah Hamlet both in terms of knowledge and awareness. With this community service activity, farmers in Kasah Hamlet can optimize cow manure which has the potential to support their agricultural and plantation sectors because it can increase the C/N ratio of land so that agricultural yields will also increase. In addition, this optimization indirectly also has a good impact on the community environment to become cleaner, healthier, and able to reduce the amount of waste that is wasted. This activity can also increase the awareness of the people of Kasah Hamlet about the importance of utilizing the potential around the environment and the importance of treating waste in order to preserve nature.

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