

Awareness on the Benefits of the Adoption of Dairy Vermicomposting Technology in Selected Cooperatives in Region 02

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Abstract There is a lack of information available on dairy vermicomposting technology in the Cagayan Valley Region, which has led to its non-adoption. The Department of Agriculture (DA) and other government organizations, on the other hand, have acknowledged and funded advocacy initiatives to raise awareness about the use of dairy manure in vermicomposting technology. As a result, the goal of this study was to determine the level of awareness, utilization, and adoption of vermicomposting technology using dairy manures, as well as to identify issues and constraints in the utilization and adoption of vermicomposting using dairy waste, and to suggest possible solutions. The Likert scale, frequency, percentage, and average mean were used to assess the data collected during the interview (FGD) and (KII). The average mean of the samples was used to calculate the levels of awareness, adoption, and utilization. According to the findings, Dairy MSMEs have an average level of awareness of 3.2, indicating that most of the respondents have moderately high awareness, while the level of adoption of Dairy MSMEs has an overall scale of 3.6, indicating that most of the respondents have a high level of adoption, resulting in a high level of utilization of vermicompost dairy manure. However, according to the distribution of the respondents' issues and concerns in the vermicomposting technology using dairy animal waste, the respondents' main concern was difficulty in integrating vermicomposting technology,

lack of technical know-how, added cost in the production process, costly and limited source of capital and insufficient technical and financial support. As a result, the study suggests that capacity building and access to loan windows are steps that should be taken to increase awareness and utilization of technology to strengthen respondents' knowledge, abilities, skills, behavior, and incomes in determining agricultural long-term strategy.

Keywords Adoption, Awareness, Dairy, Utilization, Vermicomposting

1. Introduction

With the advent of increasing interest in the adoption of sustainable and organic methods in the dairy industry, the importance of adopting vermiculture technology in the processes of dairy waste composting is beginning to be widely recognized. Kavita et al. [1] regarded vermicomposting as a clean, sustainable, and zero-waste approach to manage organic wastes but there are still some constraints in the popularization of vermicomposting. Instead of increasing research in the field of vermicomposting, they pointed that practical application of vermicomposting needs more attention.

The use of vermicomposting dairy animal manure had been of increasing interest in the dairy industry; however, dairy farmers still face many challenges when it comes to managing animal waste manure. It was stated that it is necessary to guide farmers about vermicomposting and the appropriate use of vermicompost by organizing various training and extension activities [1].

In the study of Cristina et al. [2], it was reported that the effects of vermicomposting on plant-soil systems are not yet fully understood which resulted in the unawareness of the farmers on the significance of the technology in increasing crop production and its contribution to the mitigation of the emission of greenhouse gasses resulting to global warming. This is similar to the study of Kavita et al. [1] wherein they also pointed that one of the major constraints is the lack of awareness and proper knowledge regarding vermicomposting and the use of vermicompost.

Some of the potential benefits of vermicomposting technology are that it enhances plant growth, suppresses disease in plants, increases porosity and microbial activity in the soil, and improves water retention and aeration. It also benefits the environment by reducing the need for chemical fertilizers and decreasing the amount of waste going to landfills. Vermicompost production is trending up worldwide and it is finding increasing use especially in Western countries, Asia-Pacific, and Southeast Asia [3].

In addition, reduced use of water for irrigation, reduced pest attack, reduced termite attack, reduced weed growth; faster rate of seed germination and rapid seedlings growth and development; greater numbers of fruits per plant (in vegetable crops) and greater numbers of seeds per year (in cereal crops) are also some of the beneficial effects of the vermicompost usage in agricultural production [4].

Vermicomposting is the end product of earthworms' consumption of organic materials in the form of nutrient-rich "castings" and degraded bedding materials. Dairy producers are in an advantageous position to adopt and incorporate this vermicomposting technology into their manure handling systems due to the vast amounts of resources available from the farm such as manure and crop residues that can be used as bedding and feedstock for the worms [5].

However, despite the benefits associated with vermicomposting, the practical application and adoption of the technology using dairy manure are still at their early stage. In Cagayan Valley, for example, vermicomposting using refuse such as kitchen waste, garbage, and other waste materials has been a common practice but only a few or close to none are practicing or adopting vermicomposting using dairy animal manure in the region.

In the Province of Isabela, there is also a dearth of information on dairy vermicomposting technology which resulted in the non-adoption of the technology. However, the Department of Agriculture (DA) and the other government agencies have recognized and supported the advocacy campaigns on the awareness in the adoption of

vermicomposting technology using dairy manure, hence this study.

In addition, this study would lead to the sustainable protection of the environment in support of the Ecological Waste Management (RA 9003) of the Philippines. As dairy farmers would engage or adopt this technology, they could increase their income through the increase of their yield production and this, in turn, could contribute to the mitigation of environmental pollution or global warming. Thus, the study aimed to determine the level of awareness, utilization, and adoption of vermicomposting technology using dairy manures.

2. Objectives

This study generally aims to review the awareness in the adoption and use of vermicompost technology using dairy animal waste in Region 02, Philippines.

Specifically, this study aims to achieve the following:

1. Determine the demographic profile of the respondents;
2. Assess the level of awareness of the dairy practitioners on the use of:
 - a To evaluate the level of utilization of the vermicompost in the production and farm operation of practitioners; and
 - b To evaluate the level of adoption of the vermicompost in the production and farm operation of practitioners;
3. Identify issues and constraints in the utilization and adoption of vermicomposting using dairy waste and recommend possible solutions;
4. Recommend intervention to intensify the awareness and utilization of vermicomposting technology.

3. Review of Related Literature

According to Nilo et al. [6] in their study, they pointed out the fact that the bulkiness of producing the nutrient content equivalent to inorganic fertilizer dampens the enthusiasm of the prospective vermin entrepreneurs to adapt to vermicomposting. However, if we are to consider and weigh the advantages or benefits derived from composting using dairy animal waste, it would mean to the contribution in mitigating environmental pollutions or gas emissions which is priceless in terms of health benefits and environmental safety of all the living in this polluted universe.

In one of the dairy congresses held at Tuguegarao City, Cagayan in 2018, it was pointed out that the same finding was also emphasized, reiterating the fact that the value or advantage of utilizing dairy animal waste would be priceless because this technology would recycle dairy manures that could cause environmental pollutions which

would then lead to unprecedented calamities caused by global warming.

It was highly recommended in their study the adoption of vermicomposting using dairy animal waste as a material for vermicompost production that would contribute to the mitigation of environmental pollution, specifically in the gas emission of dairy animal wastes, and as a way of employment generation, thus increasing the income of the household farmers and improving the lives of the people in the community [6].

In addition, the study of Carlos [7] shows that in vermicomposting, the increasing trend in the number of vermin compost technology adaptors was popularized among local entrepreneurs for the reason that it is considered profitable and it maximizes the flow of materials within the farm level. He also stated that the process of utilizing the organic wastes within the farms leads to a more sustainable farming practice wherein nutrients are retained and returned to the soil through vermicompost application. Such practice would make the soil suitable for crop production and increase crop yield since the soil quality is improved.

4. Research Methodology

A. Respondents and Location of the Study

The study was conducted in Region 02, Philippines, wherein selected MSMEs, dairy cooperatives, and dairy practitioners were chosen as respondents. It was conducted from January to September 2021. Respondents of this study were the dairy farm practitioners and MSMEs in the selected municipalities in the Province of Isabela, particularly in the municipalities of Mallig, Roxas, and San Agustin, respectively.

B. Data Gathering and Instrumentation

Active dairy cooperatives, dairy farm practitioners, and dairy MSMEs in the region were identified as the target population in the conduct of the study. Request letters were then floated to the respective municipalities wherein the concerned respondents were identified. Proper communication and coordination procedures were done and followed with the help of their respective key officials. Three (3) municipalities in the region were identified to have the needed respondents and were purposively selected for the study, namely, the municipalities of Mallig, Roxas, and San Agustin, Isabela.

Primary data was gathered and obtained through questionnaires floated through virtual and face-to-face interviews, Focus Group Discussions (FGD), and Key Informant Interviews (KII). Purposive sampling was used to obtain respondents from the selected municipalities. Ten (10) respondents from the selected locations were then identified to have the qualities of the needed target population of the study. Data collected from the

respondents include their socio-demographic profiles in terms of sex, age, educational attainment, years of operation, dairy farm animals, income, and family size.

A structured questionnaire was developed and used to obtain the necessary data needed for the study. It includes a set of questions relating to their socio-demographic profiles mentioned above in the first part, questions needed for evaluating their level of awareness, adoption, and utilization of the vermicomposting technology in its second part, and the issues and problems identified by the respondents in its last part.

Statistical tools used for data analysis include the Likert scale, frequency, percentages, and, average mean. Descriptive analysis was used to explain the socio-demographic characteristics of respondents in the study area.

C. Data Analysis

The gathered data from the interview were analyzed using the Likert scale, frequency, percentage, and average mean. Descriptive analysis was used to explain the socio-demographic characteristics of respondents in the study area. The level of awareness, adoption, and utilization were analyzed by computing the average mean of the samples. The following were the scale for the interpretation:

Likert Scale Description	Likert Scale	Likert Scale Interval
Low	1	1.00-1.79
Moderately Low	2	1.80-2.59
Moderately High	3	2.60-3.39
High	4	3.40-4.19
Very High	5	4.20-5.00

*Five Point Likert Scale based on the study of Geraldine et al. [8].

Actual observations and documentation were also undertaken to validate the data.

5. Results and Discussions

A. Socio-Demographic Profile of the Respondents

The socio-demographic profile of the respondents in terms of sex, age, educational attainment, years of operation, dairy farm animals, income, and family size was determined in the conduct of the study and the results are as follows:

a Socio-Demographic Profile of the Respondents in terms of Sex

Table 1 shows the socio-demographic profile of the respondents in terms of their sex. As seen in the table, the majority (70%) of the respondents were females. The results indicate that women could also be a part of the

farming activities, contrary to the findings of Obi et al. [9], which reported a higher percentage of males (67.2%) as the herdsmen/livestock farmers' structure compared to females (32.8%) in Anambra State, Nigeria. It also contradicts the findings of John et al. [10] who reported a percentage of 59.6% of males engaging in dairy farming compared to a percentage of 40.4% females in Uganda.

Table 1. Socio-Demographic Profile of the Respondents in terms of Sex

Sex	Frequency	Percentage
Male	3	30
Female	7	70
Total	10	100

b Socio-Demographic Profile of the Respondents in terms of Age

Table 2. Socio-Demographic Profile of the Respondents in terms of Age

Age	Frequency	Percentage
48-50	4	40
51-53	1	10
54 and above	5	50
Total	10	100
Average Age		

Table 2 indicates the socio-demographic profile of the respondents in terms of their age. Base on the gathered results, most of the respondents belong to ages 54 and above. It indicates that the vermicomposting technologies were mostly adopted by said age group. These results, however, were contrary to the findings of John et al. [10] in their study, wherein the largest percentage of the age group that adopts the said technology was within the age bracket of 30-40 years (46.54%).

c Socio-Demographic Profile of the Respondents in terms of Educational Attainment

Table 3. Socio-Demographic Profile of the Respondents in terms of Educational Attainment

Educational Attainment	Frequency	Percentage
Elementary	1	10
High School	7	70
College	2	20
Total	10	100

Table 3 shows the socio-demographic profile of the respondents in terms of their educational attainment. The results of the interview shown in the table indicate that most of the respondents were high school graduates, 20% of them were college graduates and 10% of them were elementary graduates. The results indicate that majority of the practitioners were high school graduates, which is

similar to the findings of Khayali et al. [11], wherein 20 percent of the respondents in their study were educated up to high school level, followed by middle school and primary school level.

d Socio-Demographic Profile of the Respondents in terms of Years of Operation

Table 4. Socio-Demographic Profile of the Respondents in terms of Years of Operation

Years of Operation	Frequency	Percentage
1-5 years	7	70
6-10 years	2	20
11 years above	1	10
Total	10	100

Table 4 indicates the socio-demographic profile of the respondents in terms of their years of operation. It is shown in the table that in the conducted interview, the majority of the respondents were engaged for 1-5 years of using the vermicomposting technology, 20% of them engaged for about 6-10 years of operation and, 10% of them engaged for more than 11 years of the technology operation. Contrary to the findings of Uddin et al. [12], the majority (40.18%) of their respondents had about 10 years of experience, and the least number of farmers (14.73%) had more than 20 years of rearing experience.

e Socio-Demographic Profile of the Respondents in terms of Dairy Farm Animals

Table 5. Socio-Demographic Profile of the Respondents in terms of Dairy Farm Animals

Dairy Farm Animal	Frequency	Percentage
Carabao	6	60
Cattle	4	40
Total	10	100

The table above shows the socio-demographic profile of the respondents in terms of their dairy farm animals. Based on the gathered results shown in the table, in terms of dairy farm animals, Table 5 indicates that the majority of the respondents were engaged in raising carabao. This indicates that dairy carabao raisers dominate the dairy cattle raisers.

f Socio-Demographic Profile of the Respondents in terms of Income

Table 6 indicates the socio-demographic profile of the respondents in terms of their income. The results show that the majority of the respondents have a marginal average income of Php 1,000.00 to 17,500.00. This result contradicts the findings of Verma et al. [13], wherein they reported that the majority of their respondents (46.50%) were in the medium-income followed, by low income (27.00%) and, high income (26.50%), respectively.

Table 6. Socio-Demographic Profile of the Respondents in terms of Income

Income Range	Frequency	Percentage
P1,000.00 - P17,500.00	6	60
P17,501.00 - P34,001.00	3	30
P34,000.00 and above	1	10
Total	10	100

g Socio-Demographic Profile of the Respondents in terms of Family Size

Table 7. Socio-Demographic Profile of the Respondents in terms of Family Size

Family Size	Frequency	Percentage
1-2	2	20
3-4	4	40
5-6	4	40
Total	10	100

Table 7 shows the socio-demographic profile of the respondents in terms of their family size. As seen in the table, the results indicate that 40% of the respondents have family sizes of 3-4 and 5-6 members, respectively. This result coincides with the findings of Satyanarayan et al. [14] wherein they revealed that the majority (68.33%) of their respondents had big size families followed by the small size of families (31.67%). The family size of dairy animal owners had a negative but non-significant relationship with the adoption of improved dairy husbandry practices.

B. Level of Awareness, Adoption, and Utilization of the Dairy Practitioners

The level of awareness, adoption and utilization of the vermicomposting technology of the dairy practitioners were evaluated in the conduct of the study and the results are as follows:

a Level of Awareness of the Dairy MSMEs on the Use of Vermicompost Dairy Manure in Farming

Table 8 shows the level of awareness of the dairy MSMEs on the use of vermicompost dairy manure in farming. Based on the results shown in the table, it indicates that the level of awareness of the Dairy MSMEs has an average level of awareness equivalent to 3.2, which means that most of them have moderately high awareness. This means that the respondents were generally aware of the use of vermicomposting technology using dairy manure in farming. In the study of Jeffrey et al. [15], it was pointed out that many vermin raisers were beginners who adopted vermiculture for less than one year, as revealed by 15 out of 47 respondents. Next in rank was 1-2 years with a total of 11 or 23.40%, followed by 4-5 years with 17.02%, then 2-3 years and 5 years and above with 6 or 12.77% and lastly, 3-4 years with 1 or 2.13%.

Their data revealed that 75% of the respondents had a medium level of knowledge and had a strong favorable attitude (74.17%), while the 69.17% of the respondents had a medium practice level towards vermiculture technology.

Table 8. Level of Awareness of the Dairy MSMEs on the Use of Vermicompost Dairy Manure in Farming

Scale	Frequency	Percentage
1 – Low	1	10
2 – Moderately Low	1	10
3 – Moderately High	4	40
4 – High	3	30
5 – Very High	1	10
Total	10	
Overall Scale	3.2	Moderately High

b Level of Adoption of Vermicompost Dairy Manure in Farming

Table 9. Level of Adoption of Vermicompost Dairy Manure in Farming

Scale	Frequency	Percentage
1 – Low	2	20
2 – Moderately Low	1	10
3 – Moderately High	1	10
4 – High	1	10
5 – Very High	5	50
Total	10	
Overall scale	3.6	High

Table 9 indicates the level of adoption of vermicompost dairy manure in farming. The results show that the level of the adoption of the Dairy MSMEs has an overall scale equivalent to 3.6, which means that most of the respondents have a high level of adoption. Swetha et al. [16], in their study, revealed that about 56.67% established the vermicompost as an enterprise, and 41.18% of respondents who adopted belonged to high adoption level. All their respondents fully adopted the recommended practices concerning pit construction with recommended size and method of watering. While 96.67% considered recommended points for selection of the site and sequential method of filling the pit as per the procedure, 95.00% fully adopted the method of harvesting and 93.33% adopted the practice of several worms to be released/m².

c Level of Utilization of Vermicompost Dairy Manure in Farming

Table 10 shows the level of utilization of vermicompost dairy manure in farming. As seen in the table, the results indicate that the level of utilization of the vermicompost dairy manure in farming has an overall scale equivalent to 3.7, which means that most of the respondents have a high

level of utilization. Liyue et al. [17] stated that the utilization of vermicompost in agricultural productivity increase has been largely demonstrated.

Table 10. Level of Utilization of Vermicompost Dairy Manure in Farming

Scale	Frequency	Percentage (%)
1 – Low		
2 – Moderately Low	2	20
3 – Moderately High	2	20
4 – High	3	30
5 – Very High	3	30
Total	10	100
Overall Scale	3.7	High

C. Issues and Constraints in the Utilization and Adoption of Vermicomposting using Dairy Waste

The issues and constraints in the utilization and adoption of vermicomposting using dairy waste were identified in the conduct of the study. The graph shows the distribution of the respondents’ issues and concerns in the vermicomposting technology using dairy animal waste.

As seen in figure 1, it was identified that the respondents’ main concern (30%) was its added costs in the production process in the dairy farm in adopting the vermicomposting technology. The costly technology and limited sources of capital for acquisition and implementation of the vermicomposting technology in the farm were also stated by 20% of the respondents. This may be due to the higher cost of adopting organic fertilizer, like using dairy animal waste, than synthetic fertilizer which serves as an obstacle for farmers to adopt

organic farming [1].

Findings also found that 20% of the respondents identified concerns on the lack of technical know-how about vermicompost technology. This result is similar to the study of Kavita et al. [1] wherein they stated that one of the major constraints is the lack of awareness and proper knowledge regarding vermicomposting and the use of vermicompost. It is necessary to guide farmers about vermicomposting and the appropriate use of vermicompost by organizing various training and extension activities.

In addition, 20% of the respondents stated that it is difficult for them to integrate the vermicompost technology using dairy animal manure in their activities on the farm. This may be due to their lack of proper knowledge in using the technology. It is then necessary to guide farmers about vermicomposting and the appropriate use of vermicompost by organizing various training and extension activities [1].

Furthermore, insufficient technical and financial support from the government for green dairy technologies was also identified by the remaining 10% of respondents. It was stated by Kavita et al. [1] that the mass application of vermicompost is not achieved due to the failure of policy implementation related to vermicompost technology.

Based on this data, it can be interpreted that there are still concerns that need to be further addressed in the adoption of the dairy vermicomposting technology. Future research should focus on these issues. This will help in increasing the awareness of farmers in adopting dairy vermicomposting technology.

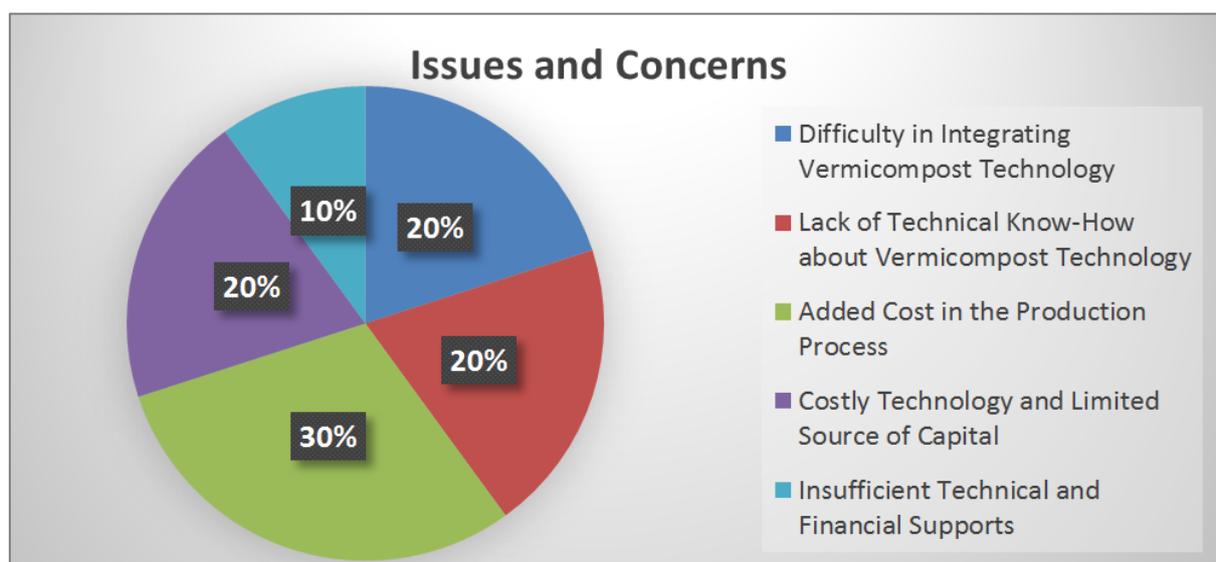


Figure 1. Distribution of the Respondents’ Issues and Concerns

D. Interventions to Intensify the Awareness and Utilization of Vermicomposting Technology

This is based on the identified issues and concerns raised by respondents using vermicomposting technology with dairy waste. As a result, this intervention suggests that the following steps be taken to increase awareness and utilization of the aforementioned technology:

- **Capacity Building** - Strengthening the respondents' knowledge, abilities, skills, and behavior, as well as improving institutional structures and processes, so that the respondent can meet its mission and goals in terms of technical know-how in utilizing the vermicomposting technology. It is the ability to take advantage of the potential for further growth, allowing the respondent to advance even further and face any challenges that may arise along the way.
- **Access to Loan Windows** - Credit availability is a key aspect in determining agriculture's future orientation. Poor people in emerging nations face a credit crunch that prevents them from investing and growing their income. Thus, access to loan windows is an antidote to rural poverty alleviation and it encourages the adoption of the respondents to new technologies like vermicomposting that will increase farmers' income and thus alleviate their poverty. Although the vermicomposting technology is still in its infant stage, it will still benefit the respondents to know that access to loan windows is available for them as they continue to adopt and utilize the said technology.

6. Conclusion and Recommendations

The level of awareness, utilization, and adoption of vermicomposting technology using dairy manures in Region 02 was reviewed and evaluated in this study. According to the findings, Dairy MSMEs have an average level of awareness of 3.2, indicating that most of them have moderately high awareness, while the level of adoption of Dairy MSMEs has an overall scale of 3.6, indicating that most of the respondents have a high level of adoption, resulting in a high level of utilization of vermicompost dairy manure.

The socio-demographic profile of the dairy practitioners was also determined in terms of sex, age, educational attainment, years of operation, dairy farm animal, income, and family size. Furthermore, several issues and constraints in the utilization and adoption of vermicomposting using dairy waste were identified. According to the distribution of the respondents' issues and concerns in the vermicomposting technology using dairy animal waste, the respondents' main concern was difficulty in integrating vermicomposting technology, lack of technical know-how, added cost in the production process, costly and limited source of capital and

insufficient technical and financial support.

Possible solutions and interventions were recommended to intensify the awareness and utilization of the vermicomposting technology. As a result, the study suggests that capacity building and access to loan windows are steps that should be taken to increase awareness and utilization of technology to strengthen respondents' knowledge, abilities, skills, behavior, and incomes in determining agricultural long-term strategy.

Vermicomposting using dairy manure is still considered in its infant stage in Region 02. Although it has started a long time ago by practicing other methods of vermicomposting, dairy farmers did not gain momentum in the adoption of the technology using dairy animal waste due to the influences of several issues and concerns in adopting the said technology.

As stated in the findings of this study, the dairy practitioners in the Cagayan Valley still need to further their knowledge in the practical application of adopting the vermicomposting technology using dairy manure. It is necessary to guide the dairy farmers about the appropriate use of dairy vermicomposting to increase their awareness of the benefits of integrating the said technology. Governmental support from the appropriate agencies also needs to further their support, both in technical and financial, to the dairy practitioners for them to be able to integrate the vermicompost technology.

Future in-depth research should focus on the various challenges, issues, and problems faced by the dairy practitioners identified in this study. This will help in increasing the awareness of farmers in adopting dairy vermicomposting technology.

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