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To cite this article: S Adibrata *et al* 2021 *IOP Conf. Ser.: Earth Environ. Sci.* **926** 012008

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Submission date: 14-Mar-2023 11:31AM (UTC+0700)

Submission ID: 2036769907

File name: 021_-1_Adibrata_et_al_-The_perception_level_on_the_impact.pdf (1.05M)

Word count: 3268

Character count: 17315

The perception level on the impact of integrated livestock-fish production systems towards the environmental pollution

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Abstract. The integrated farming activities have become more popular in the last decade. It expects to increase productivity by optimizing the land and minimizing environmental pollution. The study aims to understand the perception level of society towards the environmental pollution of the integrated livestock-fish production system on raising catfish and laying duck (*Clarias sp* and *Anas platyrhynchos*). The study was conducted in Desa Balunijuk, Bangka. The questionnaire was used for the data collection technique through a face-to-face interview by following the health protocol of Covid-19. Two stages of data collection were applied: before and after treatment of Probio_Fm. Qualitative descriptive was employed to analyze the data. The respondents were the society who lived nearby the location of the study. A mixture of probiotics was employed on the feed and the catfish pond. The study found that the perception was significantly different between before and after treatment of Probio_Fm particularly on the negative environmental effects such as odor pollutants due to unmanaged animal waste. It occurred at the very beginning of the study during the wet season before the probiotic treatment. Interestingly, during the dry season, the probiotic treatment was regularly applied. The odor pollutant impact decreased even not having a bad odor at all. The waste both absorbed in the sand and was streamed through the drain pipeline. However, most of the respondents were not disturbed due to the odor pollutant surrounding the integrated livestock-fish production system. It articulated that the probiotic treatment worked effectively in unraveling the bacteria so that the pollutant level decreased drastically. The study recommended various solutions to the problems: the draining pipeline should be repaired, the animal feed should use probiotics to achieve optimal use of nutrition, consistent and effective feeding should be applied, and the cleanliness of the duck house should be properly maintained. The monitoring and evaluation of the environmental impact towards the integrated livestock-fish production system should involve relevant stakeholders such as a village government, the management, and society as a whole so that the healthy and environment-friendly integrated fisheries activity can be achieved.

1. Introduction

Pesantren Daarul Hasanah Balunijuk has a wide yard to utilize in the activity that can add the additional income of the school. The curriculum is based on entrepreneurship skills to create the young Muslim entrepreneur in Indonesia [1]. Moreover, the small and medium enterprise is currently encouraged to develop in the pandemic Covid-19 situation. The business run by the school is expected to be a role model in the economic development of Islamic boarding schools as one of the SMEs in society. The



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economic development activities of Islamic boarding schools can be in various sectors such as agriculture, fisheries, livestock, handmade product, laundry, and cooperatives [2]. The benefit earned by the SME on the integrated livestock-fish production system is to provide additional income. The advantages of this activity are low cost, time utilization, and accessible feed complete from various sources.

As the activity runs, there are side effects for the environment and human beings. The side effects are odor pollution and waste of the livestock. Odour is the unwanted smell at a certain level and time that can affect mood and emotions, stress level, and perceived health [3], and the environmental comfort [4]. An aversive odor may trigger avoidance behavior and mask other olfactory information. The breeding location should be in a remote area to avoid disturbance to society. The negative effects on the environment are the piled of waste and the bad smell [5].

The substances that lead to an odor can be easily formed in anaerobic conditions. It requires the endeavor in livestock waste management system mainly from ammonia and hydrogen sulfide gas to elude human and livestock health problems. The odor derives from the high substance of ammonia (NH₃) and hydrogen sulfide gas (H₂S), dimethyl sulfide, carbon disulfide, and mercaptans [6].

Probiotic technology can be applied to reduce odor pollution and maintain livestock health [7,8] so that the integrated livestock-fish production system activity can be environmental-friendly. Probio_Fm technology involves a role of probiotic which can be utilized for both feed processing and livestock disease control [9]. The existence of good bacteria in probiotics leads to a better digestive system of livestock so that the odor of feces reduces [10]. Astuti and Yulia argue that the use of Probio_Fm as the probiotic in feed processing can maintain the quality of feed ingredients that can be seen through its color, smell, and palatability [11].

Measuring the side effect of an integrated livestock-fish production system can be applied by using the society's perception of the activity. The perception can be negative [12] and positive [13] depending upon how the farmer can manage the waste and odor as well as to provide the benefit to the society. Based on oxford learner's dictionaries, perception is defined as the way someone notices things, especially with the senses. It means that it is a cognitive process experienced by every human being in understanding information about their environment through seeing, hearing, appreciating, feeling, and smelling. Society's perception of the odor should observe the environment with the involvement of the society [6].

Managing the environmental impact should be holistically conducted by the involvement of all stakeholders such as village government, farmers, small-medium enterprises, and society as a whole to create a healthy and environmental-friendly local business. The development of community-based enterprises is expected by the government but the environmental impact should be taken into account in anticipating future conflict. This can be accommodated by analyzing the perception of society towards the potential environmental effects. The study aims to analyze the society's perception of the odor derived from the integrated livestock-fish production system in surrounding Pesantren Daarul Hasanah Balunijuk.

2. Method

The location of the study was in Balunijuk, Bangka Regency (see figure 1). The area of Balunijuk was 12.02 km² with a population of 4,640 citizens in 2020. Balunijuk was one of the villages in the Merawang District. The village was about 27 km distance from Sungailiat, the capital of the regency, while it was about 15 km distance from Pangkalpinang, the capital city of Bangka Belitung Islands Province.



Figure 1. Geographical location of Balunijuk

A structured questionnaire and face-to-face data collection method were applied to gain primary data from 14 households who lived not more than 100 meters from the livestock-fish production activity. The data collection stages were broken into two: the first stage before conducting treatment of Probio_Fm and the second stage after applying a treatment of Probio_Fm on the animal feed. The first stage was conducted on the 5th of May while the second stage was on the 3rd of June 2021, a one-month duration. The average time needed for the interview was about three-four minutes.

3. Results and Discussion

The study aims to understand the perception level of society towards the environmental pollution of the integrated livestock-fish production system on raising catfish and laying duck. In this part, at first, it would describe the profile of the respondents in terms of their socio-economic. It was followed by the discovery of the study related to the perception of society on odor pollutants.

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3.1. Socio-Economic Profile of the Respondents

The respondents of the study were those who lived nearby the location of the livestock. The majority of respondents lived with the distance 50-100 m from their houses to the location of the livestock. While there were 14% of respondents lived with a distance less than 50 m. It identified more males than females in the study with 57% of respondents were male and the rest of the respondents were female. Those were dominantly 30-40 years old while 20-30, 40-50, and 50-60 years old were 29%, 7%, and 14% consecutively. The majority of them were just graduated at a low level of education while only 7% of them were diploma holder. It led to the type of occupation of the respondent was considered as low level of social status which were labor/driver, farmer, and not-working with 42.9%, 28.6%, and 28.6% respectively. It was no surprise that their family income per month was considered as low level of welfare using the World Bank's definition in which half of the respondents were at Rp 1,400,000 – 2,100,000 or USD 98.6 – 147.9 using the current exchange at June 2021. While there were 7.1% of respondents earned both less than Rp 1,400,000 (USD 98.6) and Rp 4,800,000 – 10,000,000 (USD 338 – 704) respectively. Those data can be seen at the following table.

Table 1. Socio-Economic Profile of the Respondents (n=14)

Variable	Frequency	Percentage (%)
Sex		
Male	6	42.9
Female	8	57.1
Age (years)		
20-30	4	28.6
31-40	7	50
41-50	1	7.1
51-60	2	14.3
Education		
No Formal School	8	57.1
Elementary School	1	7.1
Junior High School	2	14.3
Senior High School	2	14.3
Diploma	1	7.1
Income Per Month (Rupiah) *\$1=Rp 14,190 at June 2021		
< 1.4 million	1	7.1
1.4 million – 2.1 million	7	50
2.1 million-4.8 million	5	35.7
> 4.8 million	1	7.1
Distance between House and Location of Livestock		
< 50 m	2	14.3
50 – 100 m	12	85.7

3.2. The Perception towards the Integrated Livestock-Fish Production System

The perception of people nearby the location of livestock-related with the feeling of being disturbed by the activity. There were five items considering its perception, they were i) bed smell of livestock as a whole (Bd_Sml); ii) smell of waste (Sml_Wst); iii) feces of laying duck (Sml_Nt_esy_gt_rd); iv) the uneasy to get rid of the smell of livestock; and v) piled of waste.

The result of the study was broken into two stages: before and after treatment of Probio_Fm. The duration from before to after treatment was one month. The study discovered the different perception between before and after treatment of Probio_Fm was dramatically altered. The following passage would describe in detail every item before and after the treatment.

Before the treatment of Probio_Fm, every single item asked the respondent had answered with all options being chosen. It meant that the respondents varied in providing their responses. The smell of livestock as a whole and the smell of waste were the first and the second items asked in the study to know their perception of the livestock. The majority of the respondents were considered as being disturbed. It was 42.9 % respondent responded with not being disturbed.

The third item on the perception was the smell of feces of livestock. There were 21.4% of respondents respectively argued for both being disturbed and being very disturbed by the smell of feces in the location of the integrated livestock-fish production system. The difficulty to get rid of the smell was the next item asked the respondents. It was almost half of the respondents considered their being disturbed.

This was quite a similar response given in the third item. The pile-up of waste was the last item asked and the most negative responses given amongst five available items. More than 60 percent of respondents considered their being disturbed by the pile of waste. It related to the flow of waste that went to their source of water. They requested to create a new flow of waste so that it could not disturb their source of water.

Surprisingly, after treatment of Probio_Fm, all items in the questionnaire were not being disturbed (see figure 1). It indicated that the treatment of Probio_Fm run successfully. It could reduce the air pollution so that the smell on the livestock was reduced even no more at all. There were many benefits of applying Probio_Fm in the feed which was providing a positive impact on the quality of the animal environment, reducing the smell of animal feces, increasing animal health as well as improving the efficiency of the feeding [7,9,16–19].

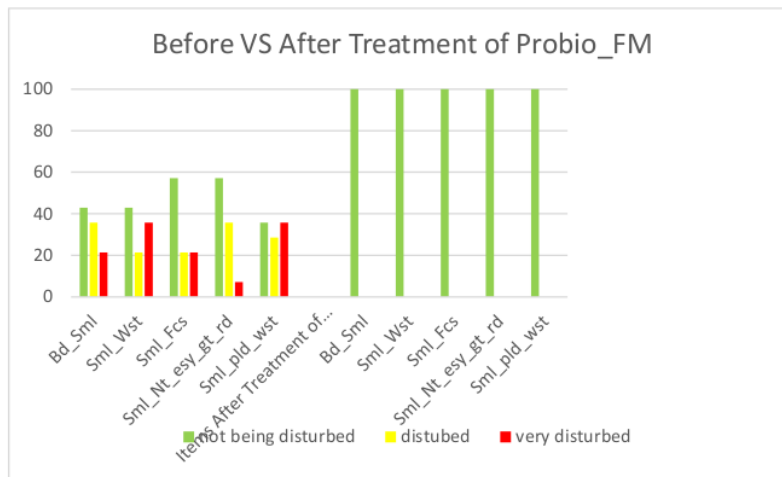


Figure 2. The comparing result between before and after treatment of Probio_Fm

4. Conclusion

The integrated farming activity was expected to maintain a better environment. Even though in the early stage most of the respondents considered as being disturbed by the activity, after the feeding treatment changed by adding up the Probio_Fm in the feed, the perception of respondents was significantly altered. None of them considered as being disturbed anymore after a one-month duration from the early interview to the last interview. It offered a vital result to stakeholders such as farmers, business actors, and local government to work hand-in-hand in ensuring no air pollutants during livestock farming. It would also benefit the society who lived nearby the livestock to enjoy a healthy life without being disturbed by the bad smell of livestock farming in the future.

Various recommendations were provided to achieve sustainable, healthy, and environmental-friendly integrated farming activity which was: repairing the drainage pipeline, optimizing the use of the probiotics in feeding, maintaining the cleanliness of the livestock environment, and monitoring the environmental impacts towards the activity. It also suggested that as the respondents were only 14 people, it should involve more samples to represent the population. The data was collected during workdays which make it difficult to get more respondents. Further study should consider weekends as the data collection time to get more available respondents. Besides, the focus of the study was on the perception of human beings. In future research, it should consider the perceptual abilities of animals in responding to their environments on the farm.

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Acknowledgment

The authors would like to thank the Institute of Research and Community Service (Indonesian: Lembaga Penelitian dan Pengabdian kepada Masyarakat or LPPM) Universitas Bangka Belitung for pleasant administration to support us during the study.

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