



Utilizing immunostimulants and probiotics for enhancing vannamei shrimp (*Litopenaeus vannamei*) aquaculture activities

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ABSTRACT

Vannamee shrimp is one of the important fisheries commodities in Indonesia. This is because vannamee shrimp are expensive, popularly consumed by people around the world, and can be cultured. However, vannamee aquaculture activities are still hampered by disease, less production, and lack of technology implementation. Kedung Pandan Village (Jabon, Sidoarjo, East Java) is one of the potential areas for vannamee shrimp aquaculture which is also constrained by these issues, so many farmers have gone out of business. This community service activity aims to increase the productivity of vannamee shrimp cultivation by administering immunostimulants and probiotics. In its implementation, this community service activity collaborates with "Putri Mandiri", a group of vannamee shrimp farmers in Kedung Pandan Village. This activity is carried out in the stages of preparation, implementation of activities (socialization-demonstration), and evaluation. Socialization and demonstration activities were carried out on August 9 2023 and were enthusiastically participated by residents. The results of this activity indicate that the knowledge of farmers in Kedung Pandan Village, Jabon, Sidoarjo has increased and can use immunostimulants and probiotics in vannamee shrimp farming activities.

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1. INTRODUCTION

Sidoarjo Regency is a large production center for vannamee shrimp (*Litopenaeus vannamei*) in East Java Province apart from Banyuwangi, Gresik and Tuban. Data from Dinas Kelautan dan Perikanan Provinsi Jawa Timur for 2015 stated that the area of aquaculture in Sidoarjo Regency reached 75,085 ha (the largest in East Java province) with the main aquaculture commodity being shrimp (Solichudin et al., 2017). Total shrimp production (tiger and vannamee shrimp) is 1,397,734 tons, with details of 652,276 tons of tiger shrimp and 745,458 tons of vannamee shrimp, making Sidoarjo Regency with the 2nd largest shrimp production in East Java Province, after Banyuwangi Regency (Dinas Kelautan dan Perikanan Provinsi Jawa Timur, 2017). Jabon District, one of the Sidoarjo Regency areas, has great potential for

vannamei shrimp farming. This is because 79% of the population has a livelihood as farmers, fish farmers and fishermen. The average income of fish farmers in this sub-district is 110 million IDR with an average number of 4-5 hectares per fish farmers land (Astuti, 2023). However, compared with the area, level of productivity of fish ponds in Sidoarjo district is still relatively low (only 18.6 tonnes/ha/year) It is much lower than other areas such as Banyuwangi which reaches 185 tonnes/ha per year. This is due to the low level of mastery of shrimp cultivation technology, poor water quality and the emergence of various types of diseases. So far, many fish farmers, especially in Kedung Pandan Village, Jabon District, still use simple traditional aquaculture systems. Some farmers are starting to upgrade their system to traditional plus but the harvest results are still not able to meet the target, so farmers still have very low income, with an average income of only IDR 1.2 million in each harvest period of 3 - 3.5 months. In fact, recent cases of mass deaths of shrimp have caused many fish farmers in the area to go out of business.

Starting from the conditions mentioned above, since 2006, a group of traditional fish farmers in Kedung Pandan Village, Jabon District joined with "Putri Mandiri", a shrimp farming group which operates in the vannamei shrimp farming (hatchery-enlargement), looking for solutions to solve these problems. The capital used is contributions from several small pond farmers. From 2008 until now, there have been 16 members who have joined pond owners with different investment amounts. The total area of the ponds of the 16 owners reached 36 hectares with an average land area of 2-3 ha/farmer. Shrimp production from "Putri Mandiri"'s traditional ponds in consumption terms currently only reaches 800 kg/ha per year. This production is still too small on the scale of traditional ponds which can reach 2.5 tonnes/ha per year. This low production is partly due to the fact that the farmers who join generally use technology that is no longer suitable, there are disease attacks, declining water quality, and a lack of knowledge about ponds. Most of the technologies used are simple traditional systems. Then, it began to be upgraded to a traditional plus system, even though with this method the harvest results still could not meet the target. The lack of optimal harvest results means that the farmers who join still have very low incomes, with an average income of only 2.9 million in each harvest period, which is 3 – 3.5 months.

To overcome this problem, the Community Service Team from the Faculty of Fisheries and Marine, Universitas Airlangga took a collaborative initiative with "Putri Mandiri" to assist vannamei shrimp aquaculture, especially in the management of vannamei shrimp cultivation using immunostimulants and probiotics. Immunostimulants are compounds that are useful for increasing the immunity of living creatures (Listiani & Susilawati, 2019). Money shrimp given antibiotics will have a high survival rate and will not get sick easily so that farmers' production can increase. Apart from immunostimulants, probiotics were also introduced by the Community Service Team to fish farmers. Probiotics will increase the nutrient absorption in digestive system of shrimp (Ali, 2020). It is hoped that the collaboration will increase the production and knowledge of farmers for vannamei shrimp aquaculture using an environmentally friendly system, and also reactivate farmers who have gone out of business, especially in Kedung Pandan Village, Sidoarjo Regency.

2. METHODS

The location for this training activity/community partnership program is located in Kedung Pandan Village, Jabon District, Kabutane Sidoarjo, East Java. Jabon District has great potential for cultivating vannamei shrimp. The population reaches 794,914 people, of which 79% earn their living as farmers, fish farmers and fishermen. The average income of fish farmers in this sub-district is 1.1 million rupiah with an average number of children of 3 - 4. The location map can be seen in Figure 1. This program collaborated with "Putri Mandiri", a shrimp farming group which operates in the vannamei shrimp farming (hatchery-enlargement).

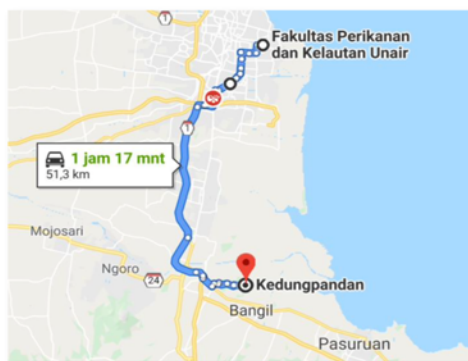


Figure 1. Location map of target partners in Kedung Pandan Village, Jabon District, Sidoarjo Regency, East Java, with a distance of approximately 51.3 km from the Community Service Team Agency

Community service activities are conducted in three stages: the preparation stage, implementation stage, and evaluation stage. This community service program was segmented into three meetings, each with distinct targets and objectives. Additional details are provided in Table 1.

Table 1. Schedule of this community service in Kedung Pandan Village

1st Meeting	Preparation Stage
Activities	Forming a team consisting of 3 lecturers and 3 students. Collaborating with “Putri Mandiri”, shrimp farming group which operates in the vannamei shrimp farming (hatchery-enlargement). Reviewing the field site and find out any problems that occur. Finding the problems that occur and provide solutions related to the introduction and application of probiotics and immunostimulants to increase vannamei shrimp production
Goals	Collaborating with community partners who experience problems with vannamei shrimp aquaculture. Understanding the problems experienced by partners and be able to provide solutions to overcome them.
2nd Meeting	Implementation Stage
Activities	Conducting a trial of making probiotics. Visiting the location and conduct outreach regarding the benefits of probiotics and immunostimulants for vannamei shrimp farming. Providing demonstrations on how to make and use probiotics and immunostimulant applications.
Goals	Increasing the knowledge of farmers of “Putri Mandiri” regarding the benefits of probiotics and immunostimulants for vannamei shrimp farming. “Putri Mandiri” farmers can apply probiotics and immunostimulants for vannamei shrimp farming.
3rd Meeting	Evaluation Stage
Activities	Conducting field site inspections after carrying out activities to evaluate the community’s ability to apply probiotics and immunostimulants Discussion with “Putri Mandiri” partners regarding possible collaborations in the future
Goals	The community has succeeded in applying probiotics and immunostimulants to their vannamei shrimp cultivation activities Carrying out sustainable collaboration with partners so that vannamei shrimp production there continues to increase

The methods used in delivering this program are socialization (presentation-Q&A) and demonstration. Socialization is a learning process that changes habits (Widiansyah et al., 2022). This socialization was carried out by members of the Community Service Team from the Faculty of Fisheries and Marine, Universitas Airlangga who were experts in the field of probiotics and immunostimulants. After socialization, demonstrations were also carried out in front of partners directly. Demonstration is a way of providing lessons through direct demonstration (Asma, 2021). By combining socialization and demonstration methods, this service activity is expected to increase partners' knowledge regarding the use of probiotics and immunostimulants up to the application stage.

3. RESULTS AND DISCUSSION

Results

This community service in Kedung Pandan Village, Jabo District, Kabutane Sidoarjo, East Java dibagi menjadi 3 stage, preparation, implementation of activities (socialization-demonstration), and evaluation. The following are the explanation of the stages.

Preparation stage

Preparatory activities had been carried out since July 18 2023. This activity included an initial meeting with farmers and representatives of Putri Mandiri to find out the current situation in the target area for community service. From the results of the initial field review and discussions with partners, 3 main problems could be investigated which can be seen in Table 2. After knowing the current situation regarding vannamei shrimp cultivation activities there, the Community Service Team from the Faculty of Fisheries and Marine, Universitas Airlangga provided a solution for using immunostimulants and probiotics to increase productivity of vannamei shrimp there. Before carrying out the activity, the team conducted a trial of making probiotics and stimulants so that the event there ran smoothly.

Trials for the multiply and application of probiotics were carried out so that the implementation of activities could run optimally. The production of probiotics was conducted using simple technology developed by the Community Service Team, Faculty of Fisheries and Marine, Universitas Airlangga. The ingredients used to make probiotics for vannamei shrimp could be seen in Table 3. The steps in multiplying probiotics can be seen in Figure 2. Probiotic starter (the bacteria used were *Bacillus amyloliquefaciens* and *Bacillus subtilis*) would be given to "Putri Mandiri" partners and accessed to be able to buy to make it easier for them.

Probiotics can be given in 4 ways, mixed with feed, mixed with natural feed, directly into water, and injection. The probiotic delivery technique can be seen in Figure 3. The Community Service Team from the Faculty of Fisheries and Marine, Universitas Airlangga used the delivery method via feeding because it was easy to apply and more effective in increasing appetite in vannamei shrimp. Shrimp health management can be done by adding probiotics to the cultivation process. Probiotics are a group of beneficial bacteria which, if given in the right manner and dose, can provide benefits to the host organism. Based on their use and mechanism of action, probiotics can be divided into several groups including: (1) probiotics that produce digestive enzymes to increase feed digestibility (Assan et al., 2022); (2) probiotics that decompose wastewater that maintain water quality (El-Kady et al., 2022); and (3) probiotics that produce anti-microbials to increase host resistance. against disease attacks (Kuebutornye et al., 2020). Currently, probiotics have been widely applied in the field of aquaculture because they are considered very environmentally friendly and can be applied to various types (invertebrate and

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invertebrate animals) and also stages (from larvae to adults) of aquaculture organisms. Probiotics are considered a solution to the use of antibiotics which have side effects that damage the environment and create antibiotic-resistant pathogens. In addition, probiotics are considered to be able to address the weaknesses of vaccination which is less effective when used on animals with simple immune systems such as invertebrate animals and the larval stage of vertebrate animals.

Table 2. Results of the Kedung Pandan Village field survey

Problem	Description	Solution
Appetite	The total feed consumed by shrimp is only 70-85% and the rest will be wasted and settle at the bottom of the water. Lack of appetite in shrimp is a problem that causes their growth to be suboptimal.	Giving probiotics can be a solution to increase appetite in shrimp. This is because probiotics function to help the intestines digest food and increase appetite. Food that is quickly digested by the intestines will be absorbed by vannamei shrimp optimally for growth. Currently the Community Service Team of the Faculty of Fisheries and Maritime Affairs, Airlangga University has succeeded in developing indigenos probiotics to increase feed digestibility (<i>Bacillus amyloliquefaciens</i> , <i>Bacillus subtilis</i>).
Water Quality	The total feed consumed by shrimp is only 70-85% and the rest will be wasted and settle at the bottom of the water. Feed that settles in waters will become ammonia and can cause high Biological Oxygen Demand (BOD) content in waters and low Dissolved Oxygen (DO) content. An unsuitable environment causes vannamei shrimp to be susceptible to disease.	Giving probiotics is expected to increase appetite so that no feed is wasted and becomes ammonia in the water. Immunostimulant is also introduced to the public because they can increase immunity in vannamei shrimp.
Lack of Innovation	The collaborator, "Putri Mandiri", do not yet know about several innovations in cultivating vannamei shrimp such as probiotics or immunostimulants.	Introducing probiotics and immunostimulants to the public Demonstrating how to use probiotics and immunostimulants to the public.

Table 3. Materials used to multiply bacteria (15 liters)

Material	Dosage
Molasses	500 mL
Fine bran	900 g
Shrimp feed	500 g
Probiotic/Bacteria	500 mL
Yeast/Fermipan	20 g
Sterile sea water	15 L

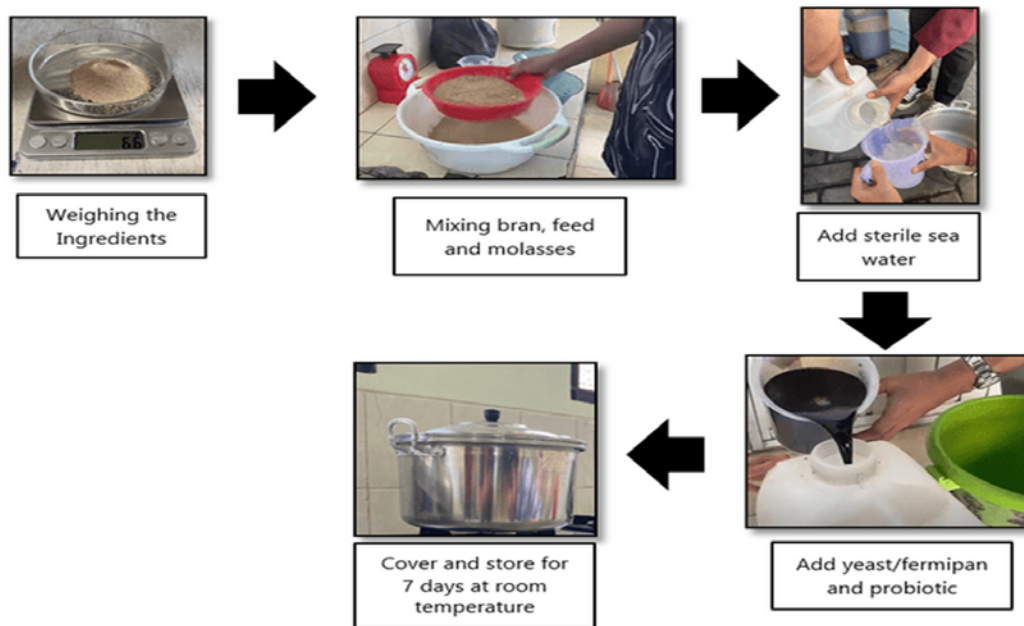


Figure 2. Steps to multiply probiotics

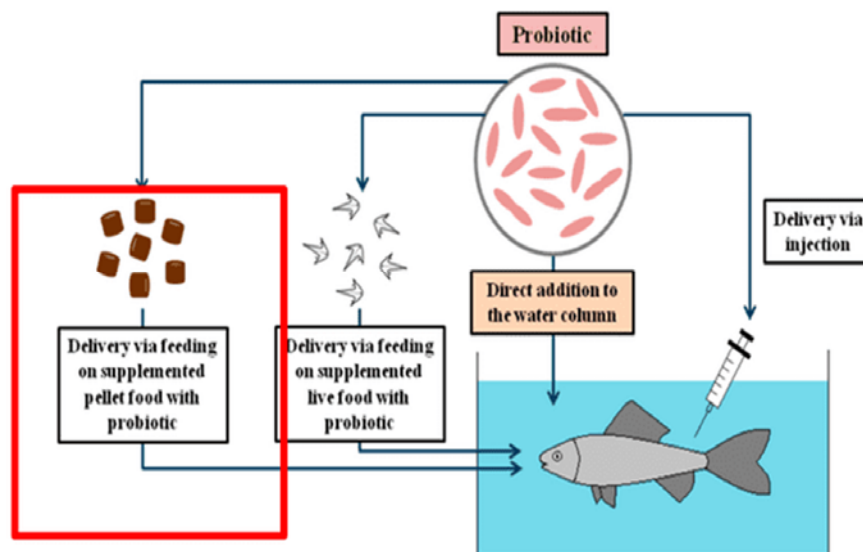


Figure 3. Pathway in providing probiotics to aquatic organisms (Jahangiri & Esteban, 2018)

The Community Service Team from the Faculty of Fisheries and Marine, Universitas Airlangga also provided immunostimulants to vannamei shrimp farmers in Kedung Pandan Village and told them how to get them. The doses given to vannamei shrimp were showed in Table 4. Immunostimulants are chemicals that activate white blood cells and therefore can make animals more resistant to infections caused by viruses, bacteria, fungi and parasites. Immunostimulants are used when aquatic organisms experience stress, there is an attack by pathogenic microorganisms and parasites, and during the

development phase (for example: larval phase of shrimp and marine fish, sex maturation) because they are susceptible to disease.

Table 4. Dosage of immunostimulants for vannamei shrimp

Method	Dosage
Deeping	3 ppm (3 ml/L) for 1 rean (5000 larvae) soaked before stocking for 10-15 minutes or during transportation (For Fry/PL-11) 5 ppm (5 – 6 ml/L) for 1 rean (5000 larvae) soaked before spreading for 10 – 15 minutes or during transportation (For Glondongan)
Mixed in feed	5 ml immunostimulant / kg feed, add 5 g Progol. Dissolve 125 ml water, mix well, mix 1 kg feed, air dry for 15-30 minutes Mix 10 ml of immunostimulant with 10 L of water and give it to 200 bags of seeds / seedlings before shipping / stocking. Mix 5 ml immunostimulant / kg feed when experiencing an attack of disease infection and environmental changes (weather, temperature, pH, salinity)

Implementation stage

This community service activity was carried out on August 9 2023 and was attended by 25 representatives of “Putri Mandiri”, as well as residents, fish farmers and officials from Kedung Pandan Village, Jabon, Sidoarjo. This activity took the form of education (socialization) regarding the role of probiotics and immunostimulants in increasing shrimp production. Socialization is a learning process that changes habits (Widiansyah et al., 2022). This socialization aimed to encourage the cultivating community of Kedung Pandan Village, Jabon, Sidoarjo to increase the use of probiotics and immunostimulants in their cultivation activities. Many studies show that immunostimulants and probiotics are good for the growth of vannamei shrimp at home and abroad (Affandi et al., 2023; Amiin et al., 2023; Kumar et al., 2023). Socialization activities could be seen in Figure 4.



Figure 4. Socialization regarding the benefits of giving immunostimulants and probiotics to vannamei shrimp

In this assistance, the Community Service Team from the Faculty of Fisheries and Marine, Universitas Airlangga also provided a direct demonstration on how to use immunostimulants and probiotics. Demonstration is a way of providing lessons through direct demonstration (Asma, 2021). Research has proven that with demonstrations or demonstrations, the learning process becomes easier to understand than just hearing or reading (Sulistyaningsih, 2020). Demonstrations in conducting socialization have been carried out and have had a good impact in its implementation (Febrian et al., 2019). This assistance

aims to enable farmers in Kedung Pandan Village, Jabon, Sidoarjo to apply immunostimulants and probiotics better. The demonstration activity of probiotics and immunostimulants can be seen in Figure 5.



Figure 5. Demonstration regarding the administration of immunostimulants and probiotics to vannamei shrimp and handing them over to the community for use

Evaluation stage

The Community Service Team from the Faculty of Fisheries and Marine, Universitas Airlangga evaluated the application of immunostimulants and probiotics used. Evaluation is a process carried out to find out the results of learning (Utami, 2021). This evaluation is expected to determine the effects of the use of immunostimulants and probiotics that have been carried out by farmers in Kedung Pandan Village, Jabon, Sidoarjo. It is also hoped that this evaluation will provide input for us in providing assistance so that we can convey fisheries science better. Evaluation activities can be seen in Figure 6. The results of the evaluation show that the assistance provided is beneficial for farmers and members of "Putri Mandiri" in Kedung Pandan Village. This is because they have never known and applied this technology before. Aquaculture productivity also increases from the use of immunostimulants and probiotics in vannamei shrimp ponds. Direct socialization and demonstrations related to its use make it easier for participants to understand the training that has been carried out.



Figure 6. Evaluation activities for representatives of farmers and members of "Putri Mandiri"

Discussion

Increasing productivity of vaname shrimp using immunostimulants and probiotics has been carried out in previous community service in Gresik by the Community Service Team from the Faculty of Fisheries and Marine, Universitas Airlangga (Dewi et al., 2022). The community service results in this

study showed better results because more optimal assistance could be provided. In a previous study, community service activity was carried out using a hybrid method (online and offline) due to COVID-19 (Dewi et al., 2022). The use of online media makes it easier to convey material because it can be done anywhere but the interaction is less lively (Al Gholaini, 2021). This showed that this activity had a better effect because it was also given a direct demonstration about how to use probiotic and immunostimulant. Demonstrations in conducting socialization have had a good impact in its implementation (Febrian et al., 2019). During the evaluation stage, it was also shown that vannamei shrimp farmers knew how to use probiotics and immunostimulants.

After this community service was carried out, the results of the evaluation stage showed that no more sick shrimp were found in aquaculture activities. Usually sick shrimp were found with the characteristics of less movement, less appetite, and even mortality occurrence. The characteristics of sick shrimp were in accordance with the statement in a previous study that sick shrimp moved passively and did not have a good appetite (Naban et al., 2023). This is because the immunostimulants and probiotics used in this community service function to improve the immune system so that shrimp are not easily attacked by disease (Won et al., 2020; Naiel et al., 2021). The "Putri Mandiri" farmer in this community service activity produced vannamei shrimp with a survival rate of 80%. This result was considered good because it was carried out in traditional method (earthen ponds) which did not require a lot of money. Many community services related to vaname shrimp got maximum results by changing the land from traditional to semi-intensive or intensive method (Akmal et al., 2020; Aminin et al., 2023). Changing to semi-intensive and intensive required maintenance which was not cheap and if farmers could not manage it well it could be detrimental (Putri et al., 2020). The use of probiotics and immunostimulants was easy because there was no need to change the construction of the pond or add infrastructure (Putra et al., 2018). This showed that this study provided a simpler solution but optimal results in increasing the productivity of vannamei shrimp aquaculture.

4. CONCLUSION AND RECOMMENDATIONS

The community service program in Kedung Pandan Village, Jabon, Sidoarjo has been conducted well. This activity increases partners' knowledge, especially that they understand better and can apply immunostimulants and probiotics in vannamei shrimp aquaculture activities. This is in line with the target in implementing community partnership training/mentoring to introduce technology that has never been applied before. The use of immunostimulants and probiotics can increase the productivity of vannamei shrimp. The introduction of these two technologies is important because previously people only used traditional methods to prepare ponds, shrimp, and feed. This causes productivity to be low.

For more optimal results, collaboration regarding other technologies needs to be carried out. Several technological applications such as prebiotics, windmills (for oxygen abundance), natural feed enrichment, and feed fermentation need to be introduced so that vannamei shrimp productivity in Kedung Pandan Village continues to increase.

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