INNOVATION OF TECHNOLOGY AND INSTITUTIONS FOR SUSTAINABILITY OF TILAPIA NURSERY FARMING IN SANDING VILLAGE, TAMPAKSIRING DISTRICT, GIANYAR REGENCY

Dian Tariningsih[a] and Putu Kepramareni[b]

[a,b]*Mahasaraswati University of Denpasar, Kamboja Street 11A Denpasar 80231, Indonesia*

Abstract

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The research of innovation of technology and institutional for sustainability of tilapia nursery farming, backed by the fact of tilapia nursery farming facing problems concerning the production capacity and institutional group. Solutions to the problems are formulated in the following research objectives: (1) to analyze the optimization of fish stocking stock density and commercial feed dose on tilapia nursery farming; and (2) to analyze innovative institutions for strengthening the existence of tilapia fishers.

Optimal doses of commercial and optimum density feeds were approached by experimental studies with factorial randomized block design, which tested the combination of feed dosage at three levels and stocking solids at three levels with three replications. The objective of the 2nd research (to analyze the innovative institute for strengthening the existence of tilapia fishers was approached by survey research Surveys were carried out on 30 indigenous tilapia farmers who have been producing tilapia seeds. Effect of commercial feed dose and fish stocking density on the growth rate and the survival of tilapia seeds were analyzed using variance analysis. The innovative institutional for tilapia fishers in order to strengthen their existence was analyzed using descriptive analysis.

The results showed that (1) the growth rate and survival of tilapia seed were influenced by stocking density, while the feed dose did not influence and there was no effect of interaction between stocking density with feed dose to growth rate and survival rate of tilapia seed. (2) innovative institutional for tilapia seed breeder in strengthening its existence is in the form of upstream and downstream partnership.

Keywords: technological innovation, innovative institute, tilapia nursery farming, partnership, upstream, downstream

1. Introduction

One type of fish that is in great demand for consumption by the community is tilapia. This causes the tilapia is very popular cultivated, because it has the advantage of easy to cultivate, resistant to disease, and has a fairly high economic value. The development of tilapia cultivation increased rapidly in response to the increasing nutrition of the people in developing countries (Hertanto, et al. (2013) .

The increase of tilapia cultivation, resulting in increased demand for seed by tilapia nursery farming. Increased demand for tilapia seeds is not only sourced from the increased demand for seeds by indigenous tilapia fishermen but also by the farming of fishing ponds. Currently fishing activities become a trend center among the wider community, both as a hobby distribution and the target to get fish for commercial purposes. There are also fishing activities conducted by the community as they relate to the momentum of certain events such as anniversaries, attract voters' sympathy in the election, and socialization of an institution's programs. Not infrequently the fishing activities are also done to relieve stress, because when the hook hit there was an outburst of spontaneity excitement, and when it was unwittingly the burden of stress instantaneous, the mood was happy. Whatever the motivation, it is clear that the fishing activity has triggered an increase in demand for tilapia seeds.

Often very unfortunate, the momentum of increased demand for tilapia seeds is not quickly and accurately can be responded by farming actors induced tilapia mainly due to constrained management of the production process. So far, the management of the production process of tilapia nursery farming is still glued to the conventional production technology which is done for generations. Indeed, the location of the indigenous fish nursery farming (Sanding Village) has an agro climate suitability that naturally supports the growth and development of tilapia seeds. The problem is the lack of adoption rate of the latest technological innovation by tilapia nursery farming entrepreneurs, so that the farming of less grown nursery even impressed the way in place. The indigenous tilapia farming actor is less sensitive to the technological innovation that is actually at the tip of his finger and ready to serve to be used to overcome the classical problem. But due to lack of a sense of criticism of the technology, positioning the indigenous fish nursery farming is located in a remote zone of technology.

It was identified that the indigenous tilapia farmers in Sanding Village faced a classic problem, namely the high mortality rate of fish seed during nursery that reached an average of 57%. The problem is exacerbated by the low rate of growth of tilapia seeds during nursery take place. This is evidently shown by the fact that the length of time required for a period of nursery, from 30 days to 40 days to achieve the average weight of 10 gram fish seeds from the initial average weight of 3 grams. The research results Diantariningsih, et al. (2015) in Sanding Village shows that a dose of probiotic 100 ml / kg of commercial feed is the optimum dose for the development of tilapia seed. However, the results of this study have not provided explicit

information about optimal dosage of feed, optimal stocking density, and duration of optimal nursery, so that further research is needed.

To find solutions to the problems faced by tilapia farmers in increasing their production capacity, alternative solutions that can be offered are increased production capacity through technological and institutional innovation. Innovation technology of indigenous fish nursery farming can be done by giving optimal probiotics, optimal feeding, and optimal stocking density. Diantariningsih, et al. (2015), found empirical fact that the provision of probiotics in the feed proved to be effective in increasing the growth rate of fish seeds, because giving probiotics cause the feed to function optimally and produce higher quality fish weight. According to Fuller (1987), probiotics affect the speed of fermentation of feed in the digestive tract, so it will greatly assist the process of food absorption in the digestion of fish. Fermentation of feed is able to break down complex compounds into simple so ready to use fish. Anggriani, et al. (2012) stated that giving of probiotic with dose of 100 ml / kg of feed can increase the growth rate of tilapia seeds by 2.92%, with the survival rate of tilapia seeds reach 70%.

In addition to production process management, tilapia farmers also face institutional problems related to the existence of their farming groups. So far, the indigenous tilapia farming groups felt not provide optimal benefits to its members. This is demonstrated by the fact that there are members of the group facing water supply problems due to pressure from subak organizations, but the institutionalized farmer groups do not provide solutions and assistance. Likewise, when group members face the problem of the slow supply of fish seeds from intermediate traders (linking tilapia farming actors to tilapia breeders), farmer groups have not been able to do so to assist their members. Individual groups of tilapia fish farmers, both in terms of group norms and organizations have not been able to provide significant socio-economic benefits to their members.

The factual condition indicates that the perpetrators of indigo tilapia farming in Sanding Village, Tampaksiring District, Gianyar Regency are often played by intermediate traders concerning the purchase price of input and the selling price of its output. There is a disparity in the purchase price of inputs and the high selling price of output among the farmers, ie there is a market literate marketer so as to obtain favorable prices, and there is a farmer that is still blindly informed of the market, thus often collapsing when buying inputs and marketing its

output. The solution offered for this problem is the need for institutional innovation for indigenous tilapia farmer groups.

The institutional innovations of the farmer groups are oriented to improve and empower the indigenous tilapia farmer groups, both on group norms and group organizations. Therefore, institutional research of farmer groups of tilapia fishers is very urgent. If tilapia fishermen are able to adopt technological innovations and compatible farmer group institutions, then the continuation of tilapia fish nursery farming will be maintained. This research was conducted to get optimal usage of probiotic and feeding, optimal stocking density, and innovative farmer group institute for sustainability of tilapia nursery farming.

1.1 Research purposes

1) Analyze the optimization of fish stocking stock density and commercial feeding dose on tilapia nursery farming.
2) Analyze the innovative farmer group institutions for tilapia nursery farming.

2. Materials and Methods

2.1 Research design

This research is designed as an experimental research and an integrated survey. Experimental research was conducted to determine the effect of feed dose and stocking density on the growth rate and survival of tilapia seeds. Experiments using a randomized block design with treatment were arranged following a factorial pattern. The tried treatment consisted of two factors, namely feed dose and fish stocking density, each consisting of three levels, namely.

Treatment of feed dosage (P)

P_1 50 kg/1000 tail

P_2 75 kg/1000 tail

P_3 100 kg/1000 tail

Treatment of stocked density (T)

T_1 50 ekor/m^2

T_2 75 ekor/m^2

T_3 100 ekor/m^2

Each factor is combined and then repeated three times so that it takes 27 plots of nursery pool. The size of the pond plot is 1.5 m x 2 m. Experimental research was conducted for 45 days.

2.2 Research Sites

Sanding Village, Tampaksiring District, Gianyar Regency, Bali Province was chosen intentionally as the location of this study, based on the consideration that (1) tilapia nursery farming center in Gianyar Regency is in Sanding Village, (2) tilapia nursery farming has been done by fish farmer on an ongoing basis since 2009.

2.3. Population and Sample

The population in this study are all members of the indigo nursery farming group in Sanding Village, Tampaksiring District, Gianyar Regency. Sampling is done by quota sampling method with 30 samples.

2.4. Method of collecting data

For experimental research, data collection using direct observation and recording techniques performed periodically. For survey research, data collection is done through direct interviews using pre-prepared questionnaires.

2.5 Research Variables

Variables in this study were (1) commercial feeding dose, (2) fish seed stocking level, (3) growth rate of tilapia seed, (4) tilapia survival rate, and (5) output level (weight per tail) .

2.6. Variable Measurement

The variables involved in this study were measured as follows.

1) The commercial feeding dose is measured from the amount of feed required at each feed dose level expressed in kg.

2) The density of stocking is measured by the number of fish seeds per m^2 of ponds expressed in the tail/m^2

3) The growth rate of fish seed is measured from the final weight difference with the initial weight divided by the length of the nipple period expressed in gr/day

4) The survival rate of fish seed is measured from the number of live fish seeds ratio with the number of seeds beginning expressed in percent.

5) The amount of output (the proceeds of nursery) is the number of tilapia seeds produced in one production cycle expressed in kg.

2.7 Data Analysis Method

The effect of feed dose and stocking density on the growth rate and survival of tilapia seeds was analyzed using variance analysis. To determine the optimal combination of feed dosage and stocking density was used regression analysis with orthogonal polynomial model. The institutional of tilapia farmer group was analyzed using descriptive analysis.

3. Results and Discussion

3.1 Influence of Stock Solid and Feed Dosage Against Growth and Sustainability Live Tilapia Fish Seed

Research activities on the effect of stocking density and feed dose on the growth and survival of tilapia, begins with the manufacture of plot plots to put the treatment pond. Experiments using factorial randomized block design with nine treatment combinations and 3 (three) replications. The treatment consisted of three feed dose levels and three solid stocking levels. Pool plots that have been prepared and then stocked fish seeds according to solid stock with total fish seeds as many as 4500 head. Each plot of ponds seeded with tilapia seed size 2-3 cm according to the treatment of stocking density. Every day tilapia fish given 2 times the feed with the dose of feed according to the treatment set.

The experimental observation data were analyzed using variance analysis (F-test). The results showed that there was a significant effect of stocking density on the growth rate and survival of tilapia ($p < 0,5$). Feed dose did not affect the growth rate and survival of tilapia. There is no effect of interaction between stocking density with feed dose to growth rate and survival of tilapia. The increase of stocking density gives the growth rate and the survival of the tilapia decreasing. Thus densely stocking is a factor that is very influential on the rate of growth and survival of tilapia. Determination of optimum stocking density will provide maximum growth and survival rate of tilapia fish. The accuracy of choosing densely stocking is the decisive factor for the success of tilapia

The feed dose did not affect the growth rate and survival of tilapia seeds, which means that the high dose of feed was randomized to the growth rate and survival of tilapia seed. Based on this, it can be assumed that the dosage of 50 kg/1000 seeds for one period of nursery

became the most efficient alternative, because the increase of feed dose did not increase the growth rate and survival of tilapia seeds. Even feeding doses lower than 50 kg/1000 seeds for a period of nursery can be further investigated, in order to obtain optimal dose of feed. This becomes important considering the feed factor becomes the largest cost component in the tilapia fish nursery farming, so the efficiency of feed use is very determining the level of profit and then the continuation of tilapia fish nursery farming. Some of the related possibilities are not affecting the feed dose to the growth rate and the survival of tilapia can be described as follows.

1) Inappropriate feeding times, eg feeding is done when the fish is not hungry, so the feed is ignored by the fish and will immediately settle to the bottom of the pond. This is most likely to occur, because fish seeds also eat larvae or other materials that exist in the pond ecosystem. When the fish is still full it will not care about the feed given, so the feed becomes useless. In this regard, it is necessary to schedule proper feeding according to the hungry period of fish seeds, whose characteristics are easily recognizable, ie when the fish is hungry, then the fish will appear to the surface of the pond water with an open mouth.

2) Incorrect feeding methods, eg feeding concentrated at one point, so there is no good distribution. This is very detrimental because the ability of the fish seed to reach the feed is very limited, especially the feed grains easily dissolve in water.

3) Distribution of improper feed doses, such as feeding in the morning less than during the day, whereas in the morning the fish are very hungry. Feeding dosage should be exactly the right size planned from the beginning. Dosing inaccuracy affects the adequacy of fish feed which then boils down to the rate of growth and survival of the fish.

4) Conditions of pond water that does not support, for example too cloudy or less given the circulation. Water ponds that irrigation does not continuously cause the condition of the pool environment is less supportive

Dense stocking of 50 tail/m^2 gives the highest growth rate and survival of tilapia fish. Increased stocking density from 50 tail/m^2 to 75 tail/m^2 decreases the growth rate and survival of tilapia. Dense stockings of 100 tail/m^2 produce the lowest growth rate and survival of tilapia fish. The results of this study in accordance with the results of research Yuliati, et al. (2003) studying the effect of density on the growth and synthesis of Tilapia Gift fish in the Depok Freshwater Fisheries Research Installation, found that the solid stocking of 50 tails/m^2 resulted

in the best growth of seedlings. This fact means that stocking stock of 50 tail/m^2 can be used as a reference by tilapia nursery farming in operating its farm so as to obtain maximum profit. In addition, the management of other factors must also be carefully observed by the indigenous fish nursery farming that leads to the optimal end result.

3.2 Innovative Institutions for Tilapia Fishing Group

The problems of indigenous tilapia farmers mostly lie in the purchase of input and output marketing. Innovation of group institutions is expected to overcome these problems. So far the marketing system of indigenous tilapia seeds is done by the marketer is the marketing in place when there are buyers who come directly to the location of nursery. While the fish seed usually brought directly to the pond nursery by seed supplier. So far, there is no visible role of the group in helping the marketers in the procurement of seeds or in marketing the results of nursery, so the group needs to be modernized in order to be able to respond to the interests of the farmer.

The farmers generally have no alternative to marketing the proceeds of nursery unless they sell it to collecting dealers. This is in accordance with the opinion of Lubis et al., (2012), which states that the farmer more tied to the owner of capital or merchant in marketing the fish seeds from nursery. The limited accessibility of information by the donors has implications for the limited marketing of tilapia seeds. Indeed, the market segment of the products is very large that should be facilitated by the group.

The group of the farmers who have formed, helplessly play a role to help its members in marketing the proceeds of nursery. Very strong individualistic impression detected in the marketing system of nursery results, because each individual as competing to immediately earn cash from the results it nursery. There is no synergistic effort in the marketing of nursery results to strengthen the bargaining power of the farmer, and even implied the existence of contestation among individuals that actually weakens the bargaining position among them. Factor weakness of capital becomes the cause of trapped farmer in system created, as expressed by Sinulingga (2011) that the middlemen in certain conditions have created a monopoly system, because they operate starting from the financial provision, ownership of production factors, and determine the marketing channel.

In order to strengthen the bargaining power of the farmer, through deep exploration and observation can be identified group institutional innovation in a more competitive

marketing system of outcomes as described in the following description.

(1) Marketing of fish seeds through web site

The group creates a web site to market the fish seeds from the nursery. This is very urgent given the wide reach of marketing that can be achieved. The group can assign marketing staff to manage the web site by constantly updating the data according to the existing conditions of indigo. Groups can play a more proactive role to educate their members so as not to get caught in the monopsony market. The role of the group is very urgent to be improved in order to strengthen the bargaining power of the farmer so that they obtain a more competitive selling price.

(2) Marketing of fish seeds through cooperative containers

Farmers can form cooperatives to specifically move in the marketing of nursery results. Cooperatives can also serve the needs of capital for its members so as not to get trapped by the middlemen in marketing the results of nursery. Cooperatives can make various breakthroughs in the marketing of nursery products, for example through the making of cooperation with farmer groups engaged in tilapia fish nursery. Cooperatives can establish partnerships with various stakeholders so that the results of nursery have the certainty of selling prices and farmers get added value. Cooperatives can expand their wings by diversifying their farming to support the nursery farming, such as alternative feed making. Alternative feed is badly needed by farmer in the midst of skyrocketing commercial feed prices. The need for alternative feed is very big to improve the efficiency of the nursery farming.

(3) Marketing of fish seeds through partnership with the fishing pond entrepreneurs

The group can cooperate with the fishing pond entrepreneurs. Through the partnership, it can be guaranteed the continuity of demand for fish seeds, so that the farmer can enjoy the added value of the nursery. The farmer is required to maintain continuity of supply so that the continuity of the partnership is maintained.

4. Conclusions and Recommendation

4.1 Conclusions

1) The rate of growth and survival of tilapia seeds is influenced by stocking density, whereas the feed dose has no effect and there is no interaction effect between stocking density with feed dose on the growth rate and survival of tilapia seed.

2) Tilapia seed drillers can form innovative group institutions that are responsive to the dynamics of stakeholders preferences

4.2 Recommendation

Based on the conclusions of this study, it is suggested that the tailings adjust the stocking density and form the group institutions that are responsive to the dynamics of stakeholder preferences

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References

Anggriani, R., Iskandar, dan Taofiqurohman, A. 2012. Efektivitas Penambahan Bacillus sp Hasil Isolasi dari Saluran Pencernaan Ikan Patin pada Paakan Komersial Terhadap Kelangsungan Hidup dan Pertumbuhan Benih Ikan Nila Merah (Oreochromis Niloticus). *Jurnal Perikanan dan Kelautan* Vol 3, No. 3 September 2012. ISSN 2088 – 3137.

Diantariningsih, Diarta, I M., dan Suryawaty, I G A. 2015. Model Pengembangan Usaha Pendederan Ikan Nila Di Desa Sanding Kecamatan Tampaksiring Kabupaten Gianyar. Laporan Hasil Penelitian Hibah Bersaing Tahun ke-1 DRPM Ditjen Penguatan Risbang Kemristek Dikti.

Fuller, R. 1987. A Review Probiotics in Man and Animal. *Journal of Applied Bacteriology* 66:365-37

Hertanto, M A., Aida, Y., dan Sidharta, B B R. 2013. Produksi Ikan Nila Merah Jantan Menggunakan Madu Lebah Hutan. e-journal.uajy. ac.id

Lubis, E., Pane, A.B., Muninggar, R., dan Hamzah, A. 2012. Besaran Kerugian Nelayan dalam Pemasaran Hasil Tangkapan: Kasus Pelabuhan Perikanan Nusantara Pelabuhan Ratu. *Maspari Journal*, 4(2): 159-167.

Sinulingga, A. 2011. Sistem Ekonomi Tengkulak pada Masyarakat Nelayan. http://www.analisadaily.com, 21 April 2011.

Yuliati, P., Kadarini, T., dan Subandiyah S. 2003. Pengaruh Padat Penebaran Terhadap Pertumbuhan dan Sisntasan Dederan Ikan Nila GIFT (*Oreochromis Niloticus*) Di Kolam. *Jurnal Iktiologi Indonesia* Volume 3, Nomor 2 Desember 2003.