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Review of Shrimp Cultivation Techniques in Plastic (Busmetic) Ponds

Review Teknik Budidaya Udang Pada Tambak Plastik (Busmetik)

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ABSTRACT

Shrimp cultivation has always been a star in the world of Indonesian aquaculture and today it is still one of the national priority aquaculture commodities. The market needs of domestic and foreign shrimp cultivation can be met by the high economic value of shrimp. There are many models of cultivation designs and shrimp farming systems that have been developed and used by farmers ranging from traditional to modern. The development of cultivation technology by utilizing marginal land by using plastic as a container for cultivation maintenance is called "Busmetik" technology, relatively small container sizes between 600m^2 - 1000m^2 are used in order to encourage young entrepreneurs or those who are new to aquaculture. Shrimp cultivation requires large funds both in investment and operational costs in its activities so that young entrepreneurs become pessimistic in starting a shrimp farming business. The banking sector can be convinced by young entrepreneurs with Busmetik technology because it can provide mutually beneficial solutions between entrepreneurs and banks. There are several things behind this Busmetik technology, namely shrimp which is currently the main focus in the cultivation business, has a stable market, the quality of the environment continues to decline, it is difficult to manage ponds with an area of >2000m^2, the types of soil used for pond plots to support the Director General of Aquaculture in the shrimp farming program.

ABSTRAK

Budidaya udang sejak dulu sudah menjadi primadona dalam dunia akuakultur Indonesia dan saat ini pun masih tetap menjadi salah satu komoditas perikanan budidaya prioritas Nasional. Kebutuhan pasar budidaya udang dalam negeri dan luar negeri dapat dipenuhi oleh nilai ekonomi udang yang tinggi. Ada banyak model desain wadah dan sistem budidaya udang yang telah dikembangkan dan digunakan oleh para pembudidaya mulai dari yang tradisional hingga modern. Pengembangan dari teknologi budidaya dengan memanfaatkan lahan marjinal dengan menggunakan plastik sebagai wadah pemeliharaan budidaya dinamakan sebagai teknologi “Busmetik”, ukuran wadah yang relatif kecil antara 600m^2 – 1000m^2 digunakan agar dapat mendorong wirausahawan muda atau yang baru terjun dibidang pertambakan. Budidaya udang membutuhkan dana besar baik dalam investasi maupun biaya-biaya operasional dalam kegiatannya sehingga para wirausahawan muda menjadi pesimis dalam memulai usaha budidaya udang. Pihak perbankan dapat diyakinkan oleh para wirausahawan muda dengan teknologi Busmetik ini karena dapat memberikan solusi yang saling menguntungkan antara wirausahawan dan perbankan. Ada beberapa hal yang melatarbelakangi teknologi Busmetik ini yakni udang yang saat ini tengah menjadi sorotan utama dalam usaha budidaya, memiliki pasar yang stabil, kualitas dari lingkungan yang terus menurun, sulitnya mengelola tambak dengan luas >2000m^2, jenis-jenis tanah yang digunakan menjadi petakan tambak agar mendukung Dirjen Perikanan Budidaya dalam program budidaya udang.

Kata Kunci	*Budidaya Udang Skala Kecil, Busmetik, Kajian Teknik Budidaya, Plastik Mulsa, Sistem Budidaya*
Keywords	*Small-Scale Shrimp Cultivation, Busmetik, Study of Cultivation Techniques, Plastic Mulch, Cultivation System*
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INTRODUCTION

Shrimp have now become a top national priority as an aquaculture commodity with high economic value to meet domestic and foreign markets and support the National food security program. The government is targeting an increase in the value of shrimp exports of 250% by 2024 (Director General of Aquaculture, 2022).

Shrimp cultivation currently still has profitable business prospects and must be accompanied by increased production and must follow developments in sustainable cultivation techniques and good waste management. Opening new ponds or managing existing ponds must pay attention to environmental, social and economic support. High shrimp production will not be sustainable for long if waste management and environmental pollution are inadequate. Potential development needs to be carried out in accordance with environmental conditions and always pay attention to spatial planning. Utilization of pond land requires a strategy to develop shrimp cultivation (Sagita et al., 2015).

The government carried out a pond revitalization program in 2013 by providing assistance with water wheels, plastic mulch, water pumps and generators so that pond farmers have a sense of responsibility for the program as well as providing opportunities for banks to provide capital assistance to manage the business, while in 2022 revitalization The ponds are only provided in the form of waterwheels because almost the majority of pond farmers are considered to have switched to using plastic mulch in cultivating their shrimp (Director General of Aquaculture, 2022).

Plastic mulch is a tool used in intensive and semi-intensive plastic pond methods for a long time (Hendrajat et al., 2015). Problems of soil porosity, soil quality, erosion of pond bottoms and embankments as well as pond water leaks can be eliminated by using plastic mulch. Plastic mulch can clean the feeding area because it does not cause colloidal water, making it easier to collect pond waste. According to (Hendrajat, 2015), by using plastic mulch the use of windmills can be saved and water changes are not carried out continuously due to the low level of respiration of organisms, ponds with high levels of porosity and problems with soil quality can increase their productivity by using thin and elastic plastic and Resistant to weathering caused by sunlight.

Plastic mulch is not made from recycling but is made using pure plastic pellets (PE/HDPE), plastic mulch has been added with UV stabilizer as an additional substance so that it is resistant to weathering caused by salt water and ultra violet rays. Plastic mulch can prevent parasite and virus contamination in pond water, pond walls that slide or seep into pond water are a source of parasite and virus contamination. Plastic mulch helps optimal growth of shrimp because it prevents contact between the mud at the bottom of the pond and the pond water.

Plastic mulch has become the government's target for revitalizing ponds for shrimp farmers. Plastic mulch technology can be used in large-scale and small-scale cultivation. One of the small-scale cultivation that has been developed is shrimp cultivation using Busmetic technology. At the end of 2009, Busmetik technology had become the main instrument in vocational education learning based on empirical studies (Rahayu, 2013). Young entrepreneurs are often constrained by capital. Shrimp cultivation requires quite high investment and operational costs for each cycle. Banks that can provide funds must be convinced by young entrepreneurs so that banks can disburse funds for shrimp cultivation. Busmetic technology can be a driving force for shrimp cultivation business actors, especially young entrepreneurs, to mobilize all the potential and utilization of marginal land and plastic pond technology which has an influence on the production and productivity of shrimp cultivation and will provide benefits for business actors to try to convince banks so they can disburse funds. the funds.

Ponds with Busmetik technology are no different from other plastic mulch ponds. The only difference is the use of small land and reducing investment and operational costs in the shrimp farming business. The advantages that we get if we apply Busmetik technology include cultivating shrimp on a medium to small scale, cultivating shrimp at an affordable cost, low risk of disease attacks, can be done in various types of land and ponds, shortens the maintenance period, efficiency in feeding and no use antibiotics in its application.

METHODS

The method used is an exploratory descriptive method from various literature from previous research, both from national journals and international journals. To search for discussion topics, use relevant keywords including shrimp ponds, cultivation systems, plastic mulch, busmetics, cultivation container design, semi-intensive, intensive and cultivation technique studies.

RESULT AND DISCUSSION

Container Design and Operation of Busmetic Pond Cultivation

Understanding the components in cultivation is key in implementing Busmetic technology. Some of the cultivation components include containers, media and cultivation biota. Growth and survival are parameters of success in cultivating shrimp in ponds. These parameters can achieve the target with the support of other parameters, namely good quality fry and water quality as well as stable pond bottoms and meeting chemical and physical feasibility criteria (Rahayu, 2013).

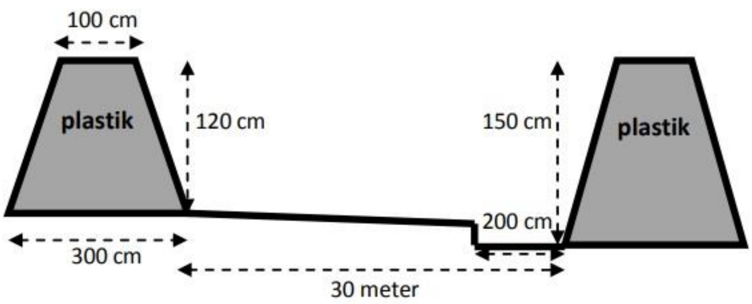

Figure 1. Konstruksi tambak busmetik
Source: Rahayu (2014)

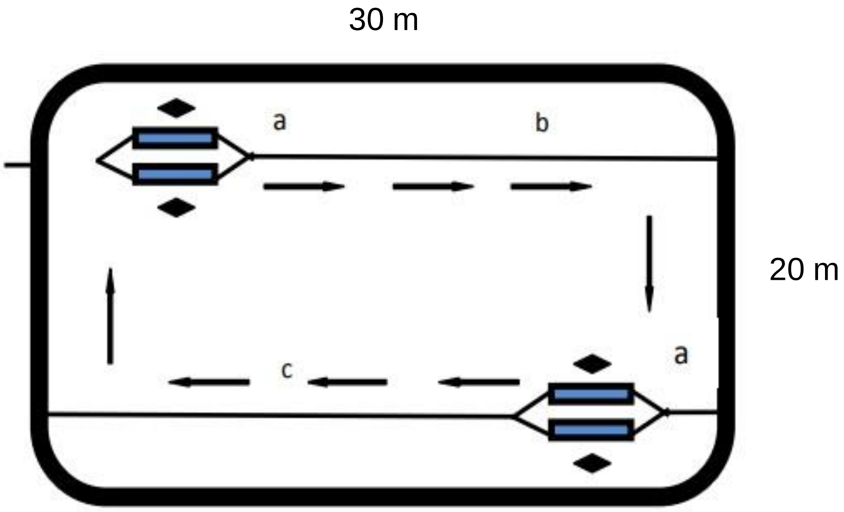

Figure 2. Busmetic technology shrimp pond design
a. pinwheel, b. Windmill rope, c. pond water flow
*The number of waterwheels is increased according to the number of shrimp
Source : Rahayu (2014)

The design of the cultivation container must be made carefully and thoroughly so that it can hold water for cultivation and make the management process easier. Shrimp rearing using Busmetic technology usually uses marginal land with a rectangular shape with an area of 600-1000 m2 in accordance with the small scale technology when compared to shrimp cultivation ponds in general with sizes above 2000 m2. The pond is lined with HDPE (high density polyethylene) plastic with a thickness of 0.5 mm. The pond is not made too deep and a "caren" is made on the inner side of the pond, a caren or small shallow channel with a length as wide as the pond and a width of 2 meters (Figure 1). The caren was created with the aim of making it easier for farmers to harvest shrimp at the end of the rearing period (Rahayu, 2014).

Drying and cleaning as well as repairs (if checking there is damage to the plastic), implementing a biosecurity system with the installation of a CPD (Crab Protecting Device) as a way to prevent pests and foreign pathogens that can carry disease from entering the cultivation area. According to Amri & Kanna (2008), health management for shrimp needs to be implemented. In the implementation stage, shrimp cultivation management is known as biosecurity. The environment is very influential and depends on the carrying capacity of cultivation land so that the implementation of maintained biosecurity can support cultivation and the quality of cultivation products.

Sudden changes to the cultivation media will cause stress to the shrimp so that the shrimp become weak and susceptible to disease. The cultivation media must comply with the criteria required by the shrimp in their maintenance, both in terms of biology, chemistry and physics. Monitoring the condition of the water that will be put into the cultivation pond must be carried out to avoid parasites that are detrimental to the cultivation business. Care must be taken to install the waterwheel so that the current pattern produced by the rotation of the waterwheel propeller is in accordance with the shrimp rearing regulations. A water wheel that produces a unidirectional current pattern will lead the shrimp waste to collect in the middle of the pond, making siphoning easier. Chlorine is used to sterilize ponds containing 60% chlorine and 40% additives. Chlorine at a dose of 60 ppm is given and distributed evenly and then the water wheel is turned on so that the chlorine content can be mixed evenly in the water and helps speed up the process of neutralizing chlorine in the water. According to Farchan (2006), using a water wheel or paddle wheel which functions as aeration can neutralize the chlorine content in the water. The water wheel remains turned on for 2 days while testing the chlorine levels using a test kit until the chlorine levels reach zero (clear).

Probiotics are given with the aim of growing good bacteria and suppressing the growth of bad bacteria. During initial maintenance, probiotics are also given to prepare the bacteria to decompose organic matter so that when cultivation is carried out, the number of bacteria available in the pond is sufficient. According to Rahayu (2013), probiotics given during the initial preparations for the cultivation business after chlorine in the pond water is neutral will provide an opportunity for microorganisms to dominate. The provision of probiotics is continued on a continuous routine schedule until the end of the harvest period so that the population of good bacteria can be maintained in the pond water.

The biota cultivated must be healthy and free from diseases or specific pathogenic free (SPF). Several types of diseases that can attack shrimp include white spot syndrome virus (WSSV), taura syndrome virus (TSF), early mortality syndrome (EMS) and infectious myonecrosis virus (IMNV). The biota cultivated is expected to be uniform with a PL size of 10-12.

Vannamei shrimp are a superior choice for pond cultivation entrepreneurs currently in Indonesia, the vannamei shrimp species continues to develop in cultivation because it is more resistant to various disease attacks, besides that, vannamei shrimp can also survive the pressure around the cultivation environment, vannamei shrimp also have a high survival rate. high around 80% to 90%, vanname shrimp growth is relatively faster with a rearing period of 2.5 months to 3 months, vanname shrimp production can reach 12 tons with a low feed consumption rate (FCR) of 1.0-1.2 (Mujiman, 2003; Poernomo, 2004; Gunarto et al., 2012).

The Effect of Using Plastic on Pond Soil

Comparison of several studies conducted by Burhanudin et al., (2016); Syah et al., (2017); Suriawan et al., (2019) with pond areas of 2,000 m2, 2,000 m2, 1000 m2 and 2,500 m2 on the effect of using plastic as a base on pond soil. The use of plastic can affect the quality of pond water, shrimp growth and also the survival rate of vannamei shrimp so that the productivity of vannamei shrimp cultivation can increase. Research by Burhanudin et al (2016) with 2 treatments, namely treatment A, which is a pond where the bund, slop and bottom of the pond have been coated using plastic mulch and treatment B does not use plastic mulch on the bottom of the pond but only the bund and slop are coated with plastic mulch. Research by Syah et al., (2017) and Suriawan et al., (2019) conducted research on ponds that used a layer of musa plastic on the pond bottom, slop and embankment. The parameters in the comparison of research results, namely shrimp growth, shrimp survival, feed conversion and production results, can be seen in the table 1.

Table 1. Comparison parameters of several previous studies

Observed parameters	Research Pond			
	Ponds With Plastic Mulch (A)	Ponds Without Plastic at the Bottom of the Pond (B)	Mulch Plastic Ponds (C)	Mulch Plastic Ponds (D)
Pond area (m2)	2.000	2.000	1000	2.500
Densely scatter shrimp seeds (ekor/petak)	100.000	100.000	750.000	312.500
Shrimp Growth (g/ekor)	13,59	12,36	16,79	20
Shrimp daily growth rate (%)	0,2	0,18	0,19	0,24
Survival (%)	85,85	84,92	87,3	82,66
Production (kg)	1.192,40	1.075	7.862	4.200
FCR	1,193	1,3	1,4	1,37
References	Burhanudin et al., (2016)	Burhanudin et al., (2016)	Syah et al., (2017)	Suriawan et al., (2019)

The impact of acidic soil can be reduced by utilizing plastic mulch (increasing the success rate). Vannamei shrimp production is also increased by managing the reservoir water before it is put into the rearing pond by adding chlorine which can inhibit the increasing population of pathogens that trigger disease by viruses, especially WSSV.

The treatment in preparing the rearing containers and rearing media was the same except that in land pond B in Burhanudin et al.'s (2016) research, liming was carried out because plastic mulch was not used. Saponin is used to eradicate pests (50-100 kg/ha), land ponds are also given lime (500-1000 kg/ha) as well as urea and SP-36 (100-150 kg/ha) at the bottom of the pond. Pond B must maintain a water level of between 1.0-1.25 m.

Shrimp seeds to be stocked must be free from WSSV, Taura and IMNV with stocking densities respectively A, B, C and D according to Table 1, namely 50 fish/m2, 50 fish/m2, 750 fish/m2 and 125 fish/m^2.

In pond A, vannamei shrimp growth tends to increase from the beginning to the end of rearing by maintaining water quality in a stable condition so that the shrimp respond better to feed and accelerate growth. In treatment pond B in the 6th week, growth was slightly delayed and continued until the end of the study. This slowing growth is due to the quality of the soil at the bottom of the pond getting worse over time. Leftover feed and shrimp droppings are a factor in the deterioration of the quality of the subsoil, organic matter that decomposes in the soil also plays a role in deteriorating the quality of the subsoil. The decomposition of organic matter that occurs in the soil under anaerobic conditions produces products that can inhibit shrimp growth and b ecome toxic at certain concentrations. In the growth of treatment plot C, the variation in shrimp weight size decreases so that at harvest time the shrimp size will be uniform. Plot D uses high salinity underground water sources and feed protein is adjusted to suit the salinity level so that maximum growth results are obtained. Based on compared data from previous research, it can be concluded that the growth of vannamei shrimp does not depend on high stocking densities so that Busmetic technology which utilizes marginal land with a relatively small pond area can provide more benefits with small land but abundant production. Good water quality and available nutrients support the ability of vannamei shrimp to utilize the entire water column so that they provide relatively the same response to growth and are not too influenced by the size of the pond plot.

Pond B made good preparations by reclamation and liming the base soil so that the quality of the soil improved but it took quite a long time to prepare the pond compared to ponds A, C and D which used plastic as a base. Water changes in pond B were also carried out more frequently than in ponds A, C and D. The survival of vannamei shrimp was almost the same between the 4 pond treatments due to the initial pond preparation carried out. Shrimp production results can be determined by looking at the number of live shrimp and the final weight of the shrimp. The feed conversion ratio (FCR) obtained was relatively the same and did not differ much between the 4 treatments, namely between 1.19-1.4. Mangampa (2007) and Pantjara (2009) also obtained FCR values of 1.329 and 1.4.

The temperatures checked in all pond treatments A, B, C and D were calculated to be within optimal limits for shrimp cultivation. According to Clifford (1998), the DO level that has the potential to cause death in vannamei shrimp is <2.0 mg/L, the minimum DO to keep shrimp healthy is 3.0 mg/L. The optimal DO value so that shrimp can be healthy and grow well if the DO value is > 3 mg/L (Suprapto, 2005).

Table 2. Range of water quality parameters

Water quality	Temperature (°C)	Salinity (ppt)	pH	DO (mg/L)	TAN (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Alkalinity (mg/L)	References
Mulch Plastic Ponds (A)	27,6-31,7	37-41	7,5-8,5	2,7-9,12	0,007-0,570	0,165-2,157	0,080-2,914	117,4-196,48	Burhanudin et al., (2016)
Land Pond (B)	26,4-31,2	37-41	7,5-8,5	3,4-4,3	0,001-0,205	0,084-0,525	0,087-0,540	117,4-179,74	Burhanudin et al., (2016)
Mulch Plastic Ponds (C)	25,3-31,6	22,1-28,9	6,5-8,4	0,5-10,6	0,0657-18,920	0,0062-40,300	0,0794-55,300	-	Syah et al., (2017)
Mulch Plastic Ponds (D)	24-30	35-38	7,94-8,15	-	0,01-1,42	0,01-1,47	-	168-227	Suriawan et al., (2019)

The ammonia values in ponds A, C and D are indeed in a critical condition, but this condition can still be overcome because ponds A, C and D (plastic ponds) change the water and also carry out liming to reduce the ammonia value. The amount of dissolved organic matter since the start of maintenance is a factor in increasing ammonia. Pond A has not had any water changes since the start of maintenance, while treatment ponds C and D are influenced by stocking density so that the accumulation of leftover feed is greater.

Ponds that use plastic mulch are easier to manage than ponds with a soil base because they do not need to manage the soil base. Land farms are required to carry out land management first to avoid failure in cultivation. Production yields in ponds using plastic as the bottom of the pond increased 13.5% and received 37.5% higher income than earthen ponds.

Research conducted by Hendrajat et al., (2015) regarding the use of plastic mulch for semi-intensive vaname shrimp cultivation at the Marana Experimental Pond at the Maros Brackish Water Aquaculture Research and Development Institute also showed better results. The stocking density carried out is 80 individuals/m2 with a rearing period of 2 months, production results can reach 2.9 tonnes/ha, survival is around 75.96% and the final size of the shrimp is around 203 individuals/kg. Ponds with plastic mulch as the bottom of the pond do not show any floating valves, the growth of valves is a problem for ponds with a soil base because the shrimp that are kept will experience stress and even sudden death because the valves eventually sink and rot at the bottom of the pond and turn into H2S which is poison (Atmomarsono et al., 2014).

Iron particles attached to the gills cause death of cultivated shrimp and trigger low pond productivity. Plastic mulch can be used in acid sulfate ponds to prevent the appearance of iron particles that will stick to the shrimp, because in ponds that do not use plastic mulch, iron particles will appear in the pond embankment, pond bottom and pond water. Pond ponds with high acid sulfate levels and iron content can clog the gills of fish and shrimp, thereby disrupting the health and growth of cultivated shrimp (Sammut, 1999) and can reduce the natural food available in cultivation ponds (Mustafa, Paena, Tarunamulia, & Sammut, 2008).

Water in ponds that use plastic mulch has more stable water quality and is more economical because plastic mulch minimizes leakage of pond water so that water loss is smaller compared to ponds with a soil base. Soil erosion which usually occurs due to currents from waterwheels on embankments can be prevented so that the use of plastic as a pond base is suitable for use in ponds that have soil quality problems and ponds with high porosity such as acid sulphate soil ponds, peat ponds and sand ponds.

Shrimp Production Results in Plastic Ponds (Busmetic)

Previous research by Untara et al (2018) regarding 2 plastic ponds with relatively small container sizes (Busmetik) aimed to determine the existing cultivation technology in the Busmetic Pond of SUPM Tegal State and the Tuvami 16 Pond of Pekalongan University.

Based on data from several studies regarding Busmetic ponds with different land sizes and stocking densities (Table 3), it can be concluded that large and small ponds can still produce good harvests and provide profits to cultivation entrepreneurs with a survival rate that is still above 90 The survival value can be categorized as good if SR>70%, 50-60% in the good category, and SR<50% in the low category. (Untara et al, 2018).

Table 3. Production results in Shrimp Farms

Research sites	Maintenance	Scattered densely (ekor)	Total Harvest (kg)	Total feed (kg)	FCR	SR (%)	ABW (g)	References
Tegal State SUPM Busmetics 1000 m^2	97	150.000	2.160	3.375	1,29	99	16	Untara et al., (2018)

Tuvami 16 Pekalongan University 600 m^2	84	60.000	915	954,05	1,04	93	16.3	Untara et al., (2018)
Pasuruan Pond 2.500 m^2	110	250.000	4.800	-	1.26	90,4	18.75	Suriawan et al., (2019)
Tegal State SUPM Pond 600 m^2	-	90.000	1183,67	-	1,3	-	-	Widodo et al., (2016)

Research by Saesario (2020) in the Tegal Secondary School of Fisheries Business School (SUPM) Busmetik pond in two ponds lined with HDPE plastic at the bottom of the pond (enlargement plot) with an area of 1,000 m2 and one pond for sterilization with an area of 1000 m2. SUPM Tegal also has one plot that is not covered with HDPE plastic which is used as a storage pond with an area of 1200 m2 which functions as a deposit for production waste. Ariadi's research (2021) at PT. Menjangan Mas Nusantara and Permatasari Research (2021) in Pekalongan Coastal Ponds as a comparison of Busmetic businesses with large-scale industries with pond areas > 2,500 m^2 (Table 4).

Table 4. Details of shrimp cultivation business

Parameter	Tegal State SUPM Busmetics1000 m^2 (Rp)	PT. Menjangan Mas Archipelago 3200 m^2 (Rp)	Pekalongan Coastal Pond (Rp)
Investment capital	284.431.400,-	2.851.990.000,-	1.110.125.000,-
Fixed cost	44.949.380,-	118.221.176,-	74.607.792,-
Variable cost	63.791.500,-	2.004.917.500,-	521.400.000,-
Total production costs	108.740.880,-	2.123.138.676,-	596.007.792,-
Number of Receipts			
Profit Amount	210.375.000,-	3.132.193.000,-	1.040.000.000,-
	101.634.120,-	1.009.054.324,-	443.992.208,-
Referensi	Saesario (2020)	Ariadi (2021)	Permatasari (2021)

Investment in capital for shrimp cultivation is very high, making it difficult for young entrepreneurs at the lower middle level to start a business. Fixed costs and variable costs are production costs incurred for the vannamei shrimp cultivation business based on the nature of their use. The size of the output (amount of production) of a cultivation business does not affect fixed costs. Costs that are influenced by the amount of output (amount of production) of a cultivation business are variable costs (non-fixed costs).

CONCLUSION

Busmetik technology which utilizes marginal land by streamlining operational activities has been proven to provide good production results and is not inferior to large-scale fish farming businesses. Busmetik has bright prospects in the future so that banks as a source of investment have confidence and trust in young entrepreneurs who use Busmetik technology. Based on Table 4, it can be concluded that Busmetic technology in shrimp cultivation is attractive in terms of land efficiency and operational costs which are relatively lower than other large industrial scale ponds and can provide profits commensurate with the total costs incurred in a cultivation business. Banking will also be easier and more confident in providing investment funds for young entrepreneurs who have just entered the world of aquaculture, most of whom are hampered by business capital.

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