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Polyculture studies with white, black tiger shrimp show promise in Indonesia

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Survival, growth and yield were excellent

Because *L. vannamei* and *P. monodon* have different protein requirements and feeding habits, feeds were adjusted several times during grow-out.

Polyculture has been practiced using different species mainly for efficiency in utilizing space or feed. The animals selected are generally different in habitat or feeding habits, and can be from the same genus or even different families, but should not be competitors.

Polyculture of pacific white shrimp (*Litopenaeus vannamei)* and genetically improved all-male tilapia (*Oreochromis niloticus)* has been carried out successfully on an experimental scale in low-salinity ground water under zero-exchange conditions during winter months to avoid losses due to white spot syndrome virus. Since Pacific white shrimp and black tiger shrimp (*Penaeus monodon)* have different habitats, feeding habits and tolerance to stocking density, the possibility of utilizing the whole pond water volume in terms of space and feeding for pond efficiency and productivity is promising.

Polyculture study

The authors recently carried out a study to evaluate the polyculture of pacific white shrimp and black tiger shrimp. The *L. vannamei* were specific pathogen-free (SPF) animals from the Central Pertiwi Bahari (CPB) hatcheries. Also from CPB's hatcheries, the *P. monodon* were not SPF, but by polymerase chain reaction tested free of known pathogens prior to stocking.

Culture system

Two earthen ponds of about 0.5 ha were used for each of three stocking treatments: 60 *L. vannamei* per square meter with 10 *P. monodon* per square meter, 50 *L. vannamei* per square meter with 20 *P. monodon* per square meter, and 40 *L. vannamei* per square meter with 30 *P. monodon* per square meter (Table 1).

Table 1. Stocking densities and pond sizes used during the polyculture studies.

	Polyculture 60/10		Polyculture 50/20		Polyculture 40/30	
	L. vannamei	*P. monodon*	*L. vannamei*	*P. monodon*	*L. vannamei*	*P. monodon*
Stocking density (shrimp/m^2)	60	10	50	20	40	30
Pond size (average)	4,400 m^2		4,500 m^2		5,300 m^2	

Table 2. Shrimp production performance during the polyculture studies.

	Polyculture 60/10		Polyculture 50/20		Polyculture 40/30	
	L. vannamei	*P. monodon*	*L. vannamei*	*P. monodon*	*L. vannamei*	*P. monodon*
Study 1						
Duration (days)	100	120	100	120	107	127
Mean body weight (g) at harvest	16.95	27.50	16.44	26.48	18.29	23.48
Feed-conversion ratio	1.34		1.38		1.53	
Survival rate (%)	89	97	93	98	91	84
Growth rate (g/day)	0.17	.23	0.17	0.22	0.17	0.19
Productivity (kg/0.5ha)	4,351	1,380	3,857	2,621	3,360	2,995
Productivity (kg/ha)	9,062	2,759	7,714	5,241	6,719	5,989
Study 2						
Duration (days	102	123	104	125	105	107
Mean body weight (g) at harvest	14.7	34.20	14.2	28.9	15.5	25.5
Feed-conversion ratio	1.51		1.66		1.67	
Survival rate (%)	100	65	93	66	89	68
Growth Rate (g/day)	0.14	0.28	0.14	0.23	0.15	0.24
Productivity (kg/0.5 ha)	4,407	1,111	3,543	1,911	2,997	2,618
Productivity (kg/ha)	8,813	2,222	7,085	3,822	5,993	5,235

Each pond had paddlewheel aerators to provide circular current flow and accumulate waste in the central areas of ponds, where drains occasionally were used to siphon out sludge. *P. monodon* postlarvae were stocked directly into the test ponds, while the *L. vannamei* were first held in a nursery at the farm for 21 days before stocking into the ponds with the *P. monodon*.

Feeding

Feeding was initially a dilemma, as the two species have different protein requirements, feeding habits, and habitats. Because *P. monodon* were stocked first, a 38 to 40 percent protein feed was used for the first month. This feed was also used as a booster feed for the *L. vannamei*. Lower-protein *L. vannamei* feed with 28 to 32 percent protein was used for the next two months to reduce feed costs.

However, after observing abnormalities in appearance and growth in the *P. monodon* during routine sampling, high-protein feed was used for the final month. Feed trays were used to monitor feed consumption and adjust rations.

Environmental conditions

Standard environmental parameters – salinity, temperature, pH, dissolved oxygen, alkalinity, and bacterial counts – were monitored and found within accepted industry standards.

Production performance

At Central Pertiwi Bahari's commercial farm ponds, the standards for monoculture of *L. vannamei* are 9.0 to 16 metric tons (MT) per hectare with 85 percent survival, whereas for *P. monodon*, standards include 4.0 to 6.0 MT per hectare with 50 percent survival. The resulting productivity performances for both species in the study was promising (Table 2, Fig. 1). Survival, growth and yield were excellent and related to their combination of stocking densities.

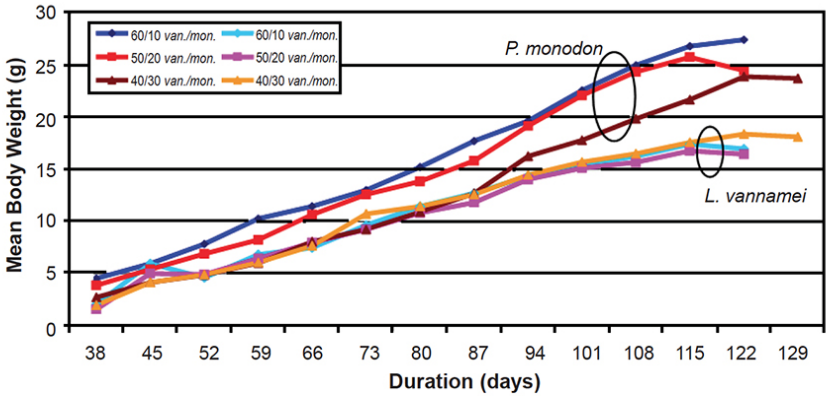

Fig. 1: Mean body weights of shrimp during polyculture study 1.

The study was repeated to cover two seasons of the year, with performance found to be almost the same, except for lower survival of *P. monodon* during the second study. Although the survival was lower, the growth rate was higher and average size was larger.

SPF status

The polyculture of these two species has been variously criticized, as one species is SPF and the other is not. The only concern that resulted from this study was the quality of the *P. monodon*, *L. vannamei* survival and other production performance parameters were consistent, possibly due to the animals' SPF status. However, for *P. monodon*, these factors varied, especially the survival rate, which reflected on other parameters such as growth and mean body weight. This may have been due to the fact that the animals were not SPF. However, additional studies have been successfully implemented with consistent results.

Polyculture allows greater utilization of the pond water in terms of space and feeding.

Stocking densities

All three stocking density combinations, which totaled 70 postlarvae per square meter, resulted in good production performance. Choices regarding which combination to use depend on what farmers want and need. The studies indicated that, if stocked at appropriate densities and times, the two species can coexist and appear to have symbiotic effects on each other's performance. This has resulted in higher overall pond productivity than in normal monoculture systems.

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