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Implementation of Double Folding Production (*PROLIGA*) Technology for Improving Shallot Production Using True Shallot Seed (*TSS*)

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Abstract

Shallot is one of the strategic horticultural commodities that has a very strategic position, considering that this commodity is widely consumed as a daily cooking spice with fluctuating prices. Therefore, it is not surprising if this commodity is a contributor to inflation. To meet the increasing consumption needs is necessary to look for the right strategy to increase domestic shallot production. One strategy considered able to increase shallot production is the implementation of the technology of shallot Double Folding Production (Proliga). Shallot *Proliga* is a technology to multiply production by using the New Superior Variety (*VUB*) principle, increasing plant population per area unit with a high planting spacing (10 cm x 10 cm), and optimizing fertilizer input and Plant Pest Organism (*OPT*) control effectiveness. This research was conducted starting from April to November 2018 in Pelem Village, Pare District, Kediri Regency, East Java. This research applied botanical seeds or TSS of Trisula varieties. The results showed that the implementation of *Proliga* technology was not only able to double shallot production compared to the technology/ methods commonly used by the local farmers, but also able to improve the farmer income with a B/ C ratio of 1.85.

Keywords: Farming, Growth, Shallot, TSS, Yield

INTRODUCTION

Shallot (*Allium ascalonicum*) is one of the horticultural commodities that have long been cultivated by farmers in Indonesia and have high economic value. Therefore, the shallot is one type of vegetable that can influence inflation, related to consumption. Shallot is one type of vegetable that is quite highly demanded, given that shallot is consumed every day as a mixture of cooking spices. Indonesian people's shallot consumption shows a fluctuating development in the period of 1993-2012 but is relatively increasing [1]. The average shallot consumption in 1993 was only 1.33 kg/ capita/ year, and it was increased to 2.764/ kg/ capita/ year in 2012 [2].

Shallot production in Indonesia is considered still low compared to the considerable potency. There are many factors causing the low shallot productivity, including the declining level of soil fertility, high rate of plant pest attacks, microclimate changes, and the use of low quality seeds [3]. The use of good-quality seeds is a determinant of the increase in shallot productivity [4].

In increasing shallot productivity, the main problem faced is the provision of seeds that are qualified, resistant to pests and diseases, high yield powered, and inexpensive. The problems emerging in the business of shallot seeding include: (1) the more complex cultivation process than the planting for meeting the need of consumption, (2) large costs, (3) ownership of narrow land, and (4) the planting that must be monthly done [5].

In meeting the growing demand for shallots, the government has set the target of shallot production for the period of 2015-2019 where the target of shallot production in 2019 is set at 1,359,056 tons [6]. Moreover, to fulfill the growing demand for shallots along with the increase in population and the development of various industries that require shallot raw material, the production and quality of shallots must continuously be improved. Besides, shallot planting must be regularly undertaken throughout the year so that the supply and prices will not fluctuate. Therefore, efforts for shallot production improvement must begin with the provision of efficient shallot technology that can benefit farmers. In line with this, the Agricultural Research and Development Agency, the Ministry of Agriculture has assembled double folding production (*Proliga*) technology for shallots. This technology, in principle, is a technology that intensifies land use with high planting spacing (10 cm x 10 cm), use of shallot seeds (TSS), application of nutrient and water management, and control of pests and diseases in an integrated manner with IPM (Integrated Pest Management) principles [7]. This technology needs to be modified by extending its implementation to shallot production centers.

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This research aimed to determine the implementation of *Proliga* technology on the production and farming of shallots usingTrisula variety seeds (TSS).

METHODOLOGY

This research was conducted in Pelem Village, Pare District, Kediri Regency starting from April to September 2018, consisting of 2 phases. The *Phase I* activity was the TSS seeding held in April-May 2018. The TSS used in this activity was from Trisula varieties as much as 2 kg for a total land area of 0.25 ha. The half of the land was for the implementation of *Proliga technology* while the other half was for the implementation of the local farmers' technology. For the implementation of *Proliga* technology, the seeds were first soaked into young coconut water for at least 4 hours prior to being sown. As for the implementation of *Proliga* technology, the seeds were soaked in plain water for 4 hours. Then, each seed was sown into a plastic bag containing a mixed media of soil and compost with a ratio of 1:1. The shallot seeds were sown until the age of 1 month and then transplanted on the land.

The *Phase II* activity, referring to the transplanting process, was carried out when the shallot seeds were 1.5 months old (the *Phase I* activity). The planting was done on the land with an area of 0.25 ha consisting of 120 beds, each of which was 5 m x 3 m sized. A total of 60 beds were for the implementation of *Proliga* technology and the remaining 60 beds were for the implementation of the local farmers' technology. The shallot seeds were planted on the beds with a spacing of 10 cm x 10 cm (the population of each bed was 1,500 plants). The plant maintenance was in accordance with the following recommendation of *Proliga* technology:

1. **Fertilization :**
   - Organic fertilizer with a dose of 10 tons/ ha
   - Biological fertilizer of Bio-Tricho with a dose of 15 kg/ ha
   - Inorganic fertilizer: 200 – 400 kg kg N/ha, 120 – 150 kg P/ha, and 120 – 140 kg K_2O/ha
2. **Plant Pest Organism Control**
   - Principles of IPM (Integrated Pest Management)
   - Pheromone Exi trap installation (25-30 units/ ha)
   - Light trap installation (25-30 units/ ha)
   - Yellow trap installation (40 units/ ha)
   - Controlled application of sistemic fungicides in off-season cultivation

One of the observation components on the *Phase I* activity was the growth percentage/ rate of shallot seeds with an observation interval of 1 week. Meanwhile, the observation component on the *Phase II* activity included the harvesting yield of all beds. An economic analysis was also conducted on the farming.

Furthermore, a comparison was made to find out the ratio of shallot production between *Proliga* technology and farmers' technology, where the difference between the two was the soaking treatment and the fertilizer input. In the use of local farmers' technology, the TSS was only soaked into plain water instead of young coconut water and the fertilizer input followed the local farmers' common usage.

RESULTS AND DISCUSSION

1 Percentage of TSS Growth

The statistical analysis showed that the administration of young coconut water had an effect on the growth percentage of botanical seeds (TSS). In the implementation of *Proliga* technology, the TSS treated with young coconut water for up to 6 weeks after seeding showed a growth rate of 90%, far higher than those in the implementation of local farmers' technology (soaked into plain water) which only reached 58% (Table 1).

Table 1. Ratio of Growth Percentage between TSS Soaked into Young Coconut Water and TSS Soaked into Plain Water at 2nd Week to 6th Week

Treatment	TSS Growth Rate (%)				
	2 WAS	3 WAS	4 WAS	5 WAS	6 WAS
Soaked into plain water for 4 hours (Farmers' Technology)	31 a	34 a	42 a	47 a	58 a
Soaked into young coconut water (*Proliga* Technology)	59 b	72 b	76 b	83 b	90 b

Description : The numbers in the same column which are accompanied by different letters show a significant difference based on the t-test at 5% significance level. WAS = Weeks After Seeding

Table 1 suggests that from the beginning of germination up to 6 weeks after seeding, the TSS treated with young coconut water (Implementation of *Proliga* Technology) showed a germination (growth) rate that was greater than those treated with plain water (Technology of

Farmers' Technology). This result is in line with Hidayat's (2000) study concluding that the use of coconut water affects the germination percentage of areca seeds [8]. The areca seed soaking into coconut water for 24 hours provided the best result in increasing the germination rate of areca seeds with a growth percentage of 98.66%. Similarly, Aysa *et al.* (2013) found that the growth percentage of dragon fruit cuttings increases to 100% after being soaked into coconut water [9]. Meanwhile, Renvillia *et al.* (2015) suggested that soaking teak stem cuttings in coconut water for 5 hours significantly increases the length of shoots, the number of roots, and the growth percentage [10].

2 Yield Components

The statistical analysis showed that the implementation of *Proliga* technology had an effect on the production of shallot bulbs. The results also indicated that the implementation of *Proliga* technology was able to increase the production of shallots by about 2 times compared to the local farmers' technology. This increased production was due to an increase in the number and weight of bulbs per shallot plant. The implementation of *Proliga* technology was able to increase the number of bulbs per shallot plant with a range of 156% and increase the weight of bulbs per shallot plant with a range of 182% (Table 2).

Table 2. Comparison of Shallot Yield between *Proliga* Technology and Farmers' Technology

Technology	Yield Component		
	Number of Bulbs per Plant	Weight of Bulbs per Plant (g)	Production (ton/ha)
Farmers	2.70 a	31.00 a	21 a
Proliga	4.23 b	56.33 b	39 b

Description : The numbers in the same column which are accompanied by different letters show a significant difference based on the t-test at 5% significance level

The components distinguishing between Proliga technology and farmers' technology were the use of organic and inorganic fertilizers and the intensive control of Plant Pest Organisms (*OPT).* The shallot bulbs produced from implementation of *Proliga* technology were more weighty than those produced from the implementation of farmers' technology, as depicted in Figure 1. The results of this research are consistent with Napitupulu (2017) finding that coconut water treatment affects both fresh and dry weights of shallot bulbs [11]. Likewise, Simangunsong *et al.* (2017) suggested that soaking shallot seeds into coconut water for up to 6 hours can increase the number and weight of bulbs per shallot plant [12]. Meanwhile, based on the results of Ekasetya's (2012) study, it is concluded that soaking cucumber seeds in coconut water can increase the plant height, number of flowers and fruit weight [13].

Figure 1. Shallot Bulbs Produced from Proliga Technology and Farmers' Technology

If further examined/ observed, in the implementation of *Proliga* technology, the shallot plants could produce 4 bulbs per plant (43.33%); 5 bulbs per plant (33.33%); and 6 bulbs per plant (3.33%). Meanwhile, the shallot plants yielded from the implementation of the local farmers' technology mostly produced 3 bulbs per plant (in the range of 46.67%) as presented in Table 3.

Table 3. Percentage of the Number of Shallot Bulbs Yielded from *Proliga* Technology and Farmers' Technology

Technology	Persentase Jumlah Umbi per Tanaman (%)					
	1 bulb	2 bulbs	3 bulbs	4 bulbs	5 bulbs	6 bulbs
Farmers	3.33	36.67	46.67	13.33	0	0
Proliga	0	0	16.67	43.33	33.33	3.33

The use of fertilizers in the implementation of *Proliga* technology was optimal, leading to the availability of nutrients such as nitrogen, phosporus, potassium to sustain the growth and production of shallots. These nutrients (nitrogen, phosporus, and postassium) are essential for plants. Hakim *et al.* (1986) suggested that if the nitrogen element is fulfilled, protein synthesis and the formation of new cells can be achieved so that plants are able to form vegetative and generative organs [14]. Furthermore, the potassium element can help increase the number and quality of shallot bulbs [15].

3 Economic Analysis

The implementation of *Proliga* technology did not only double the production of shallots but also was able to double income and even triple profits if compared to the implementation of farmers' technology (Table 4).

Table 4. Comparison of Shallot Farming Economic Analysis Between *Proliga* Technology and Farmers' Technology

No,	Description	Economic Analysis			
		Proliga Technology		Farmers' Technology	
		Amount/Vol	Value (Rp)	Amount/Vol	Value (Rp)
1,	Expenditures				
	a. Production Facilities				
	▪ Seed	5 kg	12,500,000	4 kg	10,000,000
	▪ Compost	10 tons	6,000,000	5 tons	3,000,000
	▪ Fertilizer *ZA*	1000 kg	3,200,000	350 kg	700,000
	▪ Fertilizer *SP36*	300 kg	1,500,000	-	-
	▪ Fertilizer *KCl*	200 kg	1,200,000	-	-
	▪ Fertilizer *NPK Mutiara*	200 kg	1,800,000	500 kg	4,500,000
	▪ Pesticide	90 lt/kg	23,850,000	65 lt/kg	17,225,000
	▪ Pheromone Exi/ Glue	12 pack	2,100,000	2 Lt	300,000
	▪ Plastic and Bamboo	4 rol/25 ljr	1,850,000	4 rol/25 ljr	1,850,000
	b. Labor				
	1,Nursery				
	- Making planting media	50 HOK	3,500,000	30 HOK	2,100,000
	- Sowing TSS	50 HOK	3,500,000	40 HOK	2,800,000
	- Maintaining nursery	30 HOK	2,100,000	20 HOK	1,400,000
	- Transporting the seeds to the planting area	12 HOK	840,000	8 HOK	560,000
	2,, Land processing and maintenance				
	▪ Hand tractor {by the job}	-	1,500,000	-	1,500,000
	▪ Ridge (*Gulud*), bed and sewer	60 HOK	4,200,000	60 HOK	4,200,000
	▪ Planting	190 HOK	6,650,000	140 HOK	4,900,000
	▪ Fertilization	24 HOK	1,680,000	15 HOK	1,050,000
	▪ Plant Pest Organism (*OPT)* Control	100 HOK	7,000,000	80 HOK	5,600,000
	▪ Watering	55 HOK	3,850,000	40 HOK	2,800,000
	▪ Weeding	180 HOK	6,300,000	120 HOK	4,200,000
	▪ Harvesting and drying	90 HOK	6,300,000	50 HOK	3,500,000
	▪ Transport	30 HOK	2,100,000	16 HOK	1,120,000
	Total Expenditures		103,520,000		73,305,000
2,	Production **/ Revenue	39 tons	295,500,000	21 tons	143,850,000
	Profit		191,980,000		70,545,000
	R/C ratio		2,85		1,96
	B/C ratio		1,85		0,96

CONCLUSION

The implementation of *Proliga* technology includes a high planting spacing (10 cm x 10 cm), organic fertilization with a dose of 10 t/ ha, fertilization with a dose of 200 kg N/ ha, fertilization with a dose of 130 kg P/ ha, fertilization with a dose 125 kg K/ha, Plant Pest Organism (*OPT*) control with IPM (Integrated Pest Management) principles, accompanied with installation of Pheromone Exi and light traps respectively of 25 units/ ha as well as the installation of yellow traps of 40 units/ ha. The implementation of *Proliga* technology not only can double the production of shallots (compared to farmers' technology) but also the income and profits of shallot farming.

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