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The True Seed of Shalott (TSS) Technology Production on Trisula Variety in East Java

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Abstract

One of the onion increasing production problem is the lack of quality seeds availability. In order to provide high quality seeds of high yield and available throughout the year, an improvement of seed technology is required. One of the developing onion seed technologies is onion seeding through TSS (true seed of shallot). TSS technology development is expected to overcome the problem of onion seeding in Indonesia. East Java as one of the production centers of onion requires in developing onion seeding technology through TSS. This study aims to apply and develop TSS production technology using *Trisula* varieties which has been done from April to December 2016 in Tulungrejo village, Bumiaji district, Batu. The result of TSS production technology implementation indicates that *Trisula* variety is able to produce 110,5 kg TSS. Based on its agro-ecology, Batu area has the potential as the center of TSS production in East Java.

Keywords: Onion, Technology, *Trisula* Varieties, True Seed of Shalot

INTRODUCTION

In order to provide high quality onion seeds, high-yield and healthy with sufficient volume throughout the years, an improvement of the seeding technology is required. One alternative technology of the onion seed seedling is the use of botany seeds (TSS = True Seed of Shallot). The use of TSS is expected to overcome onion seeding in Indonesia because it can quantitatively accomplish onion seeds availability (to cover the lack of high quality onion seeds that reach 82,2%) and quality, such as higher productivity, healthier plants, more efficient use of seeds, long relative storage, the handling in warehouse and easier transportation [1];[2];[3];[4];[5];[6]. With longer shelf life of TSS seeds (1-2) years, the problem inadequate seeds in every growing season can be overcome.

Currently, the use of TSS seeds in Indonesia has not developed as expected. TSS production development is more focused to dry-land agro-ecosystem in highlands. This is instigated because the planting location affects TSS production. Highlands (temperature 16-18^{o}C) is a suitable location to increase onion peak [7]. Therefore, TSS as a seed source will be more optimal if produced in the highlands with weather condition that are not foggy and windy. Indonesian Agency of Agricultural Research and Development has produced the components of TSS seed production technology which able to produce quantitative and qualitative TSS seed optimally (1-1,5 g TSS/plant with DB > 75 %), which includes manure application (horse/sheep/cow 20 ton/ha and chicken 10 ton/ha) ripe, tuber vernalization at temperature 10^{o} C for 4 weeks, SP-36 200 kg/ha, NPK 600 kg/ha, BAP 37,5 ppm, boron 3 kg/ha, bee pollinator or green fly [7];[8];[9];[10];[11];[12];[13].

Flowering and seed formation on the onion is influenced by the environment, such as the duration of irradiation, temperature, humidity in addition to internal factors such as genetics or varieties, and the balance of ZPT. Low temperatures can stimulate the onion flowering [14]. Onion plants require temperature of 9-12^{o}C in order to occur flowering induction [15]. In the tropics, flowering induction was done by tuber verbalization before planting in refrigeration at 100° C for 4 weeks [8]. Meanwhile, locations with altitudes >1000 m asl are suitable locations to produce a high percentage of onion flowering [11];[7]. The results of Putrasamedja and Permadi's research, 1994) show that varieties of *Bima*, *Maja Cipanas* and *Kuning* can reach flowering above 70% at planting in the Cipanas plateau [4].

This study aims to apply and develop TSS production technology with the use of *Trisula* varieties in East Java.

MATERIAL AND METHOD

The implementation of TSS production technology is conducted in Tulungrejo village, Bumiaji District, Batu with altitude of 1.400 m

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above sea level start with implementation time from April to December 2016. TSS production technology is implemented by Rosliani (2015).

- Plant varieties of *Trisula* onion are planted with planting distance 20 cm x 20 cm on BED as much as 41 units and the area of each bed 11 m^2 . Distance between bed 1,1 m.

The implementation of TSS production technology, including:

1. Planting Preparation
   - Soil Processing: to be pierced, clean up the grass and soil.
   - Processed soil, bed is made with size: Width = 1.2 m; height = 30-40 cm; between bed = 50 cm, length adjusted with land's condition.
   - Above bed, dispersed 1000 kg of chicken manure per 1000 m2 ripped, SP-36 25 kg per 1000 m2 and *Furadan* evenly then stirred with soil.
   - Bed is sealed with black plastic mulch and holed with gap 20 cm x 20 cm
   - Seed tubers (age 2 months) will be vernalized before planted at temperature 10 ^{0}C for 4 weeks in cool storage or cool box.

2. Planting and Shade Installation
   - Before planting, root seeds saturated with BAP, concentration 37,5 ppm for an hour and drained until dry then mixed with *Fungicide Dithane* M-45 with dose 2 g/kg seed.
   - > 7 gr sized-onion seed planted in planting hole with distance 20 cm x 20 cm, planting population total per 1000 m2 approximately 12 500 plants with 50% land efficiency.
   - Two weeks after planting or before plants peaked, shade made of bamboo with transparent white plastic roof with 2 m pole height (East side) and 1.5 m (West side), bed direction is facing East-West.

3. Macro Fertilizer's application and micro fertilizer's follow up is done at the time:
   - Age 1 HST NPK *Mutiara* fertilized as much as 6 kg per 1000 m2 dissolved in water and given by molding then fertilizer's application with the same dose given every week with total application 10 times until age 75 HST (total fertilizer given 60 kg per 1000 m2).
   - Age 3, 5 and 7 MST is done spraying of borax and borate acid with boron dose 3 kg/ha and spray volume used is 700-800 ml/1000 m2.

4. Maintenance includes
   - Pest and disease control: by installing a yellow tap since 1 week-aged plant after planting to flower bud and selective pesticide spraying.
   - Watering and early morning dew, weeding at planting holes and gutters, removing old leaves and installing raffia ropes in plants' rows to straighten and hold the flower stalk.

5. *Tagetes* planting to attract pollinators is done before planting around the field and in the bunds for every 3 bed, while the application of honey bee insects *Apis cerana* as much as 5 boxes of nest for 1000 m2 installed when the flowers begin to bloom.

6. The first harvest at age 110 days after planting (HST) and done $\pm$ 5-6 harvest times with 4-7 days intervals depending on the weather. Harvesting seeds is up to the age of 140-150 HST or approximately 5 months after planting.

7. Observation
   - Growth of plants age 2, 4 and 6 weeks (plant height and numbers of tillers)
   - Flowering component (flowering plants' percentage, number of umbel/flower per cluster)
   - Seed production component (harvest time, number of harvested seeds, number of capsules/clusters, number of seed weight/clusters, total seed weight, growing supremacy)
   - Environmental conditions (temperature, rainfall etc.)
   - Population and crop damage due to pest attack
   - Type of insects pollinator that visiting the onion buds
   - Farmers perception and preferences on the disseminated technology
   - Farmers responses as the training participants on the disseminated technology

- The Institutional Option as the respondents priority in each production location (AHP analysis material)

RESULT AND DISCUSSION

Vegetative Growth of Mother Plant

Plated onion varieties are *Trisula* varieties produced by Research Institute Vegetables Lembang. Vernalization treatment conducted in Lembang, Bandung using cold storage with temperature of 10^{o}C for 4 weeks.

The observation results of vegetative growth of onion mother plants at ages 2, 4 and 6 weeks are presented in Tables 1, 2 and 3, respectively.

From Table 1, 2 and 3 it can be seen that the growth of mother plants of Onion *Trisula* variety is very good. At 2 weeks after planting, the percentage of seed growing reached 96% with the average of plant height reach 24.12 cm and the average number of tillers per cluster 4.76 stems. Good vegetative cultivation is indicated by the average number of leaves of 17.1 strands and the color of green leaves even though the leaves are less muscular.

At the age of observation which is 4 weeks after planting, the average height of the plant reached 32.7 cm with the average number of tillers 7.13 per cluster and the average number of leaves 28.33, green leaf color. At the age of 4 weeks after planting has formed flowers with a percentage of flowers appear about 20%. Flowers that form reach 1 - 4 flower stalks per plant cluster.

At the age of 6 weeks after planting observation, there is an increasing growth of plant height, number of tillers, and number of leaves and the increasing of formed flower percentage. The average plant height reached 41.12 cm, with an average number of tillers 8.0 and the average number of leaves 33.3. The percentage of formed flower reaches approximately 75%. While the average amount of flowers reached 3.07 per plant cluster. However, at the age of 6 weeks after planting, formed flowers 1 - 5 flower stalks per plant cluster.

The growth of onion's mother plants, good *Trisula* varieties quality cannot be separated from environmental conditions. The existing environmental conditions (Table 4) support the growth of onion mother plants of *Trisula* varieties. This is in line with Samadi and Cahyono (1996) who argued that onion growth is strongly influenced by environmental factors, particularly temperature and humidity.

Table 1. The Cultivation Growth Variance *Trisula* varieties at age 2 weeks after planting

Observation Parameter	Score
Percentage of growing seed (%)	96
Plant height average (cm)	24,12
Average number of tillers (stem)	4,76
Average number of leaves (sheet)	17,1
Leaf color	Green

Table 2. The Cultivation Growth Varieties *Trisula* varieties 4 weeks after planting

Observation Parameter	Score
Plant height average (cm)	32,7
Average number of tillers (stem)	7,13
Average number of leaves (sheet)	28,33
Leaf color	Green
Flower percentage (%)	$\pm$ 20

Table 3. The Cultivation Growth Varieties *Trisula* growth age at 6 weeks after planting

Observation Parameter	Score
Plant height average (cm)	41,12
Average number of tillers (stem)	8
Average number of leaves (sheet)	33,3
Leaf color	Green
Flower percentage (%)	75
Average flowers rate per cluster (stalk)	3,07

Table 4. The Environmental Conditions Activity Location June - August 2016

No	Environmental Component	Average Score
1	**Daily Temperature**	
	Day	27 ^{o}C
	Night	19 ^{o}C
	Average Temperature	22,17 ^{o}C
2	Humidity (%)	40 - 53
3	**Rainfall**	
	Number of rainy days (days)	5 - 10
	Rainfall (mm)	52 – 168

Table 5. The production component of TSS *Trisula* varieties

No	Observation Component	Score
1	Harvest Time	I. 24 October 2016 (128 hst) II. 28 October 2016 (132 hst) III. 9 November 2016 (144 hst) IV. 10 November2016 (145 hst) V. 11 November 2016 (146 bhst)
2	Percentage of crops harvested (from total population)	I = 1% II = 10% III = 24% IV = 55% V = 10%
3	Number of seeds harvested (from total population)	98%
4	The number of capsules per cluster	Flower numbers = 3 -9 flowers/ cluster Capsule numbers/ flower = 25 – 150 Capsule numbers/ cluster = 150 – 900
5	The number of seeds per capsules	4 – 6 grain
6	The number of seeds per 1 gram	350 grains
7	Weight of 1.000 seeds	2,902 g
8	Number and weight of seeds per cluster	Number of seeds per cluster = 750 - 4,500 items Seed weight per cluster = 2.14 - 12.85 g
9	Weight seeds total	11,5 kg/ 1000 m^2
10	Total Tuber weight harvested	Total Tuber = 800 kg

Botanical Seed Production/TSS

The observation results on the TSS components production of *Trisula* varieties in detail are presented in Table 5. From Table 5 it can be seen that the ability of *Trisula* varieties to produce TSS is quite optimal. Optimal TSS production of *Trisula* varieties is indicated by the number of flowers per cluster and the number of capsules per flower as well as the number of capsules per cluster produced. *Trisula* varieties have the ability to produce flowers per cluster in the range 3-9. Meanwhile, the number of capsules produced per flower in the range 25 – 150 and the number of capsules per cluster produced in the range 150 – 900. With the number of flowers and capsules which produced quite a lot, then TSS production which produced by *Trisula* varieties is quite large. Considering the number of flowers, the number of capsules and the number of seeds and the weight of the seed per capsule, the potential for TSS production is produced by *Trisula* varieties in the range of 110-120 kg per hectare. The production of TSS as much as it can be used as a source seed on onion cultivation on a wide range of 25-30 hectares.

Based on such facts, Batu has potential as a production center for TSS in East Java. This is in line suggested that the flowering and production of botanical seeds / TSS in the highlands is greater than the plateau [7]. It was further suggested that to increase the formation of onion seeds requires a temperature in the range 17 - 19˚C. Indonesia's air temperature of that scope is only in the plateau> 1,000 m above sea level. Batu is one of the areas in East Java that has a high enough plateau area.

Population and Plant Damage Due to Pest Attack

The pest attack on *Trisula* Varieties is not only seen in vegetative growth but also during generative growth, among others: diseases caused by powdery *(Peronospora destructor)* besides that there is also a caterpillar pest *(Spodoptera exiguata)*. By the time the capsule enters the aging stage, there is an attack of the fungus on the flower stalk and the caterpillar attack with an average population of 2 tails per umbel. The difficulty in controlling is caused by continuous rain. Besides that when controlling should also pay attention to the survival of honey bees' lives. When effective control is done in the morning before sunrise, when the honey bee has not been active. Honey bee start active from 11.0 to 15.0

Types of pollinating insects that visit a flower

The results of the inventory of pollinating insect species visiting onion flower includes honey bee *(Apis cerana)*, forest bee *(Apis dorsata)*, butterfly and green fly *(Phaenicia sericata)*.

Perceptions and Preferences of Farmers on the Implemented Technology

The farmers in Tulungrejo village, Bumiaji sub district, where this activity is very concerned in the production of TSS as a source of onion seeds, this is seen at the Farmers Gather enthusiastic and very interested to develop the TSS. *Gapoktan Mitra Arjuna* is very enthusiastic in carrying out the continuation of TSS activities and has agreed to carry out TSS activities covering 4 - 5 ha by involving 25-40 members of farmers. Besides, the farmers from Ngantang district, Malang Regency who also attended the Field Gathering are also willing to develop TSS activities and will plant TSS to produce seed tuber.

CONCLUSION

1. The percentage of onion Trisula varieties grow at 96%
2. Trisula onion varieties start flowering at age 4 weeks after planting with the percentage of flowering plants by 20% and at age 6 weeks after planting the flowers formed reach average 75% with the average number of flower stalk 3,07 per cluster.
3. The number of seeds per capsule produced ranges from 4 to 6 grains.
4. Potential insects as pollinators include: honey bees, forest bees and green flies.
5. *Trisula* varieties able to produce TSS as much as 115.0 kg per hectare
6. Batu area has high potential and opportunity to produce botanical seeds/ TSS in collectively.

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