Farmers' perceptions of soil block nursery techniques on shallot seeds in Grobogan District, Central Java

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Abstract: The research aimed to know the performance of seedlings and farmers' perceptions of Shallot seed nursery techniques using soil blocks. The study was conducted in Grobogan Regency from September - November 2018. The research method used three nursery techniques, namely a seedbed with soil block, plastic bags, and plumbing. The data collected included technical data, namely data on the growth and productivity of shallots, and data on farmers' perceptions of nursery techniques obtained by interviewing 30 farmers. Technical data were analyzed descriptively using an average value and t-test, evaluated farmer's perceptions using 11 attributes and five evaluation scales, which were analyzed using a 5-scale interval scoring technique. The results showed that the average shallot productivity obtained by the soil block nursery technique was higher than the other nursery techniques. Farmers have a good perception of soil block nursery techniques compared to other methods because shallot seeds are very easy to grow, seedlings are very easy to move to the planting area, seedlings are very easy to grow in planted area, seedlings thrive in planted area, and size of the resulting bulbs is very big. The soil block nursery technique is an alternative to increasing shallot production.

1. Introduction
Shallots are one of the horticultural commodities that people in Indonesia need every day since almost every household needs shallot as a seasoning. Besides, shallots are also required by several food processing industries. Therefore, shallots have high economic value and open business opportunities as a source of income and job opportunities that contribute significantly to the farmers' economy.

Even though the opportunities for developing shallots are widely opened, business players have obstacles to develop of shallot. These constraints include technical and economic constraints [1]. Technical constraints are related to the limited availability of quality seeds, which are only available around 15-16% per year of the national seed requirement, while other seed needs are met from consumed bulbs and imported seeds [2,3]. Economic constraints are related to the high cost of shallot production, especially the purchase cost of seed bulbs and labor wages [1]. The cost of these two inputs is between 70-80% of the production cost [4].

Quality seeds have an important role to play in increasing the number and quality of production results. True Shallot Seed (TSS) can be a solution to meet seed needs and increase shallot production [5]. The development of shallot seeds can be done in three ways, namely planting seeds directly in the land (direct seedling), sowing TSS seeds through seedlings (seedling), and planting mini bulbs [6, 7]. If the seeds are planted directly in the land, they do not require a transplanting process, whereas if the
seeds are sown first, consequently, after 45 days the seeds need to be transplanted into the prepared land.

The seedling is an important phase in obtaining quality seeds, namely healthy seeds, high yield potential, and disease-free. Therefore, preparing plant nutrition, seedling media, and seedling methods are important to be noted in seedling techniques. The development of a new innovation in the seedling, namely by making the soil into blocks using the pressing technique as a medium for seedlings which is called a soil block [8]. Soil blocks are also called printed seedling media or biopot which has a function as a container for seeds as well as a medium for growing seeds [9]. The introduction of innovative soil block in seedling techniques can expand widely if farmers have a positive perception of the innovation. Therefore, this study aims to determine the performance and development of shallot seeds as well as to find out farmers’ perceptions toward seedling techniques of shallot seed using soil blocks.

2. Research methods

2.1 Place and time of study
This study was done in Padang Village, Tanggungharjo Subdistrict, Grobogan District from September - November 2018. This location was determined purposively based on the consideration that Grobogan Regency is one of the areas for shallot development in Central Java using seeds.

2.2 Method of implementation
True shallot seed (TSS) seeding activity uses three nursery techniques, namely soil block, ocher (plastic bags), and pullout system (direct seeding in the nursery).

2.2.1. Soil block nursery technique. Soil block is a nursery technique made by pressing the soil with certain media into blocks that function to seed shallot seeds. The soil block seedling technique is an innovation for respondent farmers. The media used in soil block seedling techniques is a mixture of coconut coir (cocopeat): manure: peat: natural phosphate: dolomite with a ratio of 30%: 15%: 15%: 30%: 10%. The media is then mixed into a composite, then printed using a soil block tool to form solid soil blocks [8]. The advantages of a nursery using soil blocks are that it can store water so that at the stage of maintaining the seeds in the nursery, it is enough to water it once a day, both in the morning and in the evening.

2.2.2. Bag plastic nursery technique. The nursery technique uses a plastic container (ocher) with a size of 4 x 2 cm, which is a nursery medium that is commonly practiced by existing farmers to seed several types of vegetable seeds. The media for seedling using the ocher technique is soil + chicken manure with a ratio of 1: 10. Unlike the maintenance of seedlings with the soil block technique, watering shallot seeds using ocher is done twice a day.

2.2.3. Pullout system. A nursery with a pulling technique is a nursery by planting shallot seeds in a table (planting the seeds directly) in the nursery. Shallot seeds are planted directly in the nursery with 10 cm spacing between rows so that the nursery with an area of 1 m2 has ten grooves. In each row, 10 grams of shallot seeds were planted. The media used in the nursery for the pullout system is chicken manure + husk charcoal + soil with a ratio of 1: 1: 1. The media is mixed into a composite mixture, then sprinkled on the prepared beds. The nursery technique with a pullout system is a nursery that already exists at the respondent farmer level who grows shallots with seeds. Maintenance of shallot seeds in the nursery by providing NPK Mutiara fertilizer at a dose of 1.5 - 2.0 g / liter of water at the age of 4 weeks. 45 days after sowing, the seedlings are removed and planted in the planting area.
2.3 Data analysis methods

2.3.1 To determine the growth and development of shallot seedlings in the nursery were analyzed descriptively by using the average value of each component of the observation and the t-test to distinguish between seedling techniques.

2.3.2 Farmers' perceptions were analyzed using ordinal data with a scoring technique. Hendrawati et al. [10] used a scoring techniques to measure the level of farmers' perceptions of the use of superior paddy seeds in Ketapang Regency, West Kalimantan, West Kalimantan. Theresia et al. [11] analyzed farmers' perceptions of the use of local and imported shallot seeds in Cirebon District. The ordinal data obtained were then analyzed descriptively. There are 11 attributes/performance in the shallot seed seedling technique evaluated by the farmers with five trust level evaluation scales (Table 1). Farmers' assessment of the attribute is based on the strength of the farmer's level of confidence in the attributes possessed by the three seedling techniques. Sugiyono [12] describes the criteria for response to a phenomenon from unfavorable to very good conditions so that the attribute rating is measured on a 5-digit evaluation scale, namely from scale 1 is the lowest level of confidence in an attribute and scale five is the highest level of confidence an attribute.

| No | Attributes                                         | Evaluation scale of confidence level |
|----|---------------------------------------------------|-------------------------------------|
|    |                                                   | 1        | 2            | 3            | 4            | 5            |
| 1. | Ease of obtaining nursery media                   | Very difficult | Difficult | A little difficult | Easy | Very easy |
| 2. | Ease of growing seeds in nursery media            | Very difficult | Difficult | A little difficult | Easy | Very easy |
| 3. | Ease of transplanting from the nursery to the planting area | Very difficult | Difficult | A little difficult | Easy | Very easy |
| 4. | Ease of growing seeding in the planting area       | Very difficult | Difficult | A little difficult | Easy | Very easy |
| 5. | The fertility of seedling after transplanting     | Very infertile | Infertile | Less fertile | Fertile | Very fertile |
| 6. | Plant resistant to pests                          | Very not resistant | Not resistant | Less resistant | Resistant | Very resistant |
| 7. | Bulbs size                                        | Very small | Small | Moderate | Big | Very big |
| 8. | Shallot bulbs color                               | Very pale | Pale | A little red | Red | Very red |
| 9. | Shallot production                                | The least | A little | Quite a lot | Lots | Very much |
| 10.| The selling price of shallot                      | Very cheap | Cheap | a bit expensive | expensive | Very expensive |
| 11.| Farmer's profit                                   | The least | A little | Quite a lot | Lots | Very much |

Perception analysis uses qualitative data, and qualitative data is then quantified by scoring techniques and analyzed by the average value method [11]. The average values obtained were analyzed by grouping them into five categories of interval scales as follows:
The proportion of farmers who completed formal education varies from graduation from elementary school to undergraduate level (S1) with an average formal education of 9.07 years or equivalent to completing junior high school (JHS). The education level shows the level of knowledge and insight that farmers have to apply to social and economic activities. The proportion of farmers who completed formal education at the primary school level was 40.00%, junior high school 30.00%, senior high school 26.67%, and bachelor 13.33%. This proportion indicates that the respondent farmers are more educated at the primary school level, so that efforts are still needed to increase the knowledge of farmers’ resources through additional non-formal education such as training, conducting farming demonstrations, or increasing the intensity of extension. Non-formal education can help farmers develop thinking patterns and technical skills [14].
The number of family members describes the farmer's burden as the head of the family, but the number of family members is also a labor asset in the family [15]. The number of farmer family members ranges from 2 - 6 people with an average of 4 people. This number indicates that more households have family members of 2-4 people (80.00%), and 20.00% of households have family members between 5-6 people. The more family members the farmer has, the labor requirements in shallot farming can be met from within the family and reduce the use of labor outside the family.

Farmers who have experience in shallot farming varies between 2-20 years, with an average of 5.02 years. Farming experience for most respondents (70.00%) was between 1 - 5 years, 23.33% of respondents had 6 - 10 years of experience, and 6.67% of farmers had more than 10 years of experience. This condition illustrates that shallot farming is relatively new for 70% of farmers because Grobogan Regency is an area for shallot development. In contrast to shallot farmers' experience in Brebes District who have more than 30 years of experience [13].

The main occupation of respondent farmers (90.00%) is farmers, and 10.00% has the main job not as farmers, namely civil servants and traders. Of the respondents who work as farmers, 20.00% have side jobs as masons and private workers. A farmer's side job can also act as a source of family income.

3.2. Performance of shallot seed growth in the nursery

The average viability of shallot seed in the three seedling techniques was 55 - 60 %, and it was not statistically significant between seedling techniques. Likewise with the seed vigor an average of 5 days of seeds showed growth with the appearance of the first leaves. As research by Sopha et al. [16] stated that TSS shallot seeds in several seedling media and seedling methods statistically had no significant effect on germination, plant height, and quantity of seedling leaves. Sopha et al. [17] also argued that seedling media did not significantly affect seedling growth. Likewise with research Girsang et al. [18] that planting media in the form of sand, topsoil, rice husks, manure, and compost had no significant effect on the germination of shallot seeds.

The seed viability obtained was higher than the growing power of shallot seeds in Sopha et al. [19] research, namely 51.6% obtained in soil seedling media and manure compared to other media (paddy soil + sand + manure or soil + sand + manure). The seed viability of shallot seeds in various seedling media was obtained by [20] varies between 63.50 - 83.42%. The highest yield was in the media of husk charcoal, husk charcoal + compost, and husk charcoal + compost + soil. Some of the results of this study imply that organic fertilizers in shallot seedling media have an important role in improving soil physical properties and supporting the growth of plant seeds. Thoriqussalam and Damanhuri [6] found that the media for seedlings using manure provided better seed growth.

Table 3. Performance of shallot seed growth in the nursery in Grobogan District, 2018

| No  | Descriptions                               | Soil Block | Plastic Bags | Pullout System |
|-----|--------------------------------------------|------------|--------------|----------------|
| 1.  | Seed viability (%)                         | 60.00a     | 60.00a       | 60.00a         |
| 2.  | Seed vigor (days)                          | 5.00b      | 5.00b        | 5.00b          |
| 3.  | Plant height at the time of transplanting (cm) | 25.49a     | 24.70a       | 29.62b         |
| 4.  | Average productivity (ton/ha)              | 25.28a     | 23.77a       | 20.61b         |

Note: Numbers followed by different letters on the same line indicate differences at the 0.05 level T-test (Tukey HSD)

Source: Primary Data, 2018 (processed)

At the time of transplanting, the height of shallot seedlings was obtained in the seedling technique with different roots from soil block and plastic bags technique. In contrast to the research of Sopha et al. [17] found that the height of shallot seeds at the age of 42 days was not significantly different between the media for seeding. The height size of the seedling obtained varied between 15.53 cm - 17.88 cm.
The highest productivity was obtained from the seeds sown using the soil block technique, namely 25.28 tonnes/ha, followed by the plastic bag seedling technique (23.77 tonnes/ha) and the pullout system (20.61 tonnes/ha). This difference in results is due to differences in the media used at the beginning of plant growth. Early growth functions to form root development and support the upright growth of plants [21]. The planting media in the soil block seedling technique contains more complete nutrients so that it gives the highest yield. Besides, transplanting seedlings with soil blocks is easier to work with than other seedling systems, so that root damage does not occur so that the plants grow better. Although the highest productivity was obtained in the soil block technique, this productivity was not significantly different from the productivity obtained in the plastic bag seedling technique.

3.3. Farmers' perceptions of shallot seed nursery techniques
Farmers are the main actors in efforts to increase shallot production, therefore farmers' perceptions play an essential role [11]. Farmers' perceptions influence farmers' decisions in determining the technology to be used in farming activities, including nursery techniques. The three shallot seed seedling techniques studied have advantages and disadvantages in their respective attributes. Good and very good perceptions of an attribute indicate an advantage, while poor, bad and very bad perceptions indicate the weakness of an attribute.

3.3.1. Farmers' perception of the attribute performance of soil block nursery technique. The Soil block nursery technique was perceived as good by farmers with a mean score of 3.91, meaning that the farmers liked the nursery technique compared to the bag plastic nursery technique and pullout system. Farmers have a very good perceptions criteria of the five attributes of soil block nursery technique, because 1) shallot seeds are very easy to grow, 2) seedling are very easy to move to the planting area, 3) seedling are very easy to grow in the planted area, 4) seedling grow very well after moved to the planting area and 5) the size of bulbs are very large. Farmers have good perceptions criteria of four attributes because 1) the plants are resistant to pests and diseases, 2) the color of the bulbs is red, 3) the quantity of bulbs is a lot, and 4) the farmer's profit is a lot. Farmers have poor perceptions criteria of two other attributes because 1) the nursery media for soil block is a little difficult, and 2) the selling price of shallot a bit expensive (Table 4).

Table 4. Farmers' perceptions of the attributes performance of soil block nursery technique on shallot seed in Grobogan District, 2018

| No | Attributes                                      | Scores | Attributes confidence level | Perceptions Category |
|----|------------------------------------------------|--------|-----------------------------|----------------------|
| 1. | Ease of obtaining nursery media                | 3.27   | a little difficult          | poor                 |
| 2. | Ease of growing seeds in nursery media         | 4.26   | very easy                   | very good            |
| 3. | Ease of transplanting from the nursery to the planting area | 4.23   | very easy                   | very good            |
| 4. | Ease of growing seedling in the planting area  | 4.43   | very easy                   | very good            |
| 5. | The seedling thrive after transplanting        | 4.30   | very fertile                | very good            |
| 6. | Plant resistant to pests                       | 3.43   | resistant                   | good                 |
| 7. | Bulbs size                                     | 4.32   | very big                    | very good            |
| 8. | Shallot bulbs color                            | 4.00   | red                         | good                 |
| 9. | Shallot production                             | 3.63   | lots                        | good                 |
| 10.| The selling price of shallot                   | 3.40   | a bit expensive             | poor                 |
| 11.| Farmer's profit                                | 3.80   | lots                        | good                 |
|    | Mean scores                                    | 3.91   |                              | good                 |

Source: primary Data, 2018 (processed)

The most preferential advantage of the soil block nursery technique compared to other techniques is the attribute of "the ease of growing seedling in the planting area" with a value of 4.43. Seedlings planted with soil block techniques are easier to grow if transferred to the planting area compared to other seedling techniques. This is consistent with the research of Suita et al. [9], which resulted that
calliandra seeds grown in printed seedlings had better growth than those in polybags. Soil block nursery media can better protect plants' root system to minimize stress symptoms when transplanting [8].

Another advantage of the soil block nursery technique is that it provides higher benefits because the bulbs' average productivity is higher than other techniques. The most striking weakness of the soil block nursery technique is the material from nursery media attributes are more difficult to obtain. The material in the form of cocopeat, peat, and natural phosphate is not always available at the farmer's location, so to obtain them, they have to buy from an agricultural facility shop specializing in providing them. The nursery media for bag plastic nursery technique and pullout system is very easy to obtain because it only consists of soil and manure.

3.3.2. Farmers' perception of the attribute performance of bag plastic nursery technique. The bag plastic nursery technique was perceived as good by farmers with a mean score of 3.65, meaning that the farmers preferred the bag plastic nursery technique compared to the pullout system. Farmers have good perception criteria of the nine attributes of bag plastic nursery technique because 1) the nursery media is easy to obtain, 2) shallot seeds are easy to grow, 3) seedling are easy to move to the planting area, 4) seedling are easy to grow in the planting area, 5) seedling thrives after being transferred to the planting area, 6) seedling are resistant to pests and diseases, 7) size of the bulbs are large, 8) colour of the bulbs is red and 9) the quantity of bulbs is large. Farmers have poor perceptions of two attributes because 1) the selling price of the bulbs was rather expensive and 2) the profits are quite a lot (Table 5).

**Table 5.** Farmers' perceptions of the attributes performance of bag plastic nursery technique on shallot seeds in Grobogan District, 2018

| No | Attributes | Scores | Attributes confidence level | Perceptions Category |
|----|------------|--------|----------------------------|---------------------|
| 1. | Ease of obtaining nursery media | 3.47 | easy | good |
| 2. | Ease of growing seeds in nursery media | 4.03 | easy | good |
| 3. | Ease of transplanting from the nursery to the planting area | 3.60 | easy | good |
| 4. | Ease of growing seedling in the planting area | 3.90 | easy | good |
| 5. | The seedling thrive after transplanting | 4.00 | fertile | good |
| 6. | Plant resistant to pests | 3.50 | resistant | good |
| 7. | Bulbs size | 3.77 | big | good |
| 8. | Shallot bulbs color | 3.77 | red | good |
| 9. | Shallot production | 3.50 | lots | good |
| 10. | The selling price of shallot | 3.20 | a bit expensive | poor |
| 11. | Farmer's profit | 3.37 | quite a lot | poor |

Mean scores 3.65 good

Source: Primary Data, 2018 (processed)

The most preferential advantage of the bag plastic seedling technique is the seeds are easy to grow, and the seeds thrive when transferred to the planting area. Shallot seeds are easy to grow in bag plastic media because they consist of soil and crumb textured compost. Compost consists of organic material that makes the soil texture crumbly so that there are enough pores for oxygen, this condition helps the soil to hold water and nutrients longer making it easier root growth [22]. Another advantage is that the seeds thrive after being transferred to the planting area, this is because the process of transferring the seeds is carried out simultaneously with the growing medium so that the root system is not damaged. The principle of transferring seeds from the nursery medium to the planting area using the ocher and soil block techniques is almost the same, namely without pulling out the seeds. This principle aims to reduce the damage and mortality of seedlings, protect the root system, and facilitate the transplanting process, but the bag plastic seedling technique is less practical because it has to tear the plastic. The bag plastic seedling technique is a common nursery technique used by farmers because it is easy and
cheap, but the plastic media used is not environmentally friendly. After being used for the nursery, the plastic bag is discarded and becomes inorganic waste that cannot be decomposed by bacteria and pollutes the environment [23; 24].

3.3.3. Farmers' perception of the attribute performance of pullout system. Farmers have a poor perception of the pullout system seedling with a mean score of 3.23, meaning that the farmers considered the pullout system to be less good than the other techniques. The pullout system was perceived as good by farmers only on three attributes, namely 1) the seedling media was easy to obtain, 2) the seeds were easy to grow, and 3) the color of the bulbs is red, but the other eight attributes were perceived to be less good. That’s eight attributes are 1) the seedling is a little difficult to move from the seedling media to the planting area, 2) the seedling is a little difficult to grow in the planting area, 3) the seedling are less fertile after being transferred to planting, 4) the plants are less resistant to pests and diseases, 5) the size of the bulbs are moderate 6) the quantity of bulbs are quite a lot, 7) the selling price of the bulbs a bit expensive, 8) the profits are quite a lot (Table 6).

Table 6. Farmers’ perceptions of the attributes performance of pullout system on shallot seeds in Grobogan District, 2018

| No | Attributes                                           | Scores | Attributes confidence level | Perceptions Category |
|----|-----------------------------------------------------|--------|-----------------------------|----------------------|
| 1  | Ease of obtaining nursery media                     | 3.90   | easy                        | good                 |
| 2  | Ease of growing seeds in nursery media              | 3.47   | easy                        | good                 |
| 3  | Ease of transplanting from the nursery to the planting area | 3.00   | A little difficult          | poor                 |
| 4  | Ease of growing seed in the planting area            | 2.73   | A little difficult          | poor                 |
| 5  | The seedling thrive after transplanting             | 3.17   | Less fertile                | poor                 |
| 6  | Plant resistant to pests                            | 2.80   | Less resistant              | poor                 |
| 7  | Bulbs size                                          | 3.30   | moderate                    | poor                 |
| 8  | Shallot bulbs color                                 | 3.83   | red                         | good                 |
| 9  | Shallot production                                  | 3.07   | Quite a lot                 | poor                 |
| 10 | The selling price of shallot                        | 3.17   | a bit expensive             | poor                 |
| 11 | Farmer’s profit                                     | 3.10   | Quite a lot                 | poor                 |

Mean scores 3.23 poor

Source: Primary Data, 2018 (processed)

The most preferential advantage of the pullout system is the attribute of ease of obtaining nursery media. The media used is quite easy and inexpensive, easy because it is only planted in the beds directly and is cheap because it does not require special containers or polybags. The weakness of this technique is that the attributes of seedling growth in the planting area are a little difficult. This occurs because the transfer of seedlings is done by removing the seeds from the beds which often cause stress shocks on the plants. The process of transplanting is very vulnerable to damage to plant roots due to stress due to adaptation processes to the environment and physiological stress resulting from damage to plant vegetative organs [25].

3.4. Farmers’ perceptual mapping of shallot seed nursery techniques

Farmers have different perceptions of the shallot seed nursery technique. Different perceptions at the farmer level are the result of performance orientation from product/technology that affects the purchasing decision-making process or adoption [26]. This shows that performance/attributes are very important. Based on the t-test (Tukey HSD), that farmers’ perceptions of the three nursery techniques are statistically different. The highest perception was obtained in the soil block nursery technique, followed by a bag plastic nursery technique, and finally the pullout system (Table 7).

Figure 1 shows a farmers’ perceptual mapping of the shallot seed nursery techniques based on the performance attributes. Farmers have good perceptions of soil block and bag plastic nursery techniques but have poor perceptions of the pullout system. The highest perception was produced by
the soil block nursery technique (blue line), then the bag plastic nursery technique (red line), and finally the pullout system (green line). The Soil block nursery technique is believed by farmers to be the best because it has the best performance: seeds are easier to grow, seedling are easier to move, seedling are easier to grow in the planting area, plants are more fertile, bulbs size is larger, bulbs color is red, the quantity of bulbs is more, price selling bulbs is more, and the farmer’s profit is more than the bag plastic nursery technique or pullout system.

Table 7. T-test Results (Tukey HSD)

| Nursery techniques | Mean scores |
|--------------------|-------------|
| 1. Soil block      | 39.00<sup>a</sup> |
| 2. Bag plastic     | 36.43<sup>b</sup> |
| 3. Pullout         | 32.30<sup>c</sup> |

Note: Numbers followed by different letters on the same line indicate differences at the 0.05 level T-test (Tukey HSD)

Source: Primary data, 2018 (processed)

4. Conclusion

The seed viability average of shallot seeds in three nursery techniques was 60% and an average vigor of 5 days after planting. The highest productivity of the shallot was soil block technique (25.28 tonnes/ha), which was not significantly different from the productivity obtained from with plastic bag technique (23.77 tonnes/ha) and was significantly different from the pullout system (20.61 tonnes/ha).

Farmers have a good perception of soil block seedling techniques with a mean score of 3.91 and plastic bag seedling techniques with a mean score of 3.65, while farmers’ perceptions of seedling techniques are in low perception criteria with a score of 3.23. Statistically, the farmers’ perceptions of the three seedling techniques were significantly different. The highest perception was obtained in soil block seedling technique because shallot seeds were very easy to grow, seedlings were very easy to transplanting, seedlings were very easy to grow after planting, seedlings were very fertile in the planting area, the size of the bulbs was very large and the highest productivity. Therefore, to increase the production of shallots from seedlings, soil blocks can be developed.
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