Optimization production of two varieties of shallot from true shallot seed with the application of NPK and magnesium fertilizers

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Abstract. Shallot production in Indonesia is still relatively low. This is due to the use of shallot bulbs that are not sterile and susceptible to disease. One way to increase the production of shallots is by using botanical seeds (True Shallot Seed). The research aimed to evaluate the growth and yield of two varieties of TSS with the application of NPK and Magnesium fertilizers. The treatment was arranged in a randomized block design with three factors. The first factor was varieties, which consisted of Sanren F1 and Lokananta varieties. The second factor was the application of magnesium, which consisted of without magnesium, 125, and 250 kg Mg ha⁻¹. The third factor was the application of NPK, which consisted without NPK, 83.3, 166.6, and 250 kg NPK ha⁻¹. The results showed that the effect of varieties, NPK fertilizer, and Mg were significant differences in the parameters of the number of leaves 7.0, and the number of bulbs 2.7 where sanren showed better results. While the effect of varieties, NPK, and Mg fertilizers was significant differences in the parameters of plant height 41.5 cm, the Lokananta varieties showed better yields.

1. Introduction
Shallot cultivation has long been practiced by farmers in Indonesia. One of the problems that exist in onion cultivation is low productivity. Some of the causes of the low production of shallots are conversion of agricultural land, availability of scarce planting material (bulbs), and unsterilized tuber seeds. This causes the stock of national onion needs cannot be met so that sometimes it has to supply the needs of shallots from abroad (imported). There are several ways that can be done to increase the production of shallots, namely the expansion of agricultural land (food estate), the use of planting material from seeds (True Shallot Seed), an effective and efficient fertilization.

True shallot seed/TSS is the generative part (seed) of the shallot plant. TSS has several advantages compared to planting material from bulbs, including being more sterile, inexpensive, and can increase production up to two times [1]. Currently, TSS seeds in Indonesia have been produced by Balitsa and PT. East West Seed Indonesia with various kinds of superior varieties. The varieties that have been released by Balista include Pancasona, Trisula, and Mentes during PT. East West Seed Indonesia has released the tuk-tuk, lokananta, and Sanren F1 varieties.
NPK fertilizer is a compound fertilizer consisting of elements N, P, and K. Nutrients N, P, and K are essential nutrients that cannot be replaced with other nutrients. The results of the study [2] stated that the application of NPK fertilizer to TSS had an effect on plant height, number of tillers per clump, number of bulbs per clump, wet weight of bulbs per clump, the weight of wet and dry bulbs per clump, the weight of wet and dry bulbs per plot, weight of wet tuber weight per ha and on dry weight per ha. In addition to NPK fertilization, magnesium is also a macronutrient that is needed by plants in the process of growth and development. Magnesium (Mg) plays an important role in the process of forming perfect green leaves and the formation of carbohydrates, fats, and oils. In addition, magnesium also plays an important role in phosphate transport in plants so that the phosphate content in plants can be increased by adding Mg elements [3]. The results of the study [4] reported that the application of Mg fertilizer could increase nutrient uptake, sugar synthesis, and starch translocation due to the important role of Mg in phosphate transport.

2. Materials and methods
The treatment was arranged in a randomized block design with three factors. The first factor was varieties, which consisted of Sanren F1 and Lokananta varieties. The second factor was the application of magnesium, which consisted of without magnesium, 125, and 250 kg Mg ha\(^{-1}\). The third factor was the application of NPK, which consisted without NPK, 83.3, 166.6, and 250 kg NPK ha\(^{-1}\).

2.1. Seeding, transplanting, and planting
Seeds are sown in polybags with a size of 5 cm x 7 cm, which have been filled with planting media consisting of topsoil and husk charcoal in a ratio of 2:1. Transplanting is carried out after the seeds are 28 days old. Planting is done with a spacing of 10 cm x 10 cm.

2.2. Plant maintenance plant
Maintenance includes watering twice a day, wedding at the age of 2 weeks after transplanting, controlling pests and diseases according to the intensity of pest and disease attacks.

2.3. Harvest
Harvesting is done when 90% of the leaves have turned yellow, the plant has fallen, the neck of the tuber is empty, and the tuber is sticking out. Harvesting is done by pulling the onion plants and their bulbs.

2.4. Observation of plant growth, production
Observation of morphological characters such as plant length and number of leaves at the age of 6 weeks after transplanting, number of bulbs per plant, tuber diameter after harvesting.

2.5. Data analysis
The data obtained were analyzed using variance at the level of \(\alpha = 5\%\). If there is a significant effect between the test treatments, continue with Duncan's Multiple Range Test (DMRT)
3. Result and discussion

3.1. Plant length

**Table 1.** Plant length of shallot from TSS with an application of NPK and Mg fertilizer 6 WAP.

| Treatment | NPK (kg NPK/ha) | Mean |
|-----------|----------------|------|
|           | N₀ (0) | N₁ (83.3) | N₂ (166.6) | N₃ (250) |
| Varieties |        |            |             |          |
| V₁ (Sanren F-1) | 32.7d   | 36.5b     | 35.5c       | 36.8b    | 35.4b     |
| V₂ (Lokananta) | 35.0c   | 38.0a     | 38.0a       | 41.0a    | 38.0a     |

Note: The numbers followed by different letters show significant differences according to Duncan’s Multiple Range Test at the level of α = 5%.

![Figure 1. The relationship between varieties and plant length of 6 WAP](image)

Plant length is affected by the use of varieties and the application of NPK fertilizer. The Lokananta variety produced the best plant length of 38.0 cm compared to the Sanren F-1 variety of 35.4 cm (Figure 1). At the age of 6 WAP, it can be seen that the Lokananta variety with the application of NPK fertilizer at a dose of 250 kg/ha produced the best plant length of 41 cm, a decrease in the dose of NPK fertilizer resulted in a significant decrease in length of 35 cm (Table 1). The difference in growth response is caused by different genetic factors [5]. Each variety has different genetic characteristics, water content, and morphological characteristic. The results of the study [2] NPK fertilizer had a significant effect on increasing the length of 6 WAP plants at a dose of 600 kg ha⁻¹.

3.2. Number of leaves

**Table 2.** The number of leaves of shallot from TSS with application NPK fertilizer 6 WAP.

| Treatment | NPK (kg NPK/ha) | Mean |
|-----------|----------------|------|
|           | N₀ (0) | N₁ (83.3) | N₂ (166.6) | N₃ (250) |
| Varieties |        |            |             |          |
| V₁ (Sanren F-1) | 6.5b   | 7.2a     | 6.8b       | 7.4a    | 7.0a     |
| V₂ (Lokananta) | 6.2b   | 6.4b     | 6.4b       | 6.9b    | 6.5b     |

Note: The numbers followed by different letters show significant differences according to the Duncan Multiple Range Test at the level of α = 5%.
Figure 2. The relationship between varieties and number of leaves 6 WAP

The number of leaves is influenced by the use of varieties and the application of NPK fertilizer. The Sanren F-1 variety produced the best number of leaves, which was seven strands compared to the Lokananta variety (Figure 2). At the age of 6 WAP, it can be seen that the best Sanren F-1 variety with the application of NPK fertilizer at a dose of 250 kg/ha produced the best plant length of 7.4 strands, a decrease in the dose of NPK fertilizer resulted in a significant decrease in length of 6.5 strands (Table 2). In general, the Sanren F-1 variety produced more leaves than the Lokananta variety. Superior varieties have adaptive properties so that they can produce according to their genetics if they are in a suitable environment [6]

3.3. Number of bulbs per clump

Table 3. Number of bulbs per clump of shallot from TSS with application Mg Fertilizer

| Treatment       | Mg (kg MgO ha⁻¹) | Mean  |
|-----------------|------------------|-------|
|                 | M0 (0)           | M1 (125) | M2 (250) |       |
| V₁ (Sanren F-1) | 2.9a             | 2.6a    | 2.6a     | 2.7a  |
| V₂ (Lokananta)  | 1.5b             | 1.5b    | 1.7b     | 1.5b  |

Note: The numbers followed by different letters show significant differences according to the Duncan Multiple Range Test at the level of α = 5%.
Figure 3. The relationship between varieties and number of bulbs per clump

The number of bulbs is influenced by the use of varieties and the application of Mg fertilizers. The Sanren F1 variety produced the best number of bulbs, namely 2.7 bulbs compared to the Lokananta variety, which was 1.5 bulbs (Figure 3). The best application of magnesium fertilizers to the Sanren F1 variety was the addition of control. The addition of magnesium fertilizers tended to reduce the production of the number of bulbs per clump (Table 3). The number of different bulbs in the two varieties is influenced by genetics [7]. Each variety gives a different response because each variety has a different root and leaf growth even though it is planted on the same soil.

4. Conclusions

Application of NPK fertilizer at a dose of 250 kg NPK ha\(^{-1}\) on the Lokananta variety resulted in the best plant length. There was a decrease in plant length due to a decrease in the number of doses of NPK fertilizer. The Sanren F1 variety produced more leaves and bulbs than the Lokananta variety. The addition of NPK at a dose of 250 kg/ha and a dose of Mg 250 kg MgO ha\(^{-1}\) gave better growth and production results than the Lokananta varieties.

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