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The growth and yield performance of true shallot seed production in Central Sulawesi, Indonesia

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Abstract. *Saidah, Wahyuni AN, Muchtar, Padang IS, Sutardi. 2020. The growth and yield performance of true shallot seed production in Central Sulawesi, Indonesia. Asian J Agric 4: 18-22.* Shallot (*Allium ascalonicum* L.) is a vegetable commodity that has high economic value and market prospects. So far, planting shallots using seeds from tubers, but planting onions with seeds is better and more cost efficient, with the seeds being healthier. The aim of this study was to determine the growth and yield performance of true shallot seed production in Central Sulawesi, Indonesia. The study was conducted from May to September 2018 in Wuasa Village, North Lore Sub-district, Poso District at an altitude of 1083.7 meters above sea level. Research with an on-farm research approach on farmer's land as a cooperator covering an area of 3000 m2. The study used the Probability Sampling Method with 10 replications. The results showed that the growth and yield performance of true shallot seed in Central Sulawesi was quite high. This is due to the suitability of the climatic conditions and cultivation technology that has been applied. In the yield component, the percentage of flowering plants was quite high at 78% with several capsules/flower at 80.67. The success of true shallot seed production is expected to be able to replace the source of seed from the tuber, which may contain viruses and diseases carried by the tuber seeds.

Keywords: Growth, shallot, true shallot seed, yield

INTRODUCTION

Shallot is one of the leading national horticultural commodities that is widely cultivated by farmers because of the good market prospects with high selling prices. Many attempts have been made to support the development of shallot production. One of them is the use of good quality seeds. Seed is one of the aspects that has an important role in supporting the success of plant cultivation. The use of good quality seeds is an initial step that plays an important role in supporting increased production and productivity of shallots.

The seeds used in shallot cultivation can be derived from tuber and seed of shallot. In general, the seeds used by farmers in shallot cultivation derived from the tubers of consumption from the previous planting season. Other than that, according to Maemunah and Nurhayati (2012), the farmers do not carry out the seed selection stage, and the use of tubers is carried out continuously from previous production, so that it can affect the degradation of shallot tuber production, both in terms of quality and quantity. The use of consumption tubers as seeds is done because of the lack of availability of quality seeds around the farmer's location. The farmers must bring seeds from seed production centers which require farmers to incur additional costs for distribution costs that are quite high due to the large volume of tubers to be distributed. One alternative to meet the needs of good quality seeds with relatively lower costs is the use of True Seed of Shallot (TSS).

The use of TSS has many advantages, especially related to the availability of good quality seeds and among others, have a longer storage time, low variations in seed quality, high productivity, and rarely contamination by seed-borne pathogens (Pangestuti and Sulistyaningsih, 2011). By looking at the opportunities and advantages of TSS, it is necessary to develop seed production of shallot to fulfill the lack of good quality seeds and can be available all the time, especially in Central Sulawesi. Based on the above, it is important to conduct a direct study on the farmers' land to determine the growth and yield of true shallot seed of production.

MATERIALS AND METHODS

Time and place

True shallot seed production activities were carried out from May to September 2018 in Wuasa Village, North Lore District, Poso District (-1,42678, 120,32484, 1155,9 m) at an altitude of 1083.7 meters above sea level. Location was selected in accordance with true shallot seed production requirements, which are: highlands> 900 m above sea level, not foggy, and not windy, and there are no shallot plants that flower in the vicinity for a minimum of 1 km (in accordance with the requirements in the Ministerial Regulation No. 131/Kpts/SP.130/D/11/2015).

Materials and tools

The materials used in this study were Bima Brebes Variety, Apis cerana, Benzyl Amino Purine (BAP), Boron, organic fertilizer, inorganic fertilizer, *Tagetes erecta* flowers, herbicides, fungicides, and insecticides. The equipment used is analytical scales, hoes, mulch, plastic shade, bamboo, mild steel, nails, hand sprayers, gauges, and other support tools.

Research methods

Research with an on-farm research approach of 3000 m^2 on farmer's land. The study used the Probability Sampling method with 10 replications. The samples were 10 plants in each replication, so that there were 100 observation units.

Research implementation

The stages of the research implementation consisted of planting preparation (including *Tagetes erecta* planting, land management, application of organic and basic fertilizers, mulch installation, and tuber vernalization), tuber planting, shade installation, application of supplementary fertilizer, application of boron, pest, and disease control, harvesting, and data collection and analysis.

Data collection and analysis

Analysis of the data included the average tabulation of growth components (plant height, number of tillers, and number of leaves), flowering components (percentage of flowering plants, number of flowers/clumps, flower stem height, flower diameter, percentage of capsules formed), and yield components (number of capsules/flowers, weight of 1000 seeds, number of tubers/clumps, weight of tubers/clumps, diameter of tubers, and weight of tuber).

RESULTS AND DISCUSSION

Observations on the growth components of the true shallot seed production development activities were carried out on the parameters of plant height, number of tillers, and number of leaves. Based on the observations shown in Table 1 and Figure 1, the average plant height produced reached 44.08 cm. These results indicate the growth of plant height is included in the optimum category because it can reach the maximum height of shallots based on the description of the Bima Brebes variety, which is 25-44 cm. Optimum results were also obtained in the number of leaves parameters, which amounted to 43.6 leaves with a description of the variety of 14-50 leaves. In the parameter number of tillers, the number of tillers is 8.02. Although these results are not optimum, they are still in the potential number of tillers based on varieties description, namely 7-12 tillers.

The high result of the growth components was influenced by genetic factors and environmental suitability that support the expression of the superior character of Bima Brebes Variety. This is in line with Sinaga, Bayu, and Nuriadi (2013) which states that a plant's genetic traits cannot emerge a certain character unless it is in the appropriate environmental conditions. In addition, Kurniawan, Kusmana, and Basuki (2009) stated that phenotypic characteristics of varieties are not always determined by differences in genotype, but also because of differences in environmental conditions or interactions of that factors. the provision of plastic shade also affects the rate of shallots growth, especially on plant height and number of leaves parameters. This is in line with research conducted by Sumarni et al. (2010), which states that the provision of transparent plastic shading significantly affects plant height and number of leaves per plant but does not affect the number of tillers per plant.

Table 1. The average of growth components in the development of true shallot seed production in Wuasa Village, North Lore Sub-district, Poso District, 2018.

Growth components	Value	Description*
Plant height (cm)	44,08	34,5 (25-44)
Number of tillers	8,02	7-12
Number of leaves	43,6	14-50

Note: * Description of Bima Brebes Variety (Balitsa, 2019).

Figure 1. The performance growth components in the development of true shallot seed production in Wuasa Village, North Lore Sub-district, Poso District, Central Sulawesi, Indonesia, 2018.

Table 2 and Figure 2 show the results analysis of the flowering components of shallots which include the percentage of flowering plants, number of flowers per clump, flower height, flower diameter, and percentage of capsules. In the number of flowers per clump, parameter obtained 2.83 flowers, while the height of the flower stalk parameter obtained 48 cm. According to Wibowo (2007), the height of the flower stalk ranges between 30-50 cm. Based on this, the average height of the flower stalk obtained was at maximum high potential. In the parameters of the percentage of flowering plants, the result obtained was 78%. The results of the percentage of flowering plants obtained are relatively high compared to the results of other studies. According to Pandiangan et al. (2015), a good category of the percentage of flowering is 50%. The high percentage of flowering plants is influenced by the application of BAP (Benzyl Amino Purine). BAP is a growth regulator that plays a role in increasing cell division which can ultimately initiate flower formation.

Based on research by Kurniasari et al. (2017), the use of BAP can increase the percentage of flowering up to 50% with the number of flowers produced is 2 flowers per clump. Application of growth regulators aims to stimulate the formation of flowers, so the use of growth regulators can affect the number of flowers per clump. The application of boron also influences the formation of flowers because it functions in stimulating the formation of flowers and it is a microelement related to the metabolism of auxin hormone (Amanullah et al., 2010). Based on Table 2, the average number of flowers per clump obtained 2.83 flowers. However, although the percentage of flowering plants obtained was quite high (78%), the percentage of capsules formed was only 35%. High or low percentage of capsule formation obtained is influenced by the level of pollination factor.

Pollination of shallots is strongly influenced by the presence of pollinators. In general, one of the obstacles in the development of true shallot seed production is in the pollination process. According to Curran and Proctor (1990), male and female organs of shallot are not ripe at the same time, so the shallot plants are included in the cross-pollinating plant. Male organs in shallot flowers mature 2-3 days earlier than female organs (Chandel et al., 2004). Based on this, the role of pollinating insects to assist in the process of cross-pollination is needed, to increase pollination and seed formation. Like cross-pollinating shallots, Gure et al (2009) state that natural pollination without the introduction of pollinators only reaches 9% in onions. In the development of the production of true shallot seed in Central Sulawesi, the presence of pollinators in the production location that helped the process of pollination of shallots include *Apis cerana* and green flies. According to Palupi et al. (2015), *Apis cerana* is one of the most effective pollinators in shallot pollination compared to other pollinators such as *Apis mellifera*, *Trigona* sp., and *Lucilia* sp. While the advantages of greenfly pollinators are abundant population numbers and rapid movement from one flower to another (Kunast, 2013).

Table 3 and Figure 3 show the observations on the yield components which include parameters of number of capsules/flower, weight of 1000 seeds, number of tubers/clump, weight of tubers/clump, weight of tubers, and diameter of tubers. Based on the analysis, the number of capsules/flower produced is 80.67 capsules.

Table 2. The Average of Flowering Components in the Development of True Shallot Seed Production in Wuasa Village, North Lore Sub-district, Poso District, 2018

Flowering components	Value
Percentage of flowering plants (%)	78
Number of flowers per clump	2.83
Flower height (cm)	48
Flower diameter (mm)	46.40
Percentage of capsules (%)	35

Table 3. The Average of Yield Components in the Development of True Shallot Seed Production in Wuasa Village, North Lore Sub-district, Poso District, 2018.

Yield components	Value
Number of capsules/flower	80.67
Weight of 1000 seeds (g)	1.97
Number of tubers/clump	14.17
Weight of tubers/clump (g)	70.18
Diameter of tuber (mm)	21.56
Weight of tuber (g)	5.07

Figure 2. The performance flowering components in the development of true shallot seed production in Wuasa Village, North Lore Sub-district, Poso District, 2018.

Figure 3. The Performance Yield of True Shallot Seed Production in Wuasa Village, North Lore Sub-district, Poso District, 2018.

These results are relatively high compared to the results of research on true shallot seeds production by Kurniasari et al., (2017) who obtained 32 capsules/flowers by using BAP solution concentrating 50 ppm. It is known that the optimum number of capsules is obtained at BAP solution concentration of 37.5 ppm. This is in line with the research conducted by Rosliani et al. (2012), which states that BAP treatment at a concentration of 37.5 ppm gives optimum results both on increasing flowering and the number of capsules produced. From this statement, it was concluded that one of the factors that can affect the number of capsules produced in the production of true shallot seeds is the concentration of BAP given.

On the weight of 1000 seeds parameter, it was obtained of 1.97 g. These results are still below the weight of 1000 seeds obtained by Rosliani et al. (2013) which is 2.18 g. the factor that affects the difference of the results obtained is the time of application of BAP solution. According to the results of research by Kurniasari et al. (2017) on observing the weight of 100 seeds, the increase in weight of 100 seeds was influenced by the time of application of the BAP solution. BAP application at ages 2, 4, and 6 Weeks After Planting gave a weight of 100 seeds by 0.317 g, while the application of BAP at ages 1, 3, and 5 Weeks After Planting gives 0.237 g (Kurniasari, et al., 2017).

Observation of yield components was also carried out on the shallot tubers production, including the number of tubers/clump, weight of tuber, and diameter of tuber. Based on observations, the number of tubers/clump obtained was 14.17 tubers. The yield of tuber obtained is quite high. Meanwhile, the weight of tuber obtained was 5.07 grams with a tuber diameter of 21.56 mm. Based on the results of research by Ayu et al. (2016), the average number of tubers per clump produced by the Bima Brebes variety was 4.52 tubers with a tuber weight per clump of 24.02 gr and the average weight per tuber was 5.31 gr. The number of tubers and the diameter of the tubers are influenced by factors of phosphorus (P) and Potassium (K) nutrients. In addition, soil texture is also very influential in the formation of tubers. P nutrient deficiency in shallot production activities will inhibit the growth of roots, leaves, and tubers. Type of soil containing high clay fraction will affect the process of tuber development which results in small tubers produced. While loose and fertile soil will encourage the development of large tubers and produce a high number of tubers (Napitupulu and Winarto, 2010; Brewster, 1994).

In conclusion, growth, and yield performance for true shallot seed production in Wuasa Village, North Lore Sub-district, Poso District, Central Sulawesi showed high results. The suitability of agro-climate and the right production technique is the success factor in expressing the optimum growth and yield of shallot that is obtained. The percentage of flower formation showed a high result of 78% with the number of capsules formed at 80.67 capsules per flower. Shallot variety of Bima Brebes has a good chance to produce seed from seed because it has > 75% flower in the highlands.

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