# The_Use_of_KNO3_Fertilizer_To_Improve_the_Quantity_and_Quality_of_Botanical_Seeds_(TSS)_Three_Varieties_the_Relationship_of_Vigor_and_Viability_of_Shallots_(Allium_var._ascalonicum)_.pdf

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# THE USE OF KNO3 FERTILIZER TO IMPROVE THE QUANTITY AND QUALITY OF BOTANICAL SEEDS *(TSS)* THREE VARIETIES THE RELATIONSHIP OF VIGOR AND VIABILITY OF SHALLOTS (*Allium* var. *ascalonicum*)

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## ABSTRACT

**The use of seed tubers as material for shallot propagation has several problems, including the low availability of TSS seeds in the market, low seed quality, low productivity, and expensiveness. One of the potential technology alternatives to be developed as seeds is the use of *true shallots seeds* (TSS). KNO3 is one of the best sources of potassium and nitrogen, this can be seen from the production of quantity and quality of botanical seeds *(TSS = true shallots seed)*, accelerating shoot formation and vegetative growth by treating three varieties of shallots planted, namely 1. Sanren, 2 . Superpilip, 3 Headers. All varieties were given a dose of KNO3 fertilizer; with 4 levels, namely the first treatment without $KNO_3$ fertilizers, the second was given $KNO_3$ with a dose of 7 grams, 3 $KNO_3$ a dose of 9 grams and the fourth treatment was given a dose of 11 grams, and given a growth regulator BAP with the best 250 ppm dose of treatment. Previously, all varieties were treated, starting from October 2019 to June 2020. The results obtained were 40.70 cm plant height, quality and quantity of shallot bulb seeds, 63 flower tubers, 26 lower pithy capsules, number of tubers per samples 13, tuber boot per plot 10, tuber production 18 tones $h^{-1}$ in Superpilip varieties, seed weight of TSS 35 grams, percentage of seeds germinating 44%, but based on the results of the viability and vigor index analysis test 58, 00% best shallot seed from all aspects of seed analysis is the Sanren variety.**

**Keywords:** *Allium varieties cepa* var. *ascalonicum*; KNO3; induction of flowering; viability and vigor of seeds; quality seeds.

**INTRODUCTION**

Shallot *(Allium cepa var. Ascalonicum) is* a vegetable crop that is widely cultivated in Indonesia. Quality seeds are an important factor in increasing the productivity of shallots, but generally onion seeds are produced with tubers as plant material, Hilman et al, (2014). The use of TSS (botanical *true shallots seed seeds*) as seeds for onion plant propagation is an alternative that needs to be developed. Basuki [1] states that people's needs for shallots from year to year have increased along with population growth and people's purchasing power. Which tends to increase, so that needs can be met must be balanced with the amount of production through the use of KNO fertilizers$_3$ and *Benzyl Amino Purines which* can spur an increase in seed production in terms of seed quality, although this does not necessarily improve seed quality because it is caused by varieties and genetic factors of the seed. Planting is carried out in tropical areas where the weather is cold, for the induction of longer inflorescences because temperature affects the production of shallot flowers to produce seeds that are focused on the induction of shallot bulb flowering by using locations or places that have cold temperatures [2].

The productivity of shallots in Indonesia is 3 - 7.5 tons / ha. After the release of superior varieties, the productivity in 2012 will be 9.6 - 24.5 tons / ha or an increase of 27.63% (directorate general of agriculture, 2013). The obstacle in increasing national shallot production is the low use of quality seeds and quality and quality seed production technology [3]. Lack of availability of quality shallot seeds causes farmers to use seeds from shallot bulbs for consumption. The seeds from shallot bulbs for consumption have low productivity because they are not produced from the seed selection process.

Potassium in KNO3 compounds is needed more than other nutrients, because potassium plays an important role as a catalyst in converting protein into amino acids and compilers of carbohydrates and plant metabolism. Potassium also plays a role in strengthening the plant body so that leaves do not easily wither and fall [4]. This can help plants to grow well even in dry environmental conditions. KNO3 is one of the best nitrogen sources; this can be seen from the results of the production of relatively better seed quality.

To increase flowering and seed formation can be done by application of growth regulators (ZPT) from the cytokine group [5]. One of the cytokine's that actively influence plant physiological processes, such as cell division and enlargement, is benzyl amino purine (BAP) [6].

Increasing the production of botanical seeds *(TSS)* of shallots through intensification and diversification approaches, namely by continuous cultivation activities which require the availability of sustainable shallot seeds. The increase in shallot production through the onion intensification program has not been fully supported by the provision of superior quality seeds and the import of shallot seeds is only a momentary effort. Therefore what needs to be built is cooperation between the government and farmers, in the context of developing captive breeding and the domestic seed industry.

Cultivars or shallot varieties in Indonesia provide significant production advantages from TSS seeds compared to cultivar or varieties that are propagated vegetative and are highly accepted by farmers because they have many advantages in terms of transportation, are free from pests and diseases in using seeds as seeds [7].

Application of BAP at a dose of 250 ppm increases pollen viability. An increase in pollen viability began to occur at a BAP concentration of 100 ppm, while for the amount of pollen a significant increase occurred at a dose of 250 ppm. At a dose of 250 ppm, the highest viability and pollen count was obtained based on the results obtained in previous studies so that the use of BAP as an additional treatment in the use of KNO doses$_3$ in three shallot varieties in subsequent studies. In addition to the concentration of KNO3 fertilizer and the varieties used, it can affect the growth and production of shallot bulbs and botanical seeds [8].

Viability is a measure that a seed contains structure and substance, including an enzyme system that provides the ability to germinate under suitable conditions, whereas seed vigor is a seed condition that determines the potential to grow fast, uniformly and normally under various field conditions (Meena et al., 1999; ISTA, 2008, Nurmalita et al, 2014). This study aims to improve the quality, TSS seed quality and tuber production by using KNO3 and BAP treatments as additional treatments with the same dosage in all treatments planted in the plateau 1,250 masl.

## MATERIALS AND METHODS

This research was conducted in Gunung Perak Village, West Sinjai District, Sinjai Regency, South Sulawesi and the Laboratory of the Faculty of Science and Technology, Muhammadiyah Sinjai University, which took place from October 2019 to June 2020. Soil processing using cultivators then made a map with an area of 1 meter by 4 meters. This research uses the dosage of KNO3 fertilizer and the best dose of *Benzyl Amino Purine* (BAP) 250 ppm obtained in previous studies, this research was carried out in the form of a *split plot design* in a two-factor factorial pattern, namely the first factor, the variety as the main plot of the three varieties bulb union, 1. Sanren variety, 2. Superpilip variety, 3. Canopy variety, and the second factor as subplots of 0 gram KNO3 fertilizer dosage, 7 gram, 9 gram, and 11 gram dose, then the vigor and viability test of botanical seeds *(TSS)* shallots using a completely randomized design.

### KNO3 Application

There are three varieties of shallots being planted, namely 1 Sanren, 2 Superpilip, 3 Heading varieties. All varieties were given a dose of KNO3 fertilizer; with 4 levels of treatment, namely first without treatment of KNO3 fertilizer, 2nd given KNO3 with a dose of 7 grams, 3 KNO3 with a dose of 9 grams and the 4th treatment was given a dose of 11 grams, and given a growth regulator BAP 250 ppm in all varieties, in KNO3 treatment with how to be immersed around the roots of the plant. The application of BAP *(Benzyl Amino Purine) is* additionally given by dissolving in water then spraying on the leaves of the shallot plant at the age of 25 days after planting, with the same dose in all treatments, applying KNO3 after 30 days after planting by immersing it around the roots of the plant. red onions, then installing a clear plastic shade / cover, which serves to protect the flowers from damage by exposure to rainwater and reduce dew droplets / residual rainwater on the tips of the leaves so that the plants are straighter , more stocky and increase the formation of well-lined seeds

### Parameters Studied

Growth and Production of TSS Seeds and Shallots.
Plant height, number of flower umbels per treatment, number of flower capsules per sample, tuber weight per plot, production ton h-$^{1}$, number of pithy flower capsules, botanical seed weight (TSS), seed viability and vigor of each variety.

Germination and Vigor Index of theSeeds from each treatment were germinated using the UDK method (test on paper). Observations were made on day 5, day 10 and day 15 of normal, abnormal sprouts, the seeds did not grow, and the seeds died. Seed germination capacity is the normal number of sprouts observed on the 5th, 10th and 15th day divided by the number of tested seeds multiplied by 100%. The vigor index was measured by germinating the seeds from each treatment using husk charcoal. Observations were made on day 5 *(first day count)* and day 10. The vigor index is the number of normal seeds observed on the 5th day divided by the number of seeds tested multiplied by 100% (ISTA, 2013).

### Experimental Design and Statistical Analysis

The data obtained were analyzed statistically using covariance (ANOVA) analysis. The data from the observations were analyzed statistically with analysis of variance used, if the effect of real interaction (α = 0.05) on the observed variables was followed by a difference test in the average value using the Least Significant Difference test of 0.05% (Gomez, 1995). . If the influence of a single factor is real, then it is followed by the LSD 5% test [9].

## RESULTS

The results with the application of fertilizer concentrations of $KNO_3$ and three varieties of red onions on growth and seed production of TSS *(True Shallot Seed)* and shallot relationship with vigor and seed viability onion red.

**The average Plant Height (cm) and its Variability Showed no Significant Effect of the Treatment of Varieties, and KNO3 and their Interactions had no Significant Effect**

The diagram of the average height (cm) of plants for each treatment of $KNO_3$ and shallot varieties had no significant effect on all treatments as can be seen in Fig. 1.

Fig. 1 shows that the average height of shallot plants can be seen in the diagram with treatment Varieties and KNO3 applications have no significant effect but shows the highest shallot plant is 40.70 cm in the Superpilip variety and the lowest is in the Sanren variety 36.40 cm, with KNO fertilizer treatment$_3$ with ZPT (growth regulators) BAP 250 ppm auxin group that plays a role in the elongation of shoots / shoots, stems, fruit / flower development of plants so as to prolong the flowering period of plants and spur an increase in the number of flower umbel. These findings are in line with Susanto's (2010) statement that the elements N, P and K are macro nutrients needed in the growth of leaves and tubers so that the effect is not significant on plant height.

KNO3 fertilizer is useful in the formation of carbohydrates in plants, strengthening stems, forming flowers, increasing the quality and quantity of seeds and / or seeds, cell division and protein formation, thickening plant cell walls so as to increase resistance to pests and diseases, regulating nitrogen and phosphate fertilizer balance and increasing the ability of plants to absorb water so that it shows a significant effect on the development of flowers and seeds [10].

**The Average Number of Flower Umbels, Variance Prints Showed a Significant Effect and the Interaction between the Varieties and KNO3**

The results of the generative vase research indicated by the parameters of the number of umbel flowers and the number of flower capsules, can be seen in Table 1 and Fig. 2, respectively.

Table 1 shows the number of flower umbels that do not produce seeds, the flower capsules will soon wither, after the anthesis and drying are followed by all the umbels that do not have maximum zygotes, it can be seen in Table 1 that the number of flower capsules is the highest in the Superpilp variety, the number of umbels has a significant effect. Significantly ($P < 0.05$) the highest number of umbel increased 63.00 in the treatment of 11 grams of KNO3 Superpilip variety which was significantly different in the treatment of KNOconcentration$_3$ 9 grams / plant which increased sharply compared to Sanren and Tajuk varieties, due to the potassium and nitrate required. Plants for various physiological functions, especially the Superpilip variety, meet the requirements for a dose of 11 grams / plant more than the other varieties, including carbohydrate metabolism, enzyme activity, osmotic regulation, water use efficiency, nitrogen uptake, protein synthesis, and assimilate translocation. The number of flower umbel tends to be more Lots.

The limiting factor in the production of the number of flower tubers is due to the cyclone climate and the continuous demand for TSS seed products so that a generative propagation system is carried out which has many advantages over the vegetative or through tuber propagation system. Potassium also has a role in increasing the resistance of certain plant diseases and improving the quality of plant flowers (Mc Kenzie 2001, IIED, 2002). There was a significant difference between shallot varieties, although the number of flower umbels, flower capsules and seed weight was heavier and heavier in the Superpilip variety, but it was not necessarily better in terms of seed viability and vigor, because based on the best viability and seed vigor tests in Sanren variety 44 % germination capacity, 4 % superpilip and 1 % canopy variety of seeds germinating power.

**Average Number of Pithy Flower Capsules**

The results of the vase generative research indicated by the parameter of the number of pithy flower capsules can be seen in Table 2 and Fig. 3. Table 2 shows a significant increase *($\alpha = 0.05$)* of the number of buds per umbel and the number of flower capsules of Superpilip varieties with seeds per umbel. In the 11 gram KNO3 treatment compared to doses and varieties, the percentage of the number of flower capsules decreased in the Tajuk variety and the Sanren variety, in fact the Superpilip variety had a significant effect due to an increase in the amount of KNO3 fertilizer but a decrease in the number of flower capsules in all varieties at a dose of 11 grams of KNO3, however there was an increase in seed weight per replication.

Flower capsules begin to form when the plants are 90 to 115 days after planting. The results of statistical analysis showed that there was a significant difference between the treatment of shallot varieties and the KNO3 concentration on the TSS seed production components in the treatment of the number of flower umbel, per umbel pithy capsule and samples, the seed weight of each replication can be seen in Tables 1 and 2. The production of flower capsules and seeds per umbel and per plant was influenced by the concentration of KNO3 fertilizer used.

Flower bulb can be seen in Fig. 3, the number of buds per umbel increased gradually in the Superpilip variety from 17.90 to 20.91 but there was a decrease in the 9 gram KNO3 treatment and again there was a significant increase in the KNO3 treatment of 11 grams per plant, namely 31.00 pithy flower capsules per flower interest, but on the varieties and varieties Heading Sanren decrease the number of flowers and there are plants that die in treatment $KNO_3$ 11 grams of crops caused by too high a dose of fertilizer.

**Average Number of Tubers per Plant Sample**

Based on the research results in the table of variance, it shows that the treatment of varieties and KNO3 on the parameter of the number of tubers of each plant sample can be seen in Table 3 and Fig. 4.

The results in Table 3 show that the treatment of three shallot varieties with KNO3 concentration did not provide any interaction with the treatment, but the 9 gram (K2) KNO3 treatment gave the highest number of tubers per hill, namely 12 tubers which had a significant effect on other treatments, and K0 the minimum number of tubers was 9 tubers, and the superpilip variety was 12 tubers which had no significant effect with other treatments. The formation of shallot tubers is derived from a layer of enlarged and fused leaves; in line with the statement [11] that the tubers formed from each variety have different numbers because they are products of different plant genetic products for each variety. which is influenced by the environment resulting in different plant diversity in each variety.

**Average Tuber Weight of Each Treatment Plot**

The results indicated by the tuber production parameters of each treatment plot can be seen in Table 4.

Table 4 shows that the varieties and KNO3 fertilizers have a significant effect and the interaction between the two has a significant effect by looking at the Vtreatment$_2$K$_2$, the highest seed weight was obtained 9.62 kg, but the lowest was in the $V_3K_3$ treatment caused by the Sanren and Tajuk varieties not resistant to the KNO3 fertilizer concentration that was excessive, but none of the Superpilip and Tajuk varieties died so the potential for higher yields. Variety / seed, dosage / type of fertilizer, and climate / environment are the main factors determining the level of production of red onion plants.

In line with Subandi's (2013) statement that the excess K absorbed by plants is not useful in increasing plant growth and production so that things that are not expected in plant growth and development occur, for example, the existence of plants that die due to excess fertilizer given to the Sanren and Superpilip varieties. According to Munawar (2011), growth and production are closely related to the availability of nutrients absorbed by plants that are used in plant metabolic processes.

**The Average Tuber Weight (ton h$^{-1}$) Showed that the Treatment of Varieties and KNO3 had a Very Significant Effect on their Interactions**

The results of the research indicated by the parameters of tuber production per hectare, can be seen in Table 5.

KNO3 fertilizer has a significant effect and interacts between the treatment of varieties and the dose of KNO3 has a significant effect on tuber weight tonnes $h^{-1}$; 18.24 tonnes $h^{-1}$ in Superpilip varieties, which is in line with the statement [4], that potassium in compounds KNO3 is needed more than other nutrients, because potassium plays an important role as a catalyst in converting protein into amino acids and controllers of carbohydrates and plant metabolism. Potassium also plays a role in strengthening the plant body so that the leaves do not easily wither and fall and accelerate the process of forming higher quality tubers.

The bulb harvest is carried out gradually because the flowering onions do not change the color of the stems, the leaves before the flower umbel are harvested or the flower capsules begin to dry out and when the leaves turn yellow, wilt and fall. Tuber weight does not affect the number of flower tubers, according to Sufiyati et al. [12] stated that large tubers have relatively more tuber layers and a larger root cross-sectional area so that they can increase the ability to absorb water and nutrients for plant growth. The superpilip variety of shallot is one of the vegetable plants that is sensitive to chloride compared to other varieties so that both the production of the number of flower umbels, the number of flower capsules, the weight of botanical seeds and the best tuber production are all in the Superpilip variety.

The canopy variety was harvested the fastest at the age of 100 DAS and the Superpilip variety at the age of 110 DAS, if the seed source came from TSS seeds, the harvest time was also longer than the seeds sourced from tubers. Fig. 4 shows the yield of the Superpilip variety of shallots with a weight of 18.24 tonnes $h^{-1}$ which has a significant effect on the Sanren variety and the Tajuk variety on the dose of KNO fertilizer$_3$ in all treatments because potassium plays an important role in increasing the photosynthetic ability of plants and is caused by shorter plants than the varieties,others, reduce damage to crops, maintain the quality and storage capacity of crops [13].

**The Average Seed Weight and Variance Fingerprint Showed that the KNO3 Variety Treatment had a Significant Effect on the Interaction between the Two**

The results indicated by the seed weight parameters of each variety and the KNO3 concentration can be seen in Table 6.

Table 6 shows that the Superpilip variety showed the best average seed weight after separating the pithy seeds from the empty seed. The Superpilip variety obtained the heaviest seed weight in the treatment ($V_2K_3$) weight 35.00 grams and the lowest was the Tajuk variety ($V_3K_0$) with a weight of 3.25 grams, but it was significantly different from the Sanren variety and the Tajuk variety. According to [14] low pollen viability is one of the limiting factors for the formation of flower capsules per umbel, low flower capsules that are perfectly formed will affect the number and weight of botanical seeds, Sanren varieties are characterized by better viability and seed vigor than the Superpilip variety and the Heading variety.

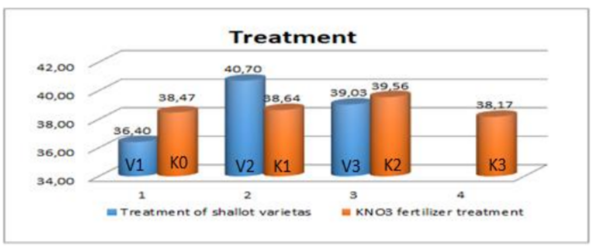


**Fig. 1. Height diagrams of shallot plant**

**Table 1. Average number of flower umbels per treatment plot**

| KNO3 Treatment | Shallot Varieties | | | NP-BNT (α=0.05) |
|---|---|---|---|---|
| | Sanren (V1) | Superpilip (V2) | Tajuk (V3) | |
| Control (K0) | $10.13^{b}_{y}$ | $52.32^{ab}_{x}$ | $12.56^{b}_{y}$ | 14.67 |
| 7 gram (K1) | $10.27^{b}_{y}$ | $43.22^{bc}_{x}$ | $10.57^{b}_{y}$ | |
| 9 gram (K2) | $11.88^{b}_{y}$ | $40.00^{b}_{x}$ | $23.28^{ab}_{x}$ | |
| 11 gram (K3) | $11.00^{b}_{y}$ | $63.00^{a}_{x}$ | $11.99^{b}_{y}$ | |
| *NP-BNT (α=0.05)* | | 20.83 | | |

Note: The numbers that are still followed by the same letters in rows (a, b, c) and columns (x, y, z) are not significantly different in the LSD test$_{\alpha-0.05}$.


**Fig. 2. Generative phase of shallots aged 95 days after planting Sanren (V1), Superpilip (V2), and Canopy (V3) varieties**

**Table 2. Average number of capsules each plot pithy interest treatment**

| KNO3 Treatment | Shallot Varieties | | | *NP-BNT (α=0.05)* |
|---|---|---|---|---|
| | Sanren (V1) | Superpilip (V2) | Tajuk (V3) | |
| Control (K0) | $8,41^{b}_{x}$ | $17,90^{ab}_{x}$ | $9,08^{b}_{x}$ | 10.17 |
| 7 gram (K1) | $16,21^{b}_{y}$ | $20,91^{ab}_{x}$ | $11,28^{b}_{xy}$ | |
| 9 gram (K2) | $17,32^{b}_{xy}$ | $26,39^{ab}_{x}$ | $25,99^{a}_{xy}$ | |
| 11 gram (K3) | $14,42^{b}_{y}$ | $31,00^{a}_{x}$ | $16,74^{b}_{xy}$ | |
| *NP-BNT (α=0.05)* | | 16.45 | | |

Note: The numbers that are still followed by the same letters in rows (a, b, c) and columns (x, y, z) are not significantly different in the LSD test$_{\alpha-0.05}$


**Fig. 3. Some of the Sanren (V1), Superpilip (V2), and Canopy (V3) variety of shallot seeds**

**Table 3. The average number of tubers per sample treatment**

| KNO3 Treatment | Shallot Varieties | | | Average | NP-BNT (α=0.05) |
|---|---|---|---|---|---|
| | V1 | V2 | V3 | | |
| Control (K0) | 5,75 | 10,00 | 10,47 | 8,74bc | 2,73 |
| 7 gram (K1) | 7,27 | 11,27 | 10,07 | 9,53ab | |
| 9 gram (K2) | 8,38 | 13,40 | 13,27 | 11,68a | |
| 11 gram (K3) | 7,24 | 11,13 | 10,20 | 9,52ab | |
| Average | 7,16a | 11,45a | 11,00a | | |
| *NP-BNT α=0.05)* | | | 9,45 | | |

Note: The numbers that are still followed by the same letters in rows (a, b, c) and columns (x, y, z) are not significantly different in the LSD test$_{\alpha=0.05}$


**Fig. 4 Sanren variety (V1), Superpilip (V2), and canopy (V3) variety of shallots**

**Table 4. Average weight (kg) of tubers for each treatment plot**

| KNO3 Treatment | Shallot Varieties | | | NP-BNT (α=0.05) |
|---|---|---|---|---|
| | V1 | V2 | V3 | |
| Control (K0) | $4{,}79^{d}_{yz}$ | $4{,}89^{bc}_{yz}$ | $5{,}73^{bc}_{x}$ | 1,09 |
| 7 gram (K1) | $6{,}11^{bc}_{yz}$ | $6{,}43^{b}_{yz}$ | $6{,}23^{b}_{yz}$ | |
| 9 gram (K2) | $8{,}12^{a}_{xy}$ | $9{,}62^{a}_{x}$ | $8{,}03^{a}_{xy}$ | |
| 11 gram (K3) | $6{,}78^{bc}_{x}$ | $6{,}56^{b}_{x}$ | $4{,}19^{bc}_{y}$ | |
| *NP-BNT (α=0.05)* | | 1,21 | | |

Note: The numbers that are still followed by the same letters in rows (a, b, c) and columns (x, y, z) are not significantly different in the LSD test$_{\alpha=0.05}$

**Table 5. Average tuber weight (ton h-1) for each treatment**

| KNO3 Treatment | Shallot Varieties | | | NP-BNT (α=0.05) |
|---|---|---|---|---|
| | Sanren (V1) | Superpilip (V2) | Tajuk (V3) | |
| Control (K0) | $9.24^{c}_{yz}$ | $9.77^{cd}_{y}$ | $13.13^{bc}_{x}$ | 1.09 |
| 7 gram (K1) | $13.23^{bc}_{y}$ | $13.20^{bc}_{y}$ | $14.47^{ab}_{x}$ | |
| 9 gram (K2) | $16.24^{ab}_{yz}$ | $18.24^{a}_{x}$ | $15.39^{a}_{y}b$ | |
| 11 gram (K3) | $13.83^{bc}_{x}$ | $13.12^{bc}_{x}$ | $8.39^{cd}_{yz}$ | |
| *NP-BNT (α=0.05)* | | 1.21 | | |

Note: The numbers that are still followed by the same letters in rows (a, b, c) and columns (x, y, z) are not significantly different in the LSD test$_{\alpha=0.05}$

**Table 6. Average grain weight per plot of treatment (g)**

| KNO3 Treatment | Shallot Varieties | | | NP-BNT ($_{\alpha}$=0.05) |
|---|---|---|---|---|
| | Sanren (V1) | Superpilip (V2) | Tajuk (V3) | |
| Control (K0) | $1{,}2^{c}_{yz}$ | $3{,}8^{ab}_{x}$ | $1{,}3^{bc}_{y}$ | 0,53 |
| gram 7 (K1) | $1{,}5^{bc}_{y}$ | $1{,}7^{b}_{x}$ | $1{,}4^{b}_{yz}$ | |
| gram 9 (K2) | $1{,}7^{b}_{y}$ | $1{,}5^{bc}_{yz}$ | $1{,}9^{a}_{x}$ | |
| gram 11 (K3) | $3{,}8^{a}_{y}$ | $4{,}4^{a}_{x}$ | $1{,}2^{ab}_{z}$ | |
| *NP-BNT (α=0.05)* | | 0,17 | | |

Note: The numbers that are still followed by the same letters in rows (a, b, c) and columns (x, y, z) are not significantly different in the LSD test$_{\alpha=0.05}$


**Fig. 5. The TSS seeds of the Sanren (V1), Superpilip (V2) and Canopy varieties (V3) varieties**

### The Average Number of Seeds that Germinated, and their Variability Showed the Significant Effect of Varieties on Germination of 3 Shallot Varieties

The results of the viability and vigor analysis of TSS (true shallot seed) can be seen in Table 7 and Fig. 6, namely seed germination.

Based on Table 7, the variety Sanren showed the best results for seed viability of 43.80% of the germinated seeds, compared to other varieties. Seed quality consists of four components, namely physical quality, physiological quality, genetic quality, and seed health quality. A seed with high physical quality can be seen from its clean, bright, pithy, and uniform physical appearance. The physiological quality of the seeds is reflected in the value of viability (such as germination) and vigor (such as growth rate, uniformity of growth in open areas, and storage capacity). In line with the statement, Purcell et al. [15] stated that quality and quality seeds do not always provide good germination as expected but are based on the genetics of the seeds themselves. Optimal roots are needed to support plant life, because they function as nutrient absorbers.

### The Mean Vigor Index and Viability of Seeds and their Variance Prints Showed a Significant Effect on the Germination of 3 Shallot Varieties

The results of the analysis of the average TSS seed vigor index (true shallot seed) can be seen in Table 8 and the TSS seed vigor testing of shallots on three shallot varieties in Fig. 7.

Testing of onion TSS seed vigor on three shallot varieties, germination has a significant effect on the vigor index and viability of seeds, seeds TSS of Sanren variety produced 58.00% growth power which was significantly different in other varieties, 44.31 and 44.31 faster germination rate and, 55.17 higher seed growth speed, and more simultaneously than Superpilip and Tajuk varieties because TSS of Sanren susnan variety genetically better in terms of cotyledos because by looking at the TSS botanical seeds of the Sanren variety, it was somewhat denser than the superpilip and crown varieties. According to Lesilolo (2013), seed growth speed is one of the benchmarks for good seed vigor.

Differences in the ability of seeds to germinate can be caused by several obstacles including water absorption by seeds and dormation [16] and the condition of the embryo, dead seeds (Triharyanto et al., 2012) and according to Baskin's statement (2004) that several seed varieties (TSS) Red onion has dormancy, *orphophysiological therefore,* when it is harvested, it cannot be sown directly, but it is stored for some time so that the embryo can grow.

The low vigor and viability of seeds can be caused by genetic factors of the shallot plant. This is in line with the statement of Makmur [17] that the growing environment and genetic makeup affect plant appearance, productivity and yield quality including seed viability and vigor influenced by genetic factors. Several factors influence the appearance of a plant phenotype, namely age, variety, physiological conditions, genetics and environmental factors.

Seed is a living thing, so a certain method is needed to maintain its viability until it is ready to be planted again. The ability of the seeds to maintain viability and vigor, the rate of deterioration is influenced by grade water of seeds before planting, temperature of storage, mechanical damage during harvest and processing, pest and disease attacks. Meanwhile, viability testing is carried out without going through a significant storage process for all varieties of red onion seeds, seed viability or seed growth capacity is reflected in two factors, namely germination and growth strength [18]. This can be demonstrated through symptoms of seed metabolism or symptoms of seed growth / germination. The seed viability test was carried out directly, with metabolic symptoms of seed germination, observing and comparing the important growth elements of the seeds in the germination process showing that not all seeds had good seed viability and vigor but Sanren varieties showed much more viability and seed vigor. Better than the superpilip and canopy varieties.

**Table 7. Average number of seed germination viability**

| Treatment of Onion Varieties | Of Seeds Germinated Average | NP-BNT (α=0.05) |
|---|---|---|
| Sanren (V1) | 43.8*a* | 6.14 |
| Superpilip (V2) | 3.5*b* | |
| Tajuk (V3) | 0.75*bc* | |

Note: The numbers are still followed by the same letters in rows (a, b, c) and columns (x, y, z) means that they are not significantly different in the LSD test$_{α = 0.05}$

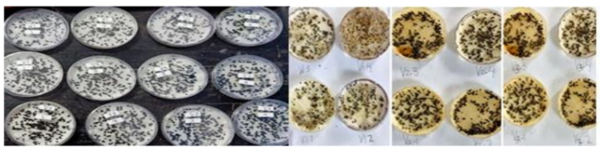

**Fig. 6. Seed vigor test of 3 shallot varieties**

**Table 8. Average seed vigor index includes germination rate, germination rate, germination index and growth rate of shallot seeds**

| Shallot Varieties | Power Grow (%) | Rate Germination (day) | Index Germination Speed (%) | Speed Seeds Grow (%) |
|---|---|---|---|---|
| Sanren | 58.00 a | 44.31 a | 10.10a | 55.17a |
| Superpilip | 4.67b | 10.00b | 0.66b | 0.38b |
| Tajuk | 1.00bc | 11.25bc | 0.18bc | 1.25bc |

Note: The numbers that are still followed by the same letter on the line (a, b, c) mean that they are not significantly different in the LSD test$_{α = 0.05}$

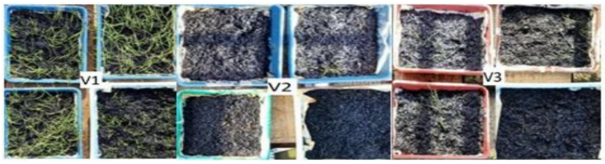


**Fig. 7. Testing of viability and vigor of shallot seeds of Sanren variety (V1), Superpilip (V2), and canopy (V3)**

## CONCLUSION

The three shallot varieties showed the best results in the 11 gram / plant KNO3 fertilizer treatment of the Superpilip variety starting with an average plant height of 41 cm, the number of flower umbels 63, the number of pithy flower capsules 31, seed weight 5 gram, both in terms of tuber production yielded 18 tones $ha^{-1}$.In terms of viability and viability tests, the seeds gave the second best results after the TSS seeds of the Sanren variety with the best yields 44 %. The germination capacity of the production objectives TSS *(True Shallots Seed)* other varieties of shallot seeds that have a lot of seed yields, before the vigor and viability tests are carried out it is not necessarily feasible to be developed by the generative propagation method on onion plants, this is influenced by various factors including the genetic composition of the seeds and varieties. Some have cotyledons that are rather thick, with many cotyledons there will be a lot of food reserves that are prepared in the cotyledons, the growth of botanical seeds or tubers is better too.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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