# Germination of true shallot seed (tss) of onion cultivars and mixing of planting media

*by* Mumarharun Mumarharun

**Journal of Smart Agriculture and Environmental Technology**
*e*-ISSN:3021-8802
Vol. 1, No. 2, August 2023
https://josaet.com | https://doi.org/10.60105/josaet.2023.1.2.37-41

Research Paper

# Germination of True Shallot Seed (TSS) of onion cultivarson mixing of soil and organic matter as planting media

Sopiana, Rina[1], Rujito Agus Suwignyo[2], M. Umar Harun[2]*, Susilawati[2]

[1] *Student of the Doctoral Program, Faculty of Agriculture, Sriwijaya University*
[2] *Department of Agronomy, Faculty of Agriculture, Sriwijaya University*
***Corresponding author**: mumarharun@unsri.ac.id

**Article History:** Received: June 24, 2023, Accepted: July 31, 2023

**Abstract**

In Indonesia, onion cultivation uses bulbs, which disrupts stocks of consumption and trade quite significantly. One way to reduce the need for bulbs from onions is to use True Shallot Seed (TSS). Onion of TSS can reduce production costs, and is practical in shipping compared to bulbs. One of the activities in the cultivation of TSS is the preparation of strong, uniform and healthy of seedling. This study aims to examine the appropriate composition of organic matter as a planting media to accelerate the germination time of various cultivars of TSS. The planting media tested was a mixture of soil, rice husk, cocopeat and sawdust. This study used a complete randomized block design which was arranged in factorials. The first factor was the varieties and the second factor was mixing of organic matter. Mixing organic matter with the soil from no tidal swamp before planting onion seeds increase in soil pH from 0.77 to 1.51. Mixing soil with organic matter increased the pH of the media, CEC, WHC, and decreases the bulb density. After germination, the husk and cocopeat mixture showed a pH (5.9), CEC (1.62 $mS.cm^{-1}$), bulb density (0.3 $g/cm^3$) and WHC (162%). The combination of rice husk and cocopeat as the planting media (4,9 days) exhibited the fastest germination. Planting directly from onion seeds in soil of no tidal swamp resulted in many seeds dying. Germination of cultivar Sanren (78%) was better than Lokananta (65%), Trisula (60%) and Bima brebes (64%) on a mixture of husk and cocopeat.

**Keywords**

*Germination, Onion, Planting media, True shallow seed*

## 1. INTRODUCTION

Increasing production and productivity is key to meeting field requirements through intensification and extensification activities (Bancin et al., 2016). However, increased production faces constraints related to the planting area. To expand the planting area, not only land is required, but also large quantities of seedling. Although substantial income can be earned from onion farming, its significance diminishes if the expenses incurred are also high. Future expectations for onion cultivation include achieving a substantial ratio between income and expenses to effectively finance inputs in onion farming. The greater the obtained ratio, the more precise our selection becomes in determining inputs to provide and in quantities (Rahmadona et al., 2015). Seedling are a costly production factor in onion farming, with a requirement of approximately from 0,8 until 1,2 tons per hectare. Despite the high demand for onion seedling, both in the form of commercial seedling and source seedling, seedling production has not kept pace. Onion production in Indonesia experiences annual fluctuations, resulting in frequent price fluctuations due to uneven distribution in onion production areas.

Onion cultivation in South Sumatra province is still primarily relies on bulbs as planting material and is typically carried out in both dry land and paddy fields during the dry season. Onion production achieved through bulbs cultivation in this province can range from 5 tons per ha to 10 tons per hectare (BPS, 2021). The production of onion bulbs can be accomplished using either vegetative methods, such as bulbs, or generative methods, such as seeds. While using bulbs as planting material is easier to implement, it has several drawbacks, including the requirement for a large quantity of seedling, relatively high costs, difficulties in arranging planting schedules, and competition with consumption onion (Fairuzia et al., 2022). Another approach adopted by various countries such as India, Bangladesh, China, and Egypt is to utilize seeds as planting material.

Some farmers in Indonesia had also begun using seeds as planting material, but the results had been unsatisfactory (Adam et al., 2021). One of the obstacles in utilizing

True Shallot Seed (TSS) as planting material is the lack of a suitable technology package for various agro-ecosystems (Aldila, 2016; Adiyoga, 2020). Several onion seed varieties had been used as planting materials in Indonesia, including Sanren, Lokananta, Bima Brebes, Trisula, and Tuk Tuk (Saidah et al., 2020). The most common planting system used by farmers to cultivate onion from seeds is by planting seeds. However, this system results in relatively high costs and also a lot of labor. To overcome the obstacles of cultivating onions from seeds is through seedbeds. Onion seed sowing will be successful if the exact composition of the planting media is known for germination. For this reason, site-specific organic material resources are alternatives such as husks, coconut fiber, and wood sawdust.

No tidal swamp has the potential to cultivation onions after the rice harvest. Therefore, information is needed about direct seed germination in soil of that swamp, and determining a mixture of organic matter as a planting media for seeds of various onion cultivars from TSS. Therefore, testing the chemical and physical properties of planting media mixed with various organic materials, and studying the germination response of various onion cultivars.

## 2. EXPERIMENTAL SECTION

### 2.1 Materials

This research was conducted from April 2021 to Mei 2021 in a greenhouse belonging to the Faculty of Agriculture, Sriwijaya University, at Bukit Besar, Palembang. The tools used in this study included stationery items, 200 ml plastic seedling pots (cup of water mineral), water hoses, trowels, seedling racks, and necessary laboratory equipment such as analytical scales, a pH meter, and a CEC meter. The materials used consisted of TSS onion seeds from the Sanren, Lokananta, Trisula, and Bima Brebes cultivars, as well as the planting media (soil, rice husk, cocopeat, and wood sawdust) based on the treatment composition. Transparant plastic pots with a volume of approximately 200 ml (cup of water mineral) were used in this study and filled with a complete planting media mixture (level with the surface of the cup). The prepared planting media consisted of soil from back swamp in Pemulutan, rice husks from the Rice mill owned by PT. Buyung TBK, saw dust from wood processing on Jalan Japan Musi II, and cocopeat obtained from the coconut belt processing industry in Tanjung Lago. All the materials used as planting media were mixed on a volume basis using a 10 L plastic bucket and then transferred to the cup of water mineral as the planting media. The onion seeds used for the experiment came from the Sanren, Lokananta, Trisula, and Bima brebes varieties and were provided in the form of seed packets (sachets).

### 2.2 Methods

The treatments were arranged by factorial (4x7) in a randomized block design with 3 replications. First factor were the onion varieties as Sanren (V1), Lokananta (V2), Trisula (V3), and Bima brebes (V4). The second factor were the composition of the planting media as Soil (M1), Soil-husk-coco peat (M2), Soil-husk-sawdust (M3), Soil-coco peat-sawdust (M4), husk and cocopeat (M5), husk and sawdust (M6), and coco peat and sawdust (M7). There were 28 treatment combinations with a total of 84 sample pots.

The planting media was soaked in water baths, with the water level reaching -1 cm from the surface of the mineral water cup. Each treatment was soaked for approximately 15 minutes, using a separate water bath for each group. Following the soaking process, the pH (measured digitally), electrical conductivity (measured using a CEC digital device), and the difference in wet weight and dry weight (before media immersion) were measured to obtain data on water holding capacity. The density of the media contents (bulb density) was determined by weighing the growing media without water and dividing it by the volume of the pot. After the research, all planting media were dried for three days in the greenhouse, and their weight was measured and divided by the volume of the pot to determine the contents density of the media. Especially for germination observations were carried out in plastic tanks (40 cm x 25 cm x 5 cm), with 100 seeds for all growing media for all cultivars, and replicated 3 times. Sprouts that appeared and normal from each planting media of each cultivar, and observations up to 14 days after planting (14 DAP) The observed variable for all plants was the time of shoot growth, which was measured during a 14-day observation period after planting (DAP). Data were analyzed by using analysis of variance (ANOVA) and for significant result was continued by a LSD Least Significance Different (LSD) with 0.05 level of significant difference.

## 3. RESULTS AND DISCUSSION

The planting media used exhibited differences in chemical and physical properties before and after planting onion seeds. The soil-based planting media demonstrated a pH value classified as very acidic before use and after the research. Mixing organic matter with the soil before planting onion seeds led to an increase in soil pH from 0.77 to 1.51. This increase was accompanied by higher electrical conductivity (CEC) and water holding capacity (WHC), as well as a decrease in bulb density (BD) of planting media. On the other hand, mixing organic matter without soil resulted in a pH difference in the planting media ranging from 5.81 to 6.02, with lower density compared to the mixture containing soil. Furthermore, the mixing of soil and organic matter enhanced the CEC and WHC of the planting media (see Table 1).

Based on the analysis of variance, there was a significant interaction between onion cultivars and the composition of the planting media on the growing time of TSS onion shoots and germination of seeds, and cultivars and planting media had a very significant effect on onion seed germination

 

**Table 1.** Physical and chemical properties of planting media before (A) and after (B) as a medium for germination and growth of onion seeds

| Planting Media | pH | | Electrical Conductivity (mS.cm$^{-1}$) | | Bulk Density (g/cm$^3$) | | Water Holding Capacity (%) | |
|---|---|---|---|---|---|---|---|---|
| | A | B | A | B | A | B | A | B |
| Soil (MI) | 3.82 | 3.61 | 0.88 | 1,04 | 1.25 | 1,20 | 116 | 120 |
| Soil-husk-cocopeat (M2) | 5.15 | 4.90 | 0.95 | 1,16 | 0.90 | 0,72 | 140 | 144 |
| Soil-husk-sawdust (M3) | 4.59 | 4.25 | 1.20 | 1,52 | 0.84 | 0,65 | 148 | 150 |
| Soil-cocopeat-sawdust (M4) | 5.33 | 5.17 | 1.21 | 1,70 | 0.70 | 0,67 | 169 | 170 |
| Husk and cocopeat (M5) | 5.81 | 5.90 | 1.57 | 1,62 | 0.38 | 0,30 | 149 | 162 |
| Husk and sawdust (M6) | 6.02 | 6,05 | 1.50 | 1,60 | 0.25 | 0,31 | 147 | 150 |
| Cocopeat and sawdust (M7) | 5.61 | 5.90 | 1.48 | 1,72 | 0.20 | 0,25 | 166 | 180 |

(Table 2).

The use of planting media for two weeks leads to changes in the chemical and physical properties of the media. In particular, soil-based planting media exhibit a decrease in soil pH and BD (bulk density), along with an increase in CEC (electrical conductivity) and WHC (water holding capacity). Additionally, when organic matter is mixed with the soil, it results in an increase in pH and BD of the media, as well as increased CEC and WHC of the planting media. These findings demonstrate that after one month of use as a planting media, the addition of organic matter to soil can elevate the pH, CEC, and WHC of the planting media.

In this study, it was found that the soil media resulted in the longtime growth of onion shoots from seeds. However, the shoots start to grow between three to four days and then death. The death of sprouts in the soil media subsequently affects the observations and measurements of all other variables. The difficulty in growing and high mortality rate of onion seed shoots in the soil media can be attributed to the acidity of the planting media. Over the course of two weeks, the soil tends to gradually decrease in pH, leading to an increase in the concentration of H+ ions and the solubility of Al, Mn, and Fe (Karim and Ibrahim, 2013). The solubility of these ions has an impact on the availability of other macronutrients (Nora et al., 2021). The higher solubility of these ions leads to a lower respiration rate in onion seed embryos, resulting in decreased shoot growth and seed root. Although some seeds can grow in soil media, their seed vigor was weak due to the relatively long germination time required (see Table 1). Consequently, this causes all shoots of the four onion cultivars sown in soil media to suffer from drought, abnormalities, and eventually death.

The planting media tested consisted of seven sets of soil-based combinations, four treatment sets, and three combinations based on organic matter without soil. There was a significant interaction effect between the cultivars and the growing media on the time of shoot growth variables.

In the soil media, abnormal germination and sprouting occurred, but after the next two to three days, all onion cultivars experienced dryness and subsequent death. The death of sprouts in the soil medium prevented the growth of onion seeds, thereby restricting observations to the time of sprouting only, with no measurement of other variables possible. The death of all onion cultivars in the soil medium was attributed to the highly acidic pH, which hindered the development of root cells and plumules, leading to tissue decay.

The combination of rice husk and cocopeat as a growing medium resulted in the fastest germination time for the Sanren variety, which was significantly different from the Bima Brebes variety. The Trisula variety exhibited the longest shoot growth time in soil media, which was significantly different from the Lokananta variety. When using soil as the growing medium, seed-origin onion experienced slowed shoot growth time, which was significantly different from all other media combinations. Furthermore, the Sanren variety demonstrated a faster germination ability compared to other cultivars, and this difference was significant when compared to the Trisula and Bima Brebes cultivars (see Table 3).

Onion seed germination was influenced by seed vigor conditions and the growing media environment, including soil and microclimate. Back swamp soil, with a pH of around 3.82 (see Table 1), was still able to support the

**Table 2.** Analysis of variance effect of variety, planting media, and their combination

| Variable | Value of F calculation (0.05) | | | Coefficient of variety (%) |
|---|---|---|---|---|
| | Cultivars | Planting media | Interaction | |
| Time period of germination | 11.74* | 16.49* | 4.02* | 17.75 |
| Germination | 23,25* | 14,82* | 1,05 | 21,64 |

Noted: ** and * mean significance effect at 0.01 and 0.05 respectively
+ data transformed $\sqrt{X}+1$

**Table 3.** Effect of cultivars and composition of planting media on growing time of onion germination from seeds (days)

| Cultivars | Day after Planting (days) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Soil | Soil-husk-cocopeat | Soil-husk-sawdust | Soil-cocopeat-sawdust | Husk and cocopeat | Husk and saw dust | Cocopeat and sawdust | Mean cultivars |
| Sanren | 16.2 c B | 11.2 b B | 9.1 b B | 7.3 ab A | 3.4 a A | 4.4 a A | 5.3 a A | 7.3 A |
| Lokananta | 11.03 d A | 9.5 c A | 9.6 c A | 7.4 a A | 5.6 a A | 6.4 a A | 7.1 b A | 8.1 AB |
| Trisula | 16.4 d B | 12.1 c B | 8.5 b A | 8.3 b A | 4.1 a A | 5.5 a A | 6.1 ab A | 8.7 B |
| Bima Brebes | 15.9 c B | 13 b B | 11.2 b B | 11.2 b B | 6.7 a B | 7.4 a B | 7.6 a A | 10.4 C |
| Mean Planting Media | 14.8 d | 11.4 c | 9.6 bc | 8.55 b | 4.9 a | 5.9 a | 5.1 a | |
| LSD | 0.05: Cultivars = 0.97 | | Planting Media = 1.29 | | Interaction CxP = 2.58 | | | |

Note: Numbers followed by the same letter are not significantly different at the LSD level of 0.05. Lowercase letters are compared horizontally and uppercase letters are compared horizontally.

growth of sprouts for all onion seeds, although it took a relatively longer time compared to other planting media. This delay is thought to be due to the influence of acidic water, which suppresses the growth of embryo cells, leading to hindered cell growth and weak, abnormal development. On the other hand, the combination of rice husk and cocopeat as a planting media created a pH of 5.90, which promoted rapid growth of embryo cells and resulted in faster germination compared to other growing media.

According to Febriyanto et al. (2022) and Hasanah et al. (2022), planting media with a pH close to neutral can enhance the growth and yield of onions. The Sanren variety is believed to possess greater genetic tolerance than other cultivars, allowing its embryo cells to grow faster and lead to quicker sprouting. When grown on a mixture of rice husk and cocopeat, the Sanren variety exhibited faster germination time than other cultivars and growing media. This observation suggests that the husk and cocopeat planting media provide ideal soil acidity conditions, continuous water availability, and high electrical conductivity (CEC, see Table 1), facilitating the faster growth of embryo cells into sprouts. As for the soil, husk, and sawdust were planting media, their electrical conductivity (CEC) and water holding capacity (WHC) are not significantly different from the husk and cocopeat planting media. However, the pH of soil, husk, and sawdusk media, which is around 4.25, negatively affected the germination of all onion cultivars. Karim and Ibrahim (2013) reported soil pH between 6.2 to 6.8 for onion seed germination

The use of soil as a planting media can actually kill onion seeds for all cultivars. Mixing soil with organic matter can improve the number of seeds germinating, and planting media from non-soil mixtures has better germination for all onion cultivars (Table 4).

The planting media from no tidal swamp soil is very acidic so many onion seeds die, and the addition of organic matter to the soil can increase soil pH, CEC and WHC, and very helpful for the germination of onion seeds for all cultivars. This means that the addition of organic matter to the soil can improve soil properties for onion seed germination. Sanren onion seeds were thought to have greater adaptation to acid soils than the other three cultivars.

## 4. CONCLUSIONS

The conclusions drawn from the results of this study are none of the onion cultivars were able to germinate normally and grow into seedlings when planted in soil of no tidal swamp. Mixing of organic matter and soil of no tidal swamp can increased the soil pH and electrical conductivity (CEC) and water holding capacity (WHC), and can increase the germination of onion seeds. Combination of rice husk and cocopeat as the media planting for the Sanren cultivar exhibited more at germination and faster germination compared to other cultivars.

**Table 4.** Effect of cultivars and compositions of planting media on percentage of germination TSS

| Media/Variety | % Germinations | | | | Mean Media |
|---|---|---|---|---|---|
| | Sanren | Lokananta | Trisula | Bima | |
| Soil | 9 | 2 | 0 | 0 | 2,75 A |
| Soil-husk-cocopeat | 45 | 48 | 43 | 45 | 45,25 C |
| Soil-husk-sawdust | 28 | 22 | 32 | 28 | 27,50 B |
| Soil-cocopeat-sawdust | 35 | 36 | 30 | 39 | 35,00 C |
| Husk and cocopeat | 78 | 65 | 60 | 64 | 66,75 E |
| Husk and sawdust | 62 | 60 | 57 | 59 | 59,5 D |
| Cocopeat and sawdust | 66 | 58 | 59 | 60 | 60,75 D |
| Mean Cultivars | 46,14 b | 41,57 a | 40,14 a | 42,14 a | |
| BNT 0,05 | Media = 5.27 | | Cultivars = 3.28 | | |

Note: Numbers followed by the same letter are not significantly different at the LSD level of 0.05. Lowercase letters are compared horizontally and uppercase letters are compared horizontally.

## ACKNOWLEDGEMENT

Would like to express the sincere gratitude to all those who have contributed to this research project.

## REFERENCES

Adam, T., A. Kartina, and Z. Millah (2021). Respons Hasil varietas Bawang merah (Allium Ascalonicum L.) asal biji (True Onion Seed) terhadap tingkat konsentrasi pupuk majemuk berteknologi nano pada berbagai varietas. *Jurnal Ilmu Pertanian Tirtayasa*, **3**(2); 351–360

Adiyoga, W. (2020). Signifikansi dan Potensi Produksi Bawang Merah di Indonesia

Aldila, H. F. (2016). Daya saing Bawang Merah di Wilayah Sentra Produksi di Indonesia

Bancin, R. R., Murniati, and Idwar (2016). Pertumbuhan dan Produksi Bawang Merah (Allium ascalonicum L.) di Lahan Gambut yang Diberi Amelioran dan Pupuk Nitrogen. *Jom Faperta*, **3**(1); 1–12

BPS (2021). Produksi Tanaman Sayuran Indonesia

Fairuzia, F. et al. (2022). Longday Photoperiod Accelerates Flowering in Indonesian Non-Flowering Onion Variety. *Agrivita*, **44**(2); 216–224

Febriyanto, D. et al. (2022). Pemanfaatan abu Ketel dan vermikompos sebagai media tanam pada pertumbuhan dan hasil bawang merah. *Jurnal Agronisma*, **10**(1); 1–13

Hasanah, Y. et al. (2022). Role of Cultivation Methods on Physiological Characteristics and Production of Onion Varieties under Lowland Condition. *Asian Jornal of Plant Sciences*, **21**(3); 492–498

Karim, S. and N. Ibrahim (2013). Effect of Planting Time, Day Length, Soil pH and Moisture on Onion. *International Journal of Biology, Pharmacy and Allied Science*, **2**(4); 807–814

Nora, Nurbaiti, and Murniati (2021). Pengaruh pemberian giberelin dan pupuk kalium terhadap pertumbuhan dan produksi tanaman bawang merah (Allium ascalonicum L.). *Jurnal Dinamika Pertanian*, **XXXVII**(1); 37–46

Rahmadona, L., A. Fariyanti, and Burhanuddin (2015). Analisis Pendapatan Usahatani bawang Merah di Kabupaten Majalengka. *Agrise*, **XV**(2); 72–84

Saidah, Muchtar, et al. (2020). Growth and Yields Performance of True Onion Seed (TSS) in Dry Land of Sigi District. In *IOP Conference Series: Earth and Environmental Science*, volume 472. pages 1–7

# Germination of true shallot seed (tss) of onion cultivars and mixing of planting media

ORIGINALITY REPORT

| 2% | 2% | 2% | 0% |
|---|---|---|---|
| SIMILARITY INDEX | INTERNET SOURCES | PUBLICATIONS | STUDENT PAPERS |

PRIMARY SOURCES

| | | |
|---|---|---|
| 1 | jurnal.polbangtanmanokwari.ac.id<br>Internet Source | 2% |

| | | | |
|---|---|---|---|
| Exclude quotes | Off | Exclude matches | < 2% |
| Exclude bibliography | On | | |