E3S Web of Conferences **444**, 04018 (2023) https://doi.org/10.1051/e3sconf/202344404018
IConARD 2023

Changes of Soil Nutrient Content as Influenced by Water Hyacinth Compost and Inorganic Fertilizers on Shallot

Emma Trinurani Sofyan[1], *Rizkyani* Remona[2*], *Oviyanti* Mulyani[1]

[1] Department of Soil Sciences, Faculty of Agriculture, Universitas Padjadjaran, Bandung, Indonesia
[2] Laboratory of Soil Chemistry and Plant Nutrition, Department of Soil Sciences, Faculty of Agriculture, Universitas Padjadjaran, Bandung, Indonesia

Abstract. One of the problems with Inceptisols is their low level of soil fertility. The addition of one or more available nutrients can help the soil become more fertile and enhance quality of plants. The goal of this experiment was to find out the optimum ratio of water hyacinth compost, N, P, K, and S fertilizers in relation to variations in the soil's nutrient content, quality and yield of shallot Batu Ijo Variety. This research was conducted from February to August 2020, at the Laboratory of Soil Chemistry and Plant Nutrition Field Experiments, Universitas Padjadjaran. The research design used in this study was a randomized block design (RBD) with seven treatments, which were: one control treatment, two recommended dosage treatments of N, P, K, S fertilizers, and four combination treatments of water hyacinth compost and N, P, K, and S fertilizers. The findings demonstrated that the treatment of 1 dose recommendation of compost plus ¾ dose recommendation of N, P, K, and S was able to increase soil nutrient content and quantity (number of shallot bulbs). The use of this experiment is as information to optimize the use of water hyacinth compost in efforts to increase the productivity of soil and shallot plants.

1 Introduction

Increasing agricultural production requires more inorganic fertilizers to meet plants' nutrient requirements [1]. Urea, SP-36, KCl, and ZA are the most popular inorganic fertilizers used by farmers. Continuous application of inorganic fertilizers can lead to a decrease in land productivity; compost is one method of reducing the additional effects of using inorganic fertilizers [2]. Compost is the result of the organic material or organic material or decomposition based on the plants or animal waste by microorganisms, resulting in the production of comparatively consistent and simple organic matter [3]> Water hyancinth existed as a source of abundant organic material that has not been heavily exploited The content of nutrient of the water hyacinth at compost was quite high with N at 1,85%, P 4,06% K 2,75%, organic C at 28.73 percent, a C/N ratio of 16, and S at 990 $mgkg^{-1}$.

Inceptisols are one of the common land orders in Indonesia covering the 70,53 M ha or 37,5% from the country's mainland region. Inceptisol has great potential for agricultural and

* Corresponding author: remonarizkyani@gmail.com

also the plantatiom crops especially for the food products establishment and also horticulture [4]. As maintained on preliminary soil analysis results for Inceptisols, it has less beneficial chemical properties. Among the chemical properties that serve as factorsof the soil fertality are the somewhat acidic oH from the water sample (6.50), the low total nitrogen (0.20%), the medium available phosphorus (9.65 ppm) and the medium potassium potential (28.39 mg 100 g^{-1}), the very low SO_4^{2-} (5.11 mg kg^{-1}), the low organic-C (1.83%), and the medium Cation Exchange Capacity (21.96 cmol kg^{-1}). This necessitates the inclusion from 1 or more existence nutrients in order to maximize the soil fertility and increase plant quantity and quality.

Bulb quality and disease resistance can be improved by fertilization by the balances N,P,K fertilizers and organic fertilizers. Generally, that three fertilizers could excite the whole growth from the leaves, roots, and also stems. Athe formation of proteins improve the breaking force of leaves, produce and stems. Beside the three fertilizers, ZA existed as an essential based on the 24% conceived sulphur, a secondary macronutrient that is essential for plant growth, protein synthesis, and chlorophyll formation [7]. One of these nutrients is essential for plant growth and development.

Shallots, due to their distinctive aroma and flavor, are one of the most important agricultural crops for the community, especially as a food flavoring ingredient. Despite the fact that the demand for shallots continues to increase almost daily, shallots are included in the seasonal commodities. Shallots productivity in West Java Province decreased from 10.47 t/ha in 2015 to 10.06 t/ha in 2016 [8]. Production needs to increase to find the growth demand that aimed for the shallot. According to the Ministry of Trade [9], from 2005 to 2014, Indonesia was among the 10 countries that has the widest average shallot done harvested on earth but ranked 115th in terms of the largest average shallot productivity.

One way to increase shallot productivity in both highland and lowland areas is to use high-yielding varieties. There are many detached the shallot categories by the high yield potency, broad adaptability and lowland suitability. One of them is Batu Ijo [10]. Soil conditions, variety types, and fertilizer application are among the production factors that influence the increase in the quantity and quality of shallot plants [11]. Therefore, the effect of *Eichhornia crassipes* (Martt.) *Solm* and balanced doses of N, P, K and S fertilization on Inceptisols at both of the shallot's quality and quantity (*Allium ascalonicum* L.) should be investigated. The use of this experiment is as information to optimize the use of water hyacinth compost in efforts to intensify the soil and shallot plants' production, especially in the applicate of both fertilizers' doses on Inceptisol soil.

2 Materials and Methods

The study here is organized from February to August 2020 at the Laboratory of Soil Chemistry and Plant Nutrition Field Experiments, Faculty Agriculture, Padjadjaran University. The tools utilized were 30 x 30 cm polybags, scales, calipers, meters, stationery, and laboratory apparatus. The material utilized included cultuvate the media for Inceptisol soil, shallot sepeda of the Batu Ijo cathegory, compost by the water hyacintg, decomposer, Urea fertilizers, KCI, SP-36, and ZA in varying dosafes in pursuance of the furadan and treatment.

The research method used was an experiment with Inceptisols applied to shallot plants. The research applied a RBD by the one control treatment and two suggested dose treatments for N,P,K and S fertilizers and also 4 composite of the water hyacinth treatment. Every treatment is applied 4 imes to two study unit for a total of 56 polybags. Observations consisted of plant vegetative growth: plant height and also leaves that taken out IM every week starting from 7-42 DAP determining soil pH soil organic C, and total soil, available P, K-dd (Ammonium Acetate Method), S-total soil (Turbidimetric Method) were carried out at

35 DAP, shallot quantity: bulbs for every plant and also: diameter of bulbs. Fisher's test in SPSS version 16.0 was used to statistically analyze the experimental data. When the impact is crucial, test continued with the DMRT on 5% true level.

The use of water hyacinth in decomposition was the first application here. First, the water hyacinth is cut into small pieces (3-5 cm). Then 50 ml of the decomposer is evenly distributed over each pile of compost and stirred with a hoe. Composting is anaerobic. The compost is covered with a tarp for four weeks. The compost was ready to implemented in the field when the temperature in the compost pile dropped to between 26° and 27° C.

The process begins by measuring the soil, weighing it up to 8 kg, and then placing it into a poly bag measuring 30 x 30 cm. Subsequently, 25 tons of water hyacinth compost per hectare are mixed with the soil, and the mixture is left to incubate for a period of two weeks. At the outset of planting, a specific Batu Ijo shallot bulb is used. Prior to planting, the outer layer of the bulb's skin is cleaned, any remaining roots are removed, and the ends are trimmed to approximately one-third of their original length. The fertilizer application comprises 200 kg of urea, 500 kg of ZA, 300 kg of SP-36, and 200 kg of KCl. The SP-36 and KCl fertilizers are applied during planting, while urea and ZA are applied at 7 DAP and 21 DAP, respectively.

Plant preservation includes watering, pruning, pest control, and replanting. Daily watering in the morning or evening is carried out when there is no rain. Manual weeding is performed to eliminate plants growing about the planting tool. Pest controls executed chemically and manually, with pesticide application occurring when the pest population exceeds a certain threshold. Thinning is conducted by removing underdeveloped seeds and replacing them with new ones if any seeds fail to develop or perish between 0 and 14 DAP. Harvesting is done at 60 DAP when the bulbs exhibit characteristics such as soft stem bases, over 80% yellowing of leaves, full bulb development, and a dark red-purple color. After harvest, the bulbs are air-dried for a period of ten days to attain the required dry weight for storage.

3 Results and Discussion

3.1 Plant Height

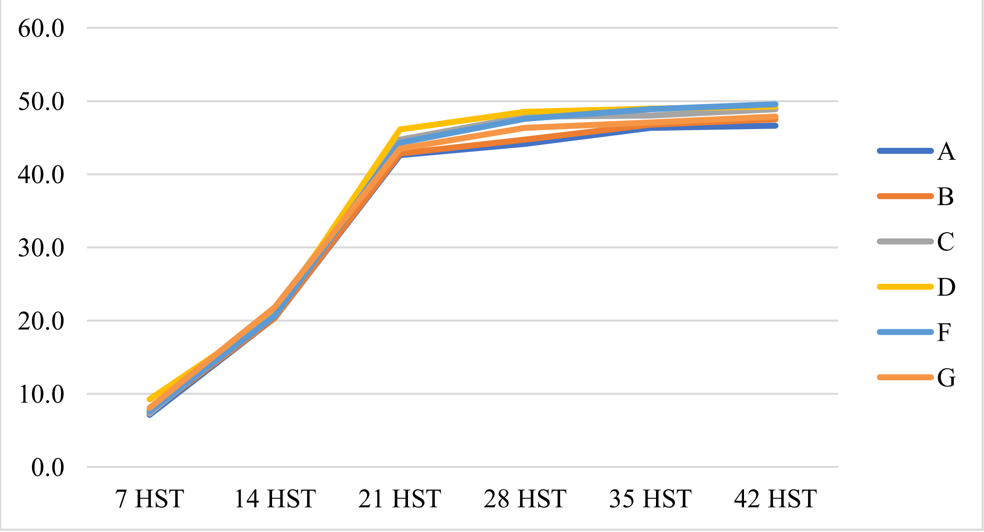

Fig 1. The Average Height of Shallot

The height of the plant is one of the most easily understood indicators of plant growth. Observing plant height during the experiment revealed a difference in plant height between shallot plants that received fertilizer and those that did not. This occurs because plants that receive fertilizer have a greater nutrient intake and can use it directly, whereas plants that do not receive fertilizer develop more slowly. The existence of the nutrients in environment, such as the nutrients supply from fertilizers that can be assimilated through the roots, can affect plant height [12].

The height of shallot plants at 7 to 14 DAP remains considered uniform (Figure 1). After 14 days after sowing, water hyacinth compost and N, P,.K, and S fertilizers affected plant height. This is because, for plants younger than 14 DAP, the process of nutrient assimilation by the roots is not optimal, and the plants are still adapting so that they don't use too many nutrients. In accordance with Mahdiannoor et al. [13], at the age of 14 DAP, plants enter the phase of suitable new plants or sluggish growth, durung the roots of plant havent developed yet and don’t asctively absorb the nutrient from the soil.

The height development of shallot plants ranges between 28 and 42 DAP. The water hyacinth cure of compost and the four nutrients resulved in tallerbplants than the treatments. Sulfur is an essential component of ferodoxin, a complecity of good environment and chlorophyl situations, the photosynthesis mechanism is able to function optimally resulting in the optimal production of the photosynthate that unscolated for the section of plant that entaul it and stored as bulbs. In addition, both variables in this study contain Nitrogen, that enhances the uptake of S elements. This is consistent with Fatmawati et al.'s [15] belief that the existence of the nitrogen nutrien content will intensify the assimilation of element S therewithal intensifying photosynthesis.

3.2 Number of Leaves

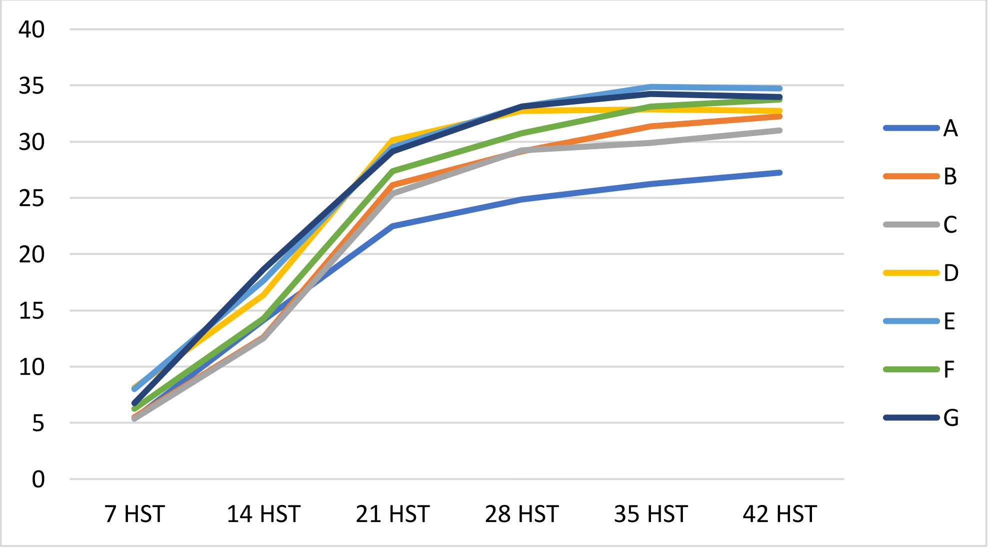

Fig 2. The Average .Number of Leaves Shallot

The leaves observed were used to determine the response of shallot plants water hyacinth and also the four fertilizers. The quantity of shallots during the experiment showed a difference between the receiving and non-fertilized plants (Figure 2). When compared to the control, the total treatment of adding the four fertilizers and also the water hyacinth compost had a greater influence in number of leaves. This is because fertilizer containing N, P, K, and S components can give nutrients for plant growth, increasing the number of leaves on shallot plants. According to Rahmah et al. [10], shallot plants grow optimally because the nutrients required by plants are available. Plant growth is part of cell elongation and cell division, which require nutrients, water, specific hormones, and carbohydrates.

As maintained by the number of leaves seen in Figure 2, the number of leaves continues to take every week from 7-35 DAP. Nonetheless, leaf number growth has begun to slow when it approaches 42 DAP since it has entered the generative phase. The cure/treatment with both compost and four fertilizers produced more leaves than the other treatments. The nutrient intake of the treatments was higher than those without adjunct of water hyancinth compost , resulting in a greater number of leaves generated. The increase in leaf number is connected to nutrition uptake by plant roots. In this scenario, the roots are critical because they act as nutrition absorbers and transport materials from the roots to the stems, leaves, or fruits [10].

N and S elements in water hyancinth compost and N,P,K,S fertilizers affect the number of leaves on shallot plants. According to Soegito [40], the more accessible nitrogen there is, the more photosynthesis results up to the maximum that turn impacts the quality of leaves. Sulfur has an impact on the height of plan and leaves, leaf zone per clump and also the Harvest index, according to Irianto et al. [16].

3.3 Soil pH

The result here shows about the implementation of both fertilizers and compost has an important impact on soil pH (Table 1). The implementation can enhance soil pH when the pH values of 1 or ½ compost + ¾ dose of the four fertilizers and the compost + ¾ fertilizers were 7.16 and 7.03, respectively, among the other treatments. An increase in soil pH can occur as a result of an organic matter overhaul caused by the addition of water hyacinth compost, which produces organic acids. Organic acids formed during decomposition can bind H^+ ions at soil, causing acidity and increasing soil pH [17]. Scnitzer [18] supports this by stating that organic acids may strap the H+ ions via negatively vharged carboxyl bunchesm Moreover, Bayer et Al claimed about the fall and rise of the soil pH as a purpose of the H+ and OH- ions with the pH increasing aa the H+ concentration ions on soil solution upgrades and the pH using the other concentration. Decomposer organic material produces the negative ion (OH-), which will neutralize the positive (H+) ions activity.

Table 1. Effect of Water Hyacinth Compost and N, P, K, S Fertilizers on Soil pH

Treatment	pH
Control	6.63 a
N, P, K, S recommendation	6.70 a
¾ N, P, K, S recommendation	6.70 a
½ Compost + ¾ dose of N,P,K,S	6.81 ab
Compost + ¾ dose of N,P,K,S	7.03 c
1½ Compost + ¾ dose of N,P,K,S	7.16 c
Compost + N,P,K,S	6.95 bc

Note: The number there followed the same letters not importantly different based on DMRT multiple distance test of 5% signficance level.

The pH values for the control treatment, treatment N, P, K, S recommendation, and ¾ N, P, K, S recommendations were not substantially different from one another, namely 6.63, 6.70, and 6.70. This can happen since there is no water hyacinth compost added, therefore the soil pH cannot be increased. According to Wijayanti [20], the weathering process releases alkaline cations, causing soil pH to rise. Based on this, it may be concentrated about the treatment with water hyacinth compost can enhance soil pH when compared to treatment without water hyacinth compost.

3.4 Soil organic C

The result here of the statitistixcal test proved about the implementation of fertilizers SDN compost significantly affected soil organic C. The apllication of both fertilizers and compost can price the organic C content of soil. According to result of statististical analysis the treatment about 1½ compost plus the four fertilizers and also the compost treatment + N,P,K,S had the greatest organic C content among the other treatments, 3.35% and 3.27%, respectively. This occurs because the upgrade in soil organic C content is directly proportionate to the addition the organic context can improve the C content which also alter soil qualities to be more valuable and good chemically, phosically, and also biologically. Carbon’s a food supply for soil microbe therefote the organic C’s existence in soil can stimulate microorganisms activity, enhancing soil decomposition as well as reactions that require the assistance of microorganisms, like P dissolving and N fixing.

Table 2. Effect of Water Hyacinth Compost and N, P, K, S Fertilizers on Soil organic C

Treatment	Organic C (%)
Control	1.46 a
N,P,K,S recommendation	1.97 a
¾ N,P,K,S recommendation	1.95 a
½ Compost + ¾ dose of N,P,K,S	2.70 b
Compost + ¾ dose of N,P,K,S	3.11 bc
1½ Compost + ¾ dose of N,P,K,S	3.35 c
Compost + N,P,K,S	3.27 c

Note: number there followed the same letters not importantly different based on DMRT multiple distance test of 5% significance level.

Treatment without water hyacinth compost provided lower C-organic content compared to treatment using water hyacinth compost. The organic C content was not substantially different between the control treatment, N,P,K,S recommendations, and ¾ of that recommendations, namely 1.46%, 1.97%, and 1.95% respectively. This occurs because there is no organic substance added to the treatment. Any substance originating from plant or animal remnants that can be applied to or in the soil surface to increase the organic C content and soil nutrients is considered organic material. This has constant direction from the Wijayanti’s study that found about compost treatment can improve the organic C’s soil concentration. The more organic matter added to the soil, the higher the soil's organic C concentration, this is because the compost has high content of C also have a lot of benefit for soil [22-23].

Based on this, treatment with water hyacinth compost can improve soil organic C content when compared to treatment without water hyacinth compost. According to Bakri [24], the sum of the organic matters to soil strengthens the connection among particle that existed as the organic matter degree on soil increases. Furthermore, adding water hyacinth compost to the soil might improve its physical properties. According to Bakri [24], organic matter has a significant impact on soil physical qualities such as enhancing soil structure, increasing soil aggregate, and increasing plant growth. Also, the organic fertilizer can reduce the pH value in soil [14].

3.5 The.Effect.of.Water.Hyacinth Compost and Inorganic Fertilizers on Soil total N, available P, and K-dd

The statistical results also indicate about the implementation of the four fertilizers and compost significantly influences the total nitrogen, available phosphorus, and potassium levels (Table 3). Both provide a higher total N value than treatment N, P, K, S recommendations, namely 0.35% and 0.23%, indicating that compost + N, P, K, S is a more optimal and efficient dose than treatment N, P, K, S recommendations. The inorganic fertilizers' function about to shallots must be managed according to the plant's requirements. Inorganic fertilizer use that is not managed can diminish productivity and soil quality. High N fertilizer addition does not boost production; in fact, it reduces the use from N fertilizer [25]. Based on Sumarni et al. [26], high N content results in increased N uptake, plant height, and dry weight of shallot plants. This is demonstrated by the use of the compost and ¼ fertilizers doses which resulted at the largest plant's height and leaves' number while compared to the established N,P,K,S treatments.

Table 3. Effect of Water Hyacinth Compost and N, P, K, S Fertilizers on Soil total N, available P, and K-dd

Treatment	Total N (%)	Available P (mg kg^{-1})	K-dd (me 100 g^{-1})
Control	0.11 a	11.96 a	0.67 a
N,P,K,S recommendation	0.23 b	18.72 b	1.17 b
¾ N,P,K,S recommendation	0.21 b	21.09 b	1.12 b
½ Compost + ¾ dose of N,P,K,S	0.20 b	29.21 c	1.23 bc
Compost + ¾ dose of N,P,K,S	0.27 bc	30.24 c	1.53 d
1½ Compost + ¾ dose of N,P,K,S	0.34 c	21.32 b	1.50 cd
Compost + N, P, K, S	0.35 c	30.12 c	1.33 bcd

Note: The number there followed the same letters not importantly different based on DMRT multiple distance test of 5% signficance level

The nutrient P is one of the most important macronutrients required by shallot plants. Phosphorus defined an enzyme's element, protein, RNA, ATP, DNA, and also phytin, all of that plays key roles at photosynthesis, the sugar and starch's consumption also the transfer of energi therefore the other nutrient never change or replace the plants' function. [26]. According to the data in Table 3, the highest available P content is compost treatment + ¾ doses of N, P, K, S, which is 30.24 mg kg^{-1}. Plants require P nutrients for the formation and development of roots at the transporting the nutrient and water's mechanism, so if water and nutrients are sufficient for plants, the plant metabolic process will run smoothly, particularly during the formation of carbohydrates during the process of cell division and enlargement [27].

Among the treatments, the compost treatment + 3/4 dosages of N, P, K, S had the greatest K-dd content, 1.53 me 100 g^{-1}. The K element in shallot plants helps to promote photosynthesis, spur early plant growth, strengthen stems, slow decay, raise disease resistance, produce greater bulb yields, and improve the quality and shelf life of shallot bulbs [28]. K increases the activity of numerous growth enzymes, which has a direct effect on metabolic processes in carbohydrate production, such as starch generation, breakdown, and translocation [29]. The high availability of K in the treatment of compost plus dosages of the four fertilizers demonstrating the result bulbs number and the weight, both fresh and dry of weight storing the bulbs were the greatest among other treatments. According to Dwidjoseputro [30], one of the byproducts of photosynthesis is fructants, which are required for bulb production.

3.6 Soil total S

The statistical analyses demonstrated that utilizing water hyacinth compost and N,P,K,S fertilizers has a noticeable impact on the overall sulfur levels in the soil (Table 4). The incorporation of both is effective in augmenting the soil's total sulfur content. Both of them contribute sulfur to the soil, causing a rise in sulfur levels. The S form of the SO_4^{2-} anion is negatively charged, and it travels quickly with water in soil solutions, making it easier to wash [31]. Sulfur supplied to the soil through fertilizers will not simply wash away if combined with organic fertilizers. The amount and quality of organic matter in binding soil particles determines the capability of soil to supply nutrients [31]. Organic material will accumulate sulfur in humus, which will eventually serve as a source of S for plants [32]. Mineralized organic matter will continuously supply N, P, K, and S to plants [33].

Table 4. Effect of Water Hyacinth Compost and N,P,K,S Fertilizers on Soil total S

Treatment	Total S (mg kg^{-1})
Control	50.50 a
N,P,K,S recommendation	153.44 c
¾ N,P,K,S recommendation	113.49 b
½ Compost + ¾ dose of N,P,K,S	172.04 d
Compost + ¾ dose of N,P,K,S	181.54 d
1½ Compost + ¾ dose of N,P,K,S	156.79 c
Compost + N,P,K,S	176.11 d

SNote: The number there followed the same letters not importantly different based on DMRT multiple distance test of 5% signficance level.

The S concentration of the water hyacinth compost used as treatment is 990 mg kg^{-1}, which is high enough to provide Sulfur by the breakdown mechanism of the organic matter, increasing the total S content of the soil. Both of them resulted in the most high yield and an important rise in sulfur, with a total S soil content of 181.54 mg kg^{-1}, while the control treatment resulted in the smallest/lowest sum of S soil content of 50.50 mgkg. These occurs cause of the unexisted addition of both fertilizers and compost to the soil, resulting in very low sulfur levels. Water hyacinth bokashi, according to Sofyan [34], is a great organic material that benefits from the sulfur element.

The treatment of various doses of both of them resulted in a substantial increase in total S soil when ½ dose of water hyacinth compost was given. The larger the dose, however, did not correspond to a higher total S soil level. The treatment of 1 ½ compost + ¾ doses of N,P,K,S produced result which is not different by statistically different from the directed N, P, K, S treatment, with total S contents of 156.79 mg kg^{-1} and 153.44 mg kg^{-1}, respectively. This is due to Sulfur immobilization caused by organic matter, as shown by the rising usage of water hyacinth compost, which does not raise total S soil concentration but is higher than other compost doses [34]. The uptake of inorganic S from the soil by microbes to create its body is known as sulfur immobilization, and the higher the organic matter, the greater the sulfur immobilization [35].

Table 4 shows that the treatment of various doses of water hyacinth compost (1/2 compost + ¾ dose N,P,K,S compost + ¾ dose N,P,K,S; compost + N,P,K,S) to total S soil was not statistically different. The total S content in these treatments was 172.04 mg kg^{-1}, 181.54 mg kg^{-1}, and 176.11 mg kg^{-1}, respectively. This is due to microbes using Sulfur as an energy source to degrade organic materials and plants absorbing Sulfur [34].

3.7 Number of Bulb

The statistical test result proved about the implementation from both of them significantly affected the number of shallot bulbs (Table 5). The treatment lacking both has the low average number of bulbs, namely four. This occurs when the plant's nutrient requirements are not met, preventing growth and development. Shallot grown without Sulfur fertilizer generally exhibits stunted growth and a small number of bulbs [16]. Among the other treatments, the compost treatment + ¾ dosages of N, P, K, S had the highest average number of bulbs, namely 9. The application of sulfur in water hyacinth and N, P, K, S fertilizers increased bulb size, total bulbs, and the aroma of shallot bulbs [36]. Sulfur influences several metabolic processes in the plant body, either directly or indirectly [37]. The sulfur's existence namely the quantity of shallots, is highly connected to the size and number of bulbs produced, according to Halifah et al. [36].

Table 5. Effect of Water Hyacinth Compost and N, P, K, S Fertilizers on Number of Bulb

Treatment	Total Bulbs
Control	4 a
N,P,K,S recommendation	8 b
¾ N,P,K,S recommendation	9 bc
½ Compostim + ¾ dose of N,P,K,S	9 bc
Compost + ¾ dose of N, P, K, S	10 c
1½ Compost + ¾ dose of N, P, K, S	9 bc
Compost + N, P, K, S	9 bc

Note: The number there followed the same letters not importantly different based on DMRT multiple distance test of 5% signficance level

After the control treatment, which had an average number of bulbs of 8, the treatment utilizing simply fertilizer N, P, K, S recommendations produced the lowest results. This is cause of the existence of sulfur at soil is lower here than in treatment with water hyacinth compost, and it will produce on shallot nutrient. The system' from water hyacinth compost the nutrients [38]. A balances structure ransomly supply will result in good bulb yields on shallot plants [39]. Because the dose is regarded excessive, treatment N,P,K,S recommendations resulted in an average number of bulbs lower than treatment ¾ N,P,K,S recommendations, namely 8. According to Irianto et al. [16], excessive Sulfur doses will impede the growth of shallot plants, resulting in a drop in production. Excess sulfur will acidify the soil and harm plants by binding other nutrients, making it difficult for plants to absorb.

3.8 Diameter of Bulb

The statistical test results proved about the implementation of both fertilizers and compost did not signficantly affect the diameter of the shallot bulbs. This is due to the huge size of the Batu Ijo variety seeds utilized as planting material. The massive diameter of shallot seed bulbs provides a substantial amount of food reserves required for after growth and development in the field [40]. Because heavier seeds with a big number of food stores produce more energy during the germination process, this impacts the amount of production and the rate of growth of seedlings [41].

The control treatment had the highest bulb diameter of 2.78 cm, followed by both of their treatments. Based on this, it can be linked to the number of bulbs manufactured; the more bulbs produced, the smaller the bulb diameter, and vice versa. The application of fertilizers containing the element N can increase plant vegetative production, affecting the quantity of shallot bulbs. The photosynthate produced by photosynthesis is divided into a number of bulbs formed as the number of bulbs increases. If only a few bulbs emerge, each bulb absorbs more photosynthate and has a larger diameter [42].

Table 6. Effect of Water Hyacinth Compost and N, P, K, S Fertilizers on Diameter of Bulb

Treatment	Diameter of Bulb (cm)
Control	2.78 a
N,P,K,S recommendation	2.22 a
¾ N,P,K,S recommendation	2.32 a
½ Compost + ¾ dose of N,P,K,S	2.30 a
Compost + ¾ dose of N,P,K,S	2.38 a
1½ Compost + ¾ dose of N,P,K,S	2.18 a
Compost + N, P, K, S	2.46 a

Note: The followed numbers the same letters not importantly different based on DMRT multiple distance test of 5% signficance level

The bulb width was bigger in the treatment from the 1/2 compost + 3/4 doses from the four fertilizers than in the treatment of 3/4 doses N,P,K,S + 1 ½ compost namely 2,30 cm and 2,18 cm. This occurs because the nutrient content of 3/4 doses N,P,K,S and 1/2 compost is sufficient for the growth and development of shallot bulbs that are balanced with water hyacinth compost. According to SNI 01-3159-1992 shallot quality requirements, the diameter of shallots of Batu Ijo variety is included in Quality I, namely a minimum bulb diameter of 1.7 cm.

4 Conclusions

1. The treatmenti of water hyacinth compost and N,P,K,S fertilizers on Inceptisols impacted the soil nutrient content and quantity (number of bulb) of shallots (*Allium Ascalonicum* L.).
2. Compost treatment combined with ¾ dosages of N, P, K, S had the greatest effect on raising soil nutrient content and quantity (number of bulb) of shallots (*Allium ascalonicum* L.) on Inceptisols.

References

1. S. Hardjowigeno, S. *Ilmu Tanah* (Akademika Pressindo, Jakarta, 2010)
2. D. W. Elisabeth, M. Santoso, and N. Herlina, Jurnal Produksi Tanaman **1(3)** (2013)
3. F. L. Sahwan, Jurnal Teknologi Lingkungan **11(1)**, 79-85 (2016)
4. U. S. Setyastika and R. Suntari, Jurnal Tanah dan Sumberdaya Lahan **6(2)**, 1291-1299 (2019)
5. H. Halimursyadah and S. Syamsuddin, J. Ilmiah Mahasiswa Pertanian Unsyiah **Vol. 1(1)** (2016)
6. E. Efendi, D. W. Purba and N. U. Nasution, J. Penelitian BERNAS **Vol.13(3)** (2017)
7. Y. T. Wati, E. E. Nurlaelih and M. Santoso, Jurnal Produksi Tanaman **2(8)** (2015)
8. Badan Pusat Statistik [BPS], bps.go.id (2018)
9. Kementrian Perdagangan, kemendag.go.id (2016)
10. A. Rahmah, R. Sipayung and T. Simanungkalit, Jurnal Online Agroteknologi **1(4)**, 2337–6597 (2013)
11. N. Afrilliana, Skripsi, Program Studi Agroteknologi, Fakultas Peternakan dan Pertanian. Universitas Diponegoro (2017)

12. D. Farastuti and V. Henuhili, Biologi-S1 **7(6)**, 429-440 (2018)
13. M. Mahdiannoor, N. Istiqomah and S. Syarifudin, Jurnal Ziraa'ah **Vol. 41 no. 1**, 1-10 (2016)
14. O. Mulyani, Y. Machfud, A. Setiawan, B. Joy, IOP Conf. Series: *Earth and Environmental Siences* **Vol. 393 No. 1** (2019)
15. F. Fatmawati, Y. E. Susilowati, and H. Historiawati, Vigor: Jurnal Ilmu Pertanian Tropika Dan Subtropika *(Journal of Tropical and Subtropical Agricultural Sciences)* **3(2)**, 40-42 (2018)
16. Irianto, Yakup, M. U. Harun, and Susilawati, Prosiding Seminar Nasional Lahan Suboptimal, Fakultas Pertanian, Universitas Brawijaya (2016)
17. M. H. Hamed, M. A. Desoky, A.M. Ghallab, and M.A. Faragallah, International Journal of Technology Enhancements and Emerging Engineering Research **Vol.2 (6)**, 2347-4289 (2014)
18. M. Scnitzer, Soil Science **151 (1)**, p 41-58 (1991)
19. C. Bayer, L. Martin-Neto, J. Mielniczuk, C. N. Pillon, and L. J. S. S. Sangoi, Soil Sci. Soc. Am. J. **65**, 1473-1478 (2001)
20. H. Wijayanti, Skripsi, Fakultas Pertanian Jurusan Tanah Program Studi Ilmu Tanah, Universitas Brawijaya (2008)
21. S. N. Utami and S. Handayani, Soil and Tillage Research **10 (2)**, 63-69 (2003)
22. O. Mulyani, B. Joy, D. Kurnia, Applied Sciences **12 (11)**, 5763 (2022)
23. O. Mulyani, B. Joy, D. Kurnia, Journal of Ecological Engineering **22 (5)**, 191-204 (2021)
24. Bakri, Agrista Volume **5 No. 2**, 114 -119 (2001)
25. W. Hartatik and J. S. Adiningsih, Prosiding Seminar Nasional Inovasi Teknologi Sumberdaya Tanah dan Iklim 14-15 (2003)
26. N. Sumarni, R. Rosliani, and R. S. Basuki, Jurnal Hortikultura **Vol. 22 No. 4**, 366-375 (2016)
27. H. S. Hendrawan, E. Arnis, and Isnaini, Jurnal Online Mahasiswa (JOM) Bidang Pertanian **Vol. 5**, 1-11 (2018)
28. N. Gunadi, J. Hort **19 (2)**, 175-175 (2009)
29. K. A. Hanafiah, *Dasar-Dasar Ilmu Tanah* (Grafindo Persada, Jakarta, 2010)
30. D. Dwidjoseputro, *Pengantar Fisiologi Tumbuhan*, Cet. 11 (Gramedia Pustaka Utama, Jakarta, 1990)
31. V. Anggraini, Skirpsi, Fakultas Pertanian, Universitas Sebelas Maret (2011)
32. M. Anisimova, S. Haneklaus, and E. Schnug, Sulfur Nutrition and Sulfur Assimilation in Higher Plants, pp. 239-244 (2000)
33. D. Foth, *Dasar-Dasar Ilmu Tanah* (Gajah Mada University Press, Yogyakarta, 1991)
34. E. T. Sofyan, Agrifor **13(2)**, 165-174 (2014)
35. N. Danapriatna, Paradigma **9(1)**, 39-52 (2008)
36. U. N. Halifah, R. Soelistyono, and M. Santoso, J. Produksi Tanaman **Vol. 2(8)**, 665-672 (2015)
37. M. V. Sriramachandrasekharan, Jurnal Comunications In Biometry and Crop Science **7(1)**, 35-40 (2013)
38. D. N. K. T. Hermanto, N. K. Dharmayani, R. Kurnianingsih, and S. R. Kamali, Ilmu Pertanian (Agricultural Science) **16(2),** 28-41 (2013)
39. D. Shiferaw, N. Dechassa, K. Woldetsadik, G. Tabor, and J. J. Sci. Technol. Arts Res. J. **4(2)**, 10-22 (2015)
40. A. Setiawan, R. Sipayung, and T. Simanungkalit, J. *Online Agroekoteknologi* **3(1)**, 340-349 (2015)
41. S. Sadjad, *Parameter Pengujian Vigor Benih* (PT. Gramedia, Jakarta, 1999)
42. M. A. Farooqui, I. S. Naruka, S. S. Rathore, P. P. Singh, and R. P. S. Shaktawat, Asian Journal of Food and Agro-Industry **2** (Special Issue) (2009)