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The Effect of Bulb Seed Diameters and KCl Fertilizer Dosage on Growth and Productivity of Bima Varieties of Shallot (*Allium ascalonicum* L.)

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***Abstract*—Shallot is one of valuable horticulture commodities that planted almost in Indonesia. One of the advantages in shallot cultivation is decreasing of shallot productivity although fertilizer was given in shallot cultivation. The purpose of this research was to determine the effect of diameter of bulb shallot (bulb size) and KCL fertilizer dosage on growth and productivity of shallot Bima cultivars. This research was conducted in Mei to July 2019 at Widasari district, Indramayu regency, West Java. Randomized block design with two factors, diameter of shallot bulbs and KCL fertilizer dosage was used to arrange the treatment in field. The result showed that the utilization of large seed bulb of shallot has highest number in growth and yield response including plant height, number of leaves, number of tiller, wet and dry yield bulb.**

Keywords: bulb, fertilizer, shallot

I. INTRODUCTION

Shallot is one of the leading vegetable commodities that has been cultivated by farmers for a long time ago. The number of shallots growers in Indonesia is increasing along with high public interest in this commodity. The projected need for shallots in Indonesia until 2025 continues to increase because it has high economic value in terms of meeting national consumption and farmers' income sources. This commodity is also a source of income and employment opportunities that contribute quite high to the regional economic development. The development of shallot production increasing from 2015 until 2018. In 2015 shallot production in west java is 129.148 tons and increasing to 167.769 tons in 2018 [1].

Some effort to increasing the productivity of shallot was done by almost farmers, such using good quality of shallot seeds and fertilizers both organic or an organic fertilizer. In Indonesia, the supply of shallot seeds insufficient for farmers needed, because almost farmers using seeds by propagations itself, uncertified seeds and low productivities [2]. The utilization of various bulb size influence to shallot productivity. To increasing the productivities of shallot almost farmers must use good quality of shallot seeds, such using health seeds, have optimal size of bulb and has broken seedling dormancy period [3]. Based on the size, shallot bulb can be determining into three groups, large bulbs (Ø ≥ 1.8 cm or> 10 g), medium bulbs (Ø = 1.5–1.8 cm or 5–10 g), and small bulbs (Ø ≤1.5 cm or <5 g) [4]. Other classified show two shallot bulb size, consist of first class, 2.5-5.0 gram/bulb and second class 5.0-7.5 gram//bulb [5]. The first of growth process of plant largely determine by weight of seed and the buds that located at base of the bulb layer [6]. The large seed bulb size has more food reserves to support growth of shallot in field [7]. Medium size of bulb utilizations produce the highest values for the parameters of wet weight per hill, dry weight per hill and per bulb [3].

Other factor that influence to shallot productivity is utilization of fertilizer. Shallot need sufficient nutrient to support their growth. Essential nutrient such nitrogen, phosphorous, and potassium have important role to shallot plant metabolism. Potassium is a macro nutrient that is important for the growth and development of shallots. Potassium fertilizer plays a role in protein and carbohydrate synthesis and increases photosynthetic translocation to all parts of the plant [8]. In addition, potassium can maintain cell turgor pressure and water content in plants, increase plant resistance to disease and drought and improve crop yield and quality. Furthermore, the growth of shallots increases gradually with the increasing amount of K fertilizer [9]. The applying potassium fertilizer with dose of 175 kg ha^{-1} can increasing the plant height, number of leaves, bulb diameter, dry weight of yield bulb and maximum yield [10]. The purpose of this research Was to know the effect of various of diameter seed bulls of shallot and dosage of KCl fertilizer to growth and yield response of shallot

II. METHODS

This research was conducted in Indramayu district West Java in Mei to July 2019. Randomized block design, two factors and repeated three times was arranging in field. First factor is various of bulb size/diameter with three level consist of U_1: 1,3 – 1,4 cm, U_2: 1,6 – 1,8 cm, and U_3: 2,0 – 2,2 cm. Second factor is KCl fertilizer dosage with three levels, consist of K_1: 50 kg K_2O ha^{-1} or 94 kg KCl, K_2: 100 kg K_2O ha^{-1} or 188 kg KCl, and K_3: 150 kg K_2O ha^{-1} or 282 kg KCl.

Growth of plant in vegetative period and yield bulb was measured in this research. The parameter of plant growth including plant height, number of leaves, and number of tiller were measured in 21, 28, 35, and 42 days after planting (DAP). While yield response including wet and dry yield bulb were measured after harvest.

III. Results and Discussion

A. Growth Response

1) Plant Height (cm): Growth response of plant height at the age of 21, 28, 35 dan 42 days after planting (DAP) presented in Tabel 1.

TABLE I. PLANT HEIGHT AT 21, 28, 35 AND 42 DAP

Treatments	Plants Height (cm)			
	21 DAP	***28 DAP***	***35 DAP***	***42 DAP***
Tuber Size (U) :				
U_1	25,478 a	28,356 a	34,633 a	38,856 a
U_2	26,133 a	27,756 a	31,178 a	37,198 a
U_3	**28,933 b**	**31,356 b**	36,267 a	41,011 a
KCl Fertilizer Dosage (K)				
K_1	26,411 a	28,633 a	32,911 a	38,649 a
K_2	27,311 a	29,711 a	35,556 a	40,349 a
K_3	26,822 a	29,122 a	33,611 a	38,067 a

Note: The average number followed by the same letter in the same column is not significantly different according to the Least Significant Difference Test (LSD) at the 5% level.

Table 1 showed that various of bulb size treatment significantly affected to plant height in 21 and 28 DAP, but not affected significantly in 35 and 42 DAP. Both 21 and 28 DAP the utilization of large seed bulb (U_3) has highest plant height than others treatment. The large seed bulb has more food reserves in their bulb. This food reserves can have used as food source when nutrient uptake does not optimally. In 35 and 42 DAP the utilization of various seed bulb not significantly affected to plant height. Its suggested cause in 35 DAP shallot plat in generative stage, so in this stage shallot plant focus to shape and enlarge of bulb.

2) Number of leaves: Leave is important organ of plant that have function as photosynthetic happened. The amount of leave influenced by nutrient status in soil and plants. Analysis statistical result of treathment to number of leaves showed in Table 2.

TABLE II. NUMBER OF LEAVES PER CLUMP AT 21, 28, 35 AND 42 DAP

Treatments	Number of Leaves			
	21 DAP	***28 DAP***	***35 DAP***	***42 DAP***
Tuber Size (U) :				
U_1	11,222 a	16,622 a	23,767 a	25,415 a
U_2	14,022 b	17,444 a	22,311 a	24,967 a
U_3	**19,111 c**	**25,756 b**	**33,133 b**	**33,800 b**
KCl Fertilizer Dosage (K)				
K_1	15,067 a	19,778 a	27,111 a	27,061 a
K_2	15,044 a	21,422 a	27,089 a	30,378 a
K_3	14,244 a	18,622 a	25,011 a	26,742 a

Note: The average number followed by the same letter in the same column is not significantly different according to the Least Significant Difference Test (LSD) at the 5% level.

Table 2 showed that number of leaves affected significantly by bulb size but not affected by KCl fertilizer. The utilization of bulb in large size have highest number of leaves than medium and small size of bulb. In 21 days after planting (DAP) U_3 treatment had the highest number of leaves (19.111) than U_1 (11.222) and U2 (14.022) and those value added constantly until 42 DAP. Seed bulb with large size have more food reserves that can support plant growth and to build new organs of plant. In line with Lana, the utilization of medium bulb has vegetative growth better than bulb in small size [6].

Table 2 showed that added of potassium fertilizer (KCl) not affected significantly to number of leaves. Potassium nutrient does not absorb optimally by plant dan the growth of plant especially leaves caused by nitrogen nutrient. In line with research by Sitompul et al. showed that application of potassium fertilizer (KCl) with dosage 0 until 400 kg ha^{-1} not affected to shallot number of leaves [11]. It's because nutrient status of potassium di soil is very high, so the added of KCl not affected to plant growth.

3) Number of tillers: Statistical analysis result of the effect utilization various bulb size and KCl fertilizer showed in Table 3. Based on Table 3 the amount of tiller independently affected by bulb size of seed shallot but not significantly affected by KCl fertilizer dosage.

In 21 days after planting (DAP) plant that used large bulb size (U_3) has highest number of tillers (4.822) than U_1 and U2 treatment. Those value added consistently until the end of period analysis (42 DAP). Number of tiller in U_1 treatment in tend has highest value and its line with other growth parameters. Plant with more number of leaves have more chance to do the photosynthetic process, so it affected to increasing number of tillers because there is an adequate assimilate to build plant organs. Amount of leaves and tillers also affected to numbers of bulbs, plants with highest number of leaves and number of tillers also have highest number of bulb [12].

TABLE III. AVERAGE NUMBER OF TILLERS

Treatments	Number of Tiller			
	21 DAP	***28 DAP***	***35 DAP***	***42 DAP***
Tuber Size (U) :				
U_1	3,178 a	3,667 a	3,878 a	4,067 a
U_2	3,556 a	4,111 a	4,333 a	4,594 a
U_3	**4,822 b**	**5,800 b**	**6,200 b**	**6,133 b**
KCl Fertilizer Dosage (K)				
K_1	3,911 a	4,556 a	4,911 a	4,944 a
K_2	3,844 a	4,533 a	4,867 a	4,978 a
K_3	3,800 a	4,489 a	4,633 a	4,872 a

Note: The average number followed by the same letter in the same column is not significantly different according to the Least Significant Difference Test (LSD) at the 5% level.

B. Yield Response

1) Wet and dry weight yield bulb: Analysis statistical the effect of treathment to wet and dry bulb yield showed in Table 4. Table 4 showed that there is no interaction between various bulb size dan KCl fertilizer to wet dan dry bulb yield of

shallot. Various of bulb size independently affected to wet and dry bulb yield, but not with KCl fertilizer dosage.

TABLE IV. EFFECT OF BULB SIZE AND DOSAGE OF KCL FERTILIZER TO WET AND DRY WEIGHT YIELD BULB CLUMP^{-1} AND PLOT^{-1}

Treatments	Wet Weight of Yield Bulb		Dry Weight of Yield Bulb	
	Clump^{-1} (gr)	*Plot^{-1} (kg)*	*Clump^{-1} (gr)*	*Plot^{-1}(kg)*
Bulb Size (U) :				
U_1	51,476 ab	3,895 a	32,332 a	2,503 a
U_2	43,313 a	3,927 a	29,523 a	2,478 a
U_3	**60,221 b**	**5,352 b**	**41,843 b**	**3,479 b**
KCl Fertilizer Dosage (K)				
K_1	44,263 a	4,123 a	30,169 a	2,626 a
K_2	53,500 a	4,631 a	36,795 a	2,867 a
K_3	57,247 a	4,419 a	36,734 a	2,967 a

Note: The average number followed by the same letter in the same column is not significantly different according to the Least Significant Difference Test (LSD) at the 5% level.

Plant production is biomass that build by plant in period of their life. In generally, plant biomass comes from nutrient and water uptake that is processed through photosynthetic. Plant biomass measured through wet and dry weight of plant is better indicator to know the nutrient uptake that used for plant growth [13].

Based on Table 4, wet and dry yield bulb increasing if used seed in large size. U_3 treatment had wet dry of yield bulb as 5352 kg plot^{-1} and dry yield bulb as 3479 kg plot^{-1}. U_1 treatment had lowest weight of bulb yield than others treatment. Treatment that used small size of bulb had wet yield bulb as 3895 kg plot^{-1}and dry yield bulb as 2503 kg plot^{-1}.

In line with plant growth parameters such plant height, number of leaves and number of tillers, there is significantly differences as the result of various bulb size to wet and dry yield bulb. Bulb with large size have more food reserves. The composition of bulb shallot is carbohydrate [14]. Carbohydrate is main source for the growth of seed bulbs in the next growing period.

The analysis in Table 4 showed that KCl fertilizer not affected significantly to wet and dry yield bulb. The effect of KCl fertilizer not suspected because the experiment land has high potassium content. It can be as residue that comes from shallot cultivation in the past. One of potassium problem is potassium uptake by plant or potassium characteristics that are easily lost. If soil has high potassium, the plants tend to absorb more potassium than is needed, but not increasing production. This condition called with luxury consumption [15].

Besides that, potassium is essential nutrient that has characteristic such mobile in soil and plant and easily lost so the potassium uptake by plant not optimally. This condition causes the application of KCl fertilization does not affect to increasing plant productions.

IV. CONCLUSION

The utilization of seed bulb in large size/diameter can increasing of growth and yield response of shallot, so it can be increasing of shallot productivity. The uptake of potassium nutrient by plants influenced by nutrient status in soil. Plant does not response to KCl fertilizer when potassium nutrient status in soil very high.

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