Applications of NPK Phonska and KCl Fertilizer for the Growth and Yield of Shallots (Allium Ascalonicum) in Serang, Banten

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Abstract

Shallots is one commodity that has been developed in Serang Banten. Productivity of shallots produced by farmers is still low because farmers have not given fertilizer N, P and K impartial. Shallots need availability nutrient of nitrogen (N), phosphorus (P) and potassium (K) in sufficient quantities and balanced on the ground to be able to grow and produce optimally. NPK Phonska and KCl fertilizer properly can increase the growth and yield of shallots. This study aims to determine the growth and yield for application of NPK Phonska and KCl fertilizers. The experiments were conducted in farmers' fields in the district Kramatwatu, Serang, Banten from December 2013 to February 2014. The treatment were four levels of NPK Phonska fertilizer (0, 200, 250 and 300 kg/ha) and KCl (0,50,100 and 150 kg/ha). The experiment was arranged in a factorial randomized block design with four replications. Shallots variety used was Bima. Basic fertilizers used were Petroganic fertilizer with a dose of 5 t/ha and SP-36 as much as 200 kg/ha. The plots size 1.5 x 1.5 m and planting distance of 25 x 25 cm. The study showed that there interaction between NPK Phonska and KCl fertilizers on growth and yield of shallots. Application of NPK Phonska fertilizer of 300 kg/ha and 100 kg KCl/ha gave the best growth and yield shallots of plant height of 47.01 cm, number of leaves 43.55 sheet, tiller number 11.56 per cluster, the weight of the wet bulb 66.78 g per cluster, weight of dry bulb per plot of 2.4 kg/2.25 m^2 (equivalent to 10.66 t/ha). NPK Phonska fertilizer application of 300 kg/ha and KCl fertilizer 100 kg/ha can increase the growth and yield, as well as economically feasible was ratio B/C of 1.01. Implementation of the fertilizer can be recommended to the farmers in Serang Banten.

Keywords: Allium ascalonicum, KCl, NPK Phonska, yield

1. Introduction

Data of Banten Province Statistics Institute (2012) show shallots production continues to decline from year to year. Shallots production in 2010 was 7.859 t/ha decreased to 5.084 t/ha in 2011, while the shallots yield potential can reach 12 t/ha. The low level of productivity of shallots in Serang Banten are due fertilizer inputs of N, P and K are not balanced, so the availability of plant nutrients shallots are not fulfilled, eventually growth and yield (production) is not optimal.

Fertilization is one of the determining factors in an effort to increase crop yields. To be able to grow and to produce optimally, shallots plants need fertilizer of nitrogen (N), phosphorus (P) and potassium (K) in the amount of sufficient and balanced. Nutrient of N, P and K are the primary macro nutrients required by shallots in considerable amounts, whereas the nutrient availability in the soil are generally low.

In general, application of N, P and K fertilizer can increase the growth and tuber yield of shallots (Sigh et al. 2000). K fertilizer can increase the vegetative growth of shallots (Vidigal et al. 2002). K nutrients are needed plant in many physiological functions of plants and reduce plant disease and improved quality of certain crops of shallots (Gunadi et al. 2009). Phosphorus is one of the essential nutrients that plants need for optimum growth and yield.

Potassium plays an important role as an activator of several enzymes important in the metabolism of plants and maintaining the cell turgor (Kelvin and Rosliani 2004, Asandhi et al. 2005). Nutrients N directly involved in the formation of amino acids, nucleic acid enzymes, and nucleoprotein (He et al. 2004).

Dose of N, P and K fertilizer are given in shallots cultivation is still very diverse, depending on the variety and location of cropping. The diversity of the land and the environment as well as varieties of shallots are planted cause needs of nutrients N, P and K are different. Several studies report that the input of N, P and K for Kuning shallot crop varieties can be sourced from the application of fertilizer: urea 250 kg/ha+TSP/SP-36 300 kg/ha, KCl 100-200 kg/ha (Sumiati and Gunawan 2007; Sumarni et al. 2008; Napitupulu and Winarto 2010; Sumarni et al. 2012). Requirement of N, P, K specific location for Bima shallot crop varieties need to be studied. Generally farmers in Serang Banten not know the needs of fertilizer N, P and K in shallots cultivation. Fertilizer is rarely given because it is difficult to obtain. For the input of N, P and K, farmers give fertilizer of NPK Phonska 200 kg/ha or SP-36 fertilizer 250 kg/ha without KCl because the price of KCI is quite expensive. Allegedly fertilizer N, P and K are given by farmers still less, so it can not increase plant growth and tuber yield of shallot. In order for growth and tuber yield of shallots plants it is necessary to input the optimal N, P and K fertilizer sourced from NPK Phonska and KCl fertilizer. For a review of the application of NPK Phonska and KCl fertilizer for shallots cultivation. This paper aims to determine the growth and bulb yield for application of NPK Phonska and KCl to Bima shallots varieties.

2. Materials and Methods

This study was conducted in farmers' fields Toyomerto village, district Kramatwatu Serang, Banten from December 2013 to February 2014, shallots varieties that be used is Bima. Given basic fertilizer is petroganic 5 tons/ha and SP-36 200 kg/ha was given one week before planting by mixing into the soil. Experiments using a randomized block design (RAK) arranged in factorial consisting of 2 factors. The first factor NPK Phonska fertilizer consisting of 4 levels and the second was KCl which consists of 4 levels, each treatment is repeated each 4 times. Plot size of 1.5 m x 1.5 m with planting distance of 25 x 25 cm. Weeding was done manually plants adapted to the circumstances of weed, while control of pest and disease were done by the observations every day.

Arrangement of treatments that be used were as follows: The first factor was the dose of NPK Phonska: A0: Control (without fertilizer NPK Phonska and KCl), A1: 200 kg/ha of NPK Phonska, A2: 250 kg/ha of NPK Phonska, A3: 300 kg/ha of NPK Phonska. The second factor was the dose of KCl: K0: without KCl, K1: 50 kg/ha of KCl, K2: 100 kg/ha of KCl, K3: 150 kg/ha of KCl. Variables of shallots growth were observed at age 42 HST was plant height, number of tillers per cluster, number of leaves. The samples used for plant height, number of tubers per cluster, number of leaves per cluster, were done by taking plants as many as five crops each plot at random and then leveled. Variable shallot yield was conducted on harvest age of 55 days is weight of wet bulb per cluster, weight of dry bulb per plot (production consumption). The data were analyzed by F-test, whereas between treatments were tested by Duncan's multiple test at the 5% significance level. To see whether the use of NPK Phonska and KCl profitable, then were carried out farming analysis of the application treatment of NPK Phonska and KCl fertilizer which the best of growth and yield of shallots.

3. Results and Discussion

3.1 Growth

Growth response of plant height and number of leaf of shallots at the age of 42 DAP are presented in Table 1and Table 2.

Table 1: Plant Height at age 42 DAP

Treatments	Plants height at NPK Phonska fertilizer dosage (kg/ha)			
	0	200	250	300
KCl fertilizer Dosage (kg/ha)				
0	38.69a A	39.50a A	44.50a A	45.25a A
50	38.70a A	42.79b A	45.59 b A	45.67ab B
100	40.89b AB	43.42ab A	46.00 a AB	47.10b AB
150	41.89a	42.80a	46.56 a	46.31ab
KK (CV)= 5.6%	tn(ns)	n(s)	n(s)	n(s)

Note: KK (CV)= Coefficient of variation
n(s)= Significant, tn(ns) = non significant

Table 2: The Number of Leaves of the Onion Plant Bima Varieties Age 42 DAP

Treatments	Leafs number at, NPK Phonska fertilizer dosage (kg/ha)			
	0	200	250	300
KCl fertilizer Dosage (kg/ha)				
0	36.69 a A	40.50a A	41.50a A	40.25a A
50	36.34a A	40.54a A	40.78a A	41.78a A
100	39.89b AB	40.42a A	42.00a A	43.55b B
150	38.29b B	41.80a A	41.56a A	40.276a AB
KK(CV) =6.64%	n (s)	tn(ns)	tn(ns)	n(s)

Note: KK (CV)= Coefficient of variation
n(s)= Significant, tn(ns) = non significant

From Table 1 and Table 2 showed real interaction on NPK Phonska and KCl fertilizer on plant height and number of leaf per cluster. NPK Phonska of 300 kg/ha and 100 kg/ha of KCl gave the highest plant height, which is 47.01 cm and the highest number of leaves, ie 43.55 sheet, compared to other fertilizer treatments. NPK Phonska fertilizer of 300 kg/ha and 100 kg/ha of KCl fertilizer can be sufficient for nutrient N, P and K for shallots Bima varieties. Fertilizer N, P and K increase the height of shallots plants. Similar results were also reported by Kelvin and Rosliani (2004), Gunadi (2009) and Napitupulu and Winarno (2010). According Asandhi et al. (2005), nitrogen is a structural component of organic compounds such as enzymes, purine, pyrimidine which is needed for enlargement and cell division so that the provision of nitrogen can increase the vegetative growth of the plants. Phosphorus is a component of the enzyme, ATP proteins, RNA, DNA and phytin that have important functions in the processes of photosynthesis, the use of sugar and starch, and energy transfer (He et al. 2004). Supply sufficient phosphorus for plants can increase root growth, branches or saplings content (Singh 2000). Function of phosphorus in plant can promote the development leaves, improve the green leaves and the formation process of photosynthesis (Nasreen et al. 2007, Asandhi et al. 2005). Deficiency of P cause slow, weak and stunted plant growth and development while giving high doses of P fertilizer can cause the plants deficient micronutrients such as Fe and Zn, so that the growth of the plant and the leaves become stunted, and dead leaves (Sumarni et al. 2008, Sumarni et al. 2012). This condition occurs in shallots crops without fertilizer.

N of nutrient deficiencies can limit enlargement and cell division (Sumiati and Gunawan 2007) as well as the formation of chlorophyll, so that growth becomes stunted and yellowish leaves (Assad and Wanda 2010). Visually plants were not given fertilizer N appear shorter and the leaves are yellowish.

3.2 Yield

Analysis of variance showed interaction NPK Phonska and KCl significantly affected the bulb number per cluster (Table 3). Greatest of bulb seen on addition of KCl at a dose of 100 kg/ha. Bulb of shallots in growth was influenced by the dose of KCl. Gunadi (2009) states that K is very necessary nutrient in the formation, enlargement and elongation of the bulb. Furthermore Napitupulu and Winarto (2010) suggested that the addition of a dose of 125 kg/ha KCl provide an amount of Kuning varieties of shallots 11 tillers per cluster. While the Bima varieties in this experiment with 100 kg/ha of the dose of KCl produced the highest number of tiller is 11.52 tillers per cluster. KCl dose difference is due to different varieties planted. The number of tillers were produced by Bima 11.52 varieties in this trial approaching the maximum potential of the tuber Bima varieties namely 7-12 tillers per cluster (Azmi et al. 2011).

Table 3: Interaction of NPK Phonska and KCl Fertilizer to Bulb Number Per Cluster

Treatments	Bulb number per cluster NPK Phonska fertilizer dosage (kg/ha)			
	0	200	250	300
KCl fertilizer Dosage (kg/ha)				
0	7.89a A	7.57a A	7.34a A	7.78a A
50	8.70 a B	8.79a A	8.56a B	8.89a A
100	8.89a A	8.79a A	8.70 a A	11.56b B
150	8.91a A	8.79a AB	9.67c B	10.00ab B
KK(CV) =7.64%	tn(ns)	tn(ns)	tn(ns)	n(s)

Note: KK (CV)= Coefficient of variation
n(s)= Significant, tn(ns) = non significant

Treatment interaction of NPK Phonska and KCl fertilizer showed significant differences to the weight of wet bulb per cluster harvest (Table 4). The highest value obtained from the weight of wet bulb combination application treatment of NPK Phonska of 300 kg/ha and 100 kg/ha of KCl ie; 63.28 g/cluster and lowest without fertilizer treatment was 45.72 per cluster. NPK Phonska fertilizer of 300 kg/ha and 100 kg/ha of KCl can be suffice for nutrient N, P and K for Bima shallots crop varieties compared with other fertilizers. The lowest of weight of the wet bulb probability associated with a dose of NPK Phonska and KCl fertilizer are given little, so N, P and K are needed by shallots crop is insufficient, ultimately have an impact on weight of wet bulb low gain. Shortage of potassium in onion plants will inhibit the growth of leaf that photosynthesis process also becomes inhibited and resulted in the size of the resulting small bulb of shallots. He et al. (2004) stated that the balance of nutrients in the soil, especially K plays an important role in the synthesis of carbohydrates and protein, so it helps enlarge bulb of shallots.

Table 4: Interaction of NPK Phonska and KCl Fertilizer on the Bulb Weight of wet per Cluster at Harvest

Treatments	Fresh bulb weight NPK Phonska fertilizer dosage (kg/ha)			
	0	200	250	300
KCl fertilizer Dosage (kg/ha)				
0	45.72 a A	46.01a A	56.450a A	59.45a A
50	46.70 a B	47.79b A	59.59a B	65.59b B
100	47.89a B	60.42a AB	61.70b AB	73.28b B
150	53.89 a A	64.80c B	64.56b B	71.46b B
KK(CV) =8.64%	n(s)	n(s)	n(s)	(ns)

Note: KK (CV)= Coefficient of variation
n(s)= Significant, tn(ns) = non significant

The results of the bulb dry weight was significantly affected by the interaction between NPK Phonska and KCL fertilizers (Table 5). In Table 5 shows that the NPK Phonska fertilizer of 300 kg and 100 kg of KCl increase bulb yield varieties of Bima. Results shallots bulb on NPK Phosnka fertilizer of 300 kg/ha and 100 kg/ha KCl provide weight of dry bulb to the highest consumption, which is 2.4 kg/2.25 m^2 (equivalent to 10.66 t/ha) was higher than other fertilizers. Bulb yield of Bima varieties in this trial in accordance with the bulb yield potential of Bima varieties ie 10-12 t/ha (Kusmana et al. 2009, Sofiari et al. 2009). The high results obtained by application of NPK Phonska treatment of 300 kg/ha and 100 kg/ha of KCl because the balance content of N and K compared with other fertilizers. Sumarni et al. (2012) that expressing the nutrient balance in the soil plays an important role in the synthesis of carbohydrates and protein so that helps enlarge the shallot bulb, which ultimately gained maximum bulb production. Weight of dried bulb per plot on giving KCl of 100 kg/ha higher than the dose of KCl 150 kg/ha, due to the increased dose of KCl did not give significantly results an increase in dry bulb yield. Absorption of K by plants from the soil depends on several factors such as soil aeration, soil structure, shallots varieties, organic fertilizer. Giving dose of KCl 100 kg/ha is the optimum dose to increase the bulb yield of shallots Bima varieties as there are additional Petroganic fertilizer 5 tonnes/ha which can improve the availability of K in the soil. While Napitulu and Winarto (2010) reported that the optimum dose of KCl for Kuning of shallots varieties was 125 kg/ha and fertilizers manure dosage 15 t/ha.

The combination of NPK Phonska and KCl fertilizer can significantly increased bulb yield than the application of NPK Phonska and KCl given independent. This conditions showed that the cultivation of onions required combinations application of NPK Phonska and KCl fertilizer, as the supply of nutrients N, P and K for crops. The fulfillment of these nutrients can be met by providing a combination of fertilizer of NPK Phonska with KCl, so that can increase the bulb yield of shallots. Therefore, to obtain optimal bulb yield of shallots need N, P and K fertilizer in balance by providing application of 300 kg/ha of NPK Phonska fertilizer and 100 kg/ha of KCl fertilizer.

Table 5: Interaction of NPK and KCl Fertilizer to the Bulb dry Weight Per Plot at Consumption

Treatments	Bulb dry weight (kg/plot) NPK Phonska fertilizer dosage (kg/ha)			
	0	200	250	300
KCl fertilizer Dosage (kg/ha)				
0	1.58 a A	2.14a A	2.18b A	2.22a A
50	1.55 a A	2.20a A	2.32a B	2.25a B
100	2.00b A	2.15b AB	2.17b AB	2.40b B
150	1.89ab B	2.05ab B	2.25ab B	2.26a B
KK(CV) =6.74%	n(s)	n(s)	n(s)	(ns)

Note : KK (CV)= Coefficient of variation
n(s)= Significant, tn(ns) = non significant

Analysis of farming of the Bima onion varieties in the application treatment of NPK Phonska of 300 kg/ha and 100 kg/ha of KCl for 1 ha of land can be seen in Table 6. In Table 6 shows that for 1 ha of crop land Bima shallots varieties needed production costs Rp. 48.5 million, receiving Rp. 99 million with a profit of Rp. 50.44 million. Shallots farming application of NPK Phonska fertilizer of 300 kg/ha and 100 kg/ha of KCl fertilizer obtain the value of the ratio B/C at 1.01. Value of the ratio B/C is greater than one (B/C> 1) means the Bima varieties of shallots farming with application of NPK Phonska of 300 kg/ha and 100 kg/ha of KCl profitable. Ratio values of 1.01 mean in each Rp. 1 costs incurred able to give in return revenue of Rp 1.01, in other words the profit which is received from application of NPK Phonska fertilizer of 300 kg/ha and 100 kg/ha of KCl in the Bima varieties was Rp 10 of each Rp.100 costs incurred. Thus, application of NPK Phonska fertilizer of 300 kg/ha and 100 kg/ha of KCl technically produce bulb yield 10.66 t/ha and profitable business with a value of ratio B/C of 1.01 means that the fertilizer application deserves to be recommended to farmers.

Table 6: Financial Analysis of Bima Shallots Varieties Farming 2014 Serang Banten per ha

Detail	**Cost**
Shallots Seed 1000 kg	Rp. 20,000,000
Pesticide	Rp 2,000,000
300 kg NPK Phonska fertilizer	Rp 660,000
100 kg KCl fertilizer	Rp. 900,000
200 kg SP-36 fertilizer	Rp. 500,000
3000 kg Petroganic fertilizer	Rp. 1,500,000
Labor (tillaging until planting, fertilizing, weeding, spraying pesticide, harvesting)	Rp. 23,000,000
Total Cost	Rp. 48.560.000
Bulb yield	10,660 tons
Shallots prices	Rp 9.900/kg
Acceptance	Rp. 99,000,000
Benefit	Rp. 50.440.000
B/C ratio	1.04

4. Conclusions and Recommendations

1. Application of NPK Phonska and KCl fertilizer provide the best to the growth and bulb yield of shallots. Application of NPK Phonska fertilizer of 300 kg/ha and 100 kg/ha of KCl fertilizer in Bima shallots produce weight of dry bulb yiled was 2.4 kg/2.25 m^2 (equivalent to 10.66 t/ha).

2. Analysis of the Bima varieties of shallots farming using application of NPK Phonska fertilizer of 300 kg/ha and 100 kg/ha of KCl fertilizer advantageous because the value of the ratio B/C was 1.01.
3. Application of NPK Phonska 300 kg/ha and 100 kg/ha of KCl fertilizer could increase of productivity of shallots can be recommended to farmers.

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