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The Effect of Age, Form and Seed Cutting to the Growth and Production of Shallot (*Allium ascalonicum* L.) at Dry Lands with Low Altitude

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Abstract

The lack of shallot seeds stock requires the effective and efficient management of shallot seeds for cultivation. The objective of this study is to know the effect of age, form and cutting seed to the growth and production of shallot at dry land with low altitude. Treatment used in this experiment include Split- Split Plot Design with main factor seed age of 1 month (U1) and 2 months (U2); sub plot factor is intact seed form (B1), large form (B2), and small form (B3); and for sub-sub plot use cutting seed 25% (P1) and 50% (P2). The results on single factor for age of seed real has significant effect to plant height at the age of 35 DAP (Days After Planting) and 45 DAP, the number of shoots of 35 DAP and 45 DAP, number of dead plants 35 DAP. Seed form has significant effect to number of shoots at 45 HST. The cutting seed has significant effect to plant height, 35 DAP, death plants 35 DAP and 45 DAP. Interaction factor for seed age of two months and large form seed (U2B2) has significant effect to the production of 15.9 ton/ha. While the age factor of 1 month and cutting 50% (U1P2) has significant effect to death plant at 35 DAP up to 20.0%. The interaction between factors of age, form and cuts has no significant effect on all observed parameters.

Keywords: *Allium ascalonicum* L.; Dry season; Dry land

Introduction

In Indonesia, the cultivation of shallot (*Allium ascalonicum* L.) has been implemented throughout the province since it has been established as one of the seven strategic commodities by the government. In 2015, the production of shallot reached 1.29 million tons while domestic demand is 1.2 million tons and almost 14,100 tons have been exported to Thailand, Vietnam, Malaysia, and Singapore. The increase in exports, in 2015 reached 219% from 4,439 tons in 2014 (Directorate General of Horticulture, 2016). In 2016, this commodity that has been cultivated and developed simultaneously require seed up to 1,54,934 tons so that the existence of seeds ready to be planted should be considered [1].

The obstacles encountered by farmers for shallot development is the lack of planting time in accordance with period of fiscal budget and the availability of seeds ready for planting as well. Several procedures in the field to overcome seeds availability include accelerating seed that has not reached shelf life or break dormancy by cutting the seed tuber in half. In addition, seed saving and fulfillment of the scale of cultivation are performed by separation of shallot tuber into large sized and small-sized tubers.

The quality of seed tubers is one of several factors that determine the level of shallot production. The good tuber for the seedlings must come from mature plants with age of about 70-80 days after planting (DAP). The medium sized seeds are 5-10 grams or 1.5 to 1.8 cm in diameter. The seeds can be planted after stored 2-4 months after harvest, and the shoots have reached the end of tuber [2]. The optimum seed to use is tubers that have been saved 2.5-4 months, with minimum growing point at least 80%, in fresh condition, solid, no defect, and free of pests and diseases [3].

The efforts of propagation and seed saving is essential due to limited seed supply. One of several techniques that has been conducted is cleavage of tuber seed. However, this technique produces number of seed lower than without cleavage. According to Deviana et al. division of the tuber seed become two to four parts produce lower weight of dry tuber 62% and 36% respectively of the seed without cleavage [4].

According to Arifin et al. the cutting shallot tuber treatment can accelerate the emergence of shoots compared with no cutting [5]. The cutting of tuber into 2 parts can produce shoot earlier than cutting into 3 parts. This is consistent with research conducted by Boswell that the cutting of tuber near point of growing result in faster growth of shoots [6]. According Jumini et al. the cutting of shallot tuber significantly affects the number of tillers at the age of 30 HST, 45 HST, number of tuber and weight of wet tuber. Cutting a quarter tend to be better than cutting a third of the observed parameters above [7].

The objective of this study was to know the effect of age of seeds, seed shape and percentage cutting shallot seeds to the growth and production of shallot with variety of Super Philip at dry land with low altitude in Palangkaraya, Central Kalimantan province.

Materials and Methods

The research location was conducted at dry land with sandy clay loam soil texture in Banturung village, Bukit Batu district, city of Palangka Raya, Central Kalimantan Province. The coordinates of geographical position are S 02°00'11.5" and E 113°43'26.7" with altitude 40 m above sea level. The experiment was conducted during the long dry season, and in the middle age of the plant until harvest, the site location was covered by dense smog caused by fires forest and land. Shallot seed varieties used is blue labeled of Super Philip taken from Bima, West Nusa Tenggara. Planting activities were conducted on 20th July 2015 and harvested on 19th September 2015 or 61 DAP (days

after planting). The size of each unit within experimental plot is 2 m^2, planted in the form of beds with a height of 15 cm. Spacing used is 10 × 15 cm. Basic fertilizing was done a week before planting using chicken manure, 12.6 ton/ha with limestone material 127 kg/ha. Additional fertilizer was applied only once at the age of 15 HST using NPK 16:16:16 and SP 36 with dosage 636 kg/ha 636 kg/ha respectively. Weed control is done manually, through pulling up by hand at the age of 7 DAP, 15 DAP and 45 DAP. For seed treatment, it was mixed using fungicide with the active ingredient propineb 70% after the seed is cut a day before planting. Pest control (Plants Pest Organisms) using active insecticide methomyl 25%, once a week while for diseases control, especially for fungus, it used to use a fungicide active benomil 50%, mankozeb 80%, ziram 90% and propineb 70%, every two days alternately. The groundwater for daily supply water is prepared using pumping machine for twice, in the morning and afternoon until the plant age 30 DAP. At the age of 30-45 DAP, daily watering was conducted once, and watering frequency is reduced only 2-3 days at the age of 45-55 DAP.

The research design used Split-Split Plot design with three replications. For treatments, it consists of main plot: U1=the age of seed one month after harvest and U2=the age is two months after harvest. For the sub-plots, it uses tuber form; B1=intact seed form in which large and small tuber is not separated, B2=large seed form, B3=small seed form. The sub-sub plot involves P1=cutting seed 25% and P2=cutting seed 50%. Parameters observed include (1) plant height that is measured from the ground to the highest end of leaf at the age of 35 DAP and 45 DAP, (2) number of shoots, calculated based on the shoots of shallot that grows at the age of 35 DAP and 45 DAP, (3) percentage of death plants, measured by the sum of death plants, compared with total population per plot, (4) harvested dry weight, calculated based on the weight of wet harvest and dried in the sun for seven days and then converted into hectares with assuming land efficiency 70%. To distinguish the effect of treatment middle value, it used Duncan's Multiple Range Test (DMRT) with level of 5%.

Results and Discussion

Rainfall condition

The planting of shallot was conducted during the long dry season in 2015. The condition is naturally identified based on total rainfall during planting to harvest which has total precipitation 123.5 mm (Figure 1). The minimum rain water conditions are overcome by watering use ground water pumping system.

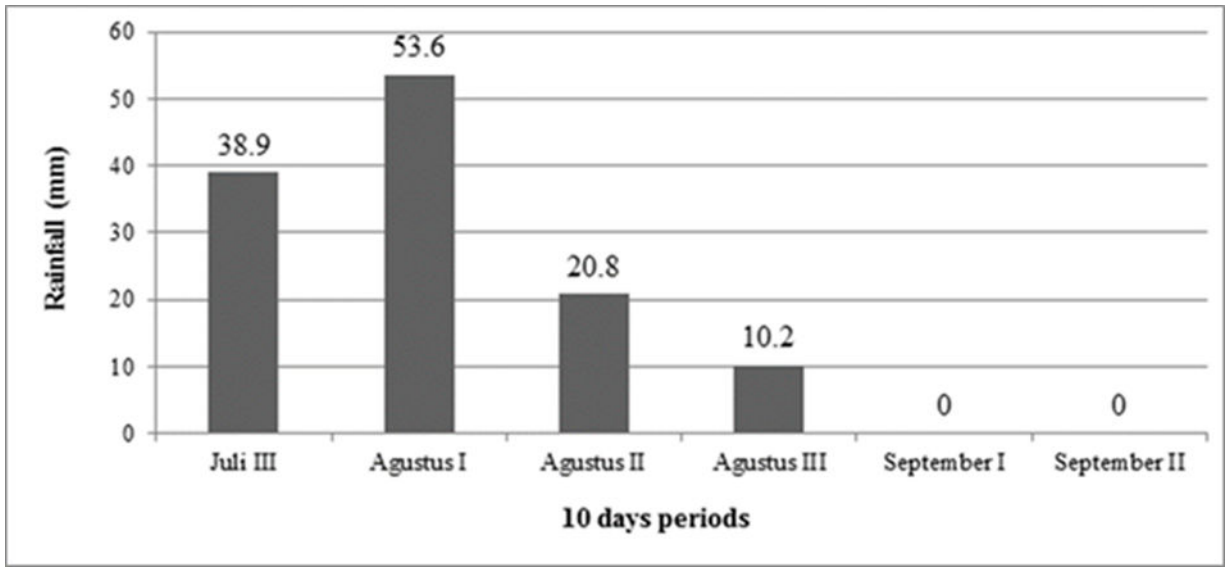

Figure 1: The rainfall condition at site location from July III to September II 2015.

Single factor

Based on the observation, the plant height does not show any differences at the age of 45 DAP, but significantly different at age of 35 DAP, in which the age of seed is 2 months longer than seed with age of a month. The parameters of number of shoots at age of 1 month of seed treatment is higher at the age of 35 DAP and 45 DAP (Table 1). According to Soedomo, tuber dormancy for a long time about a month (28 days after harvest+7 days drying during storage) able to generate well growth. Meanwhile, in the use shallot tuber seed, tuber dormancy termination period is at least one month, and for the best result, it is storage for three months [8,9].

Seed form has significant effect at the age of 45 DAP, which the intact seeds have more shoots than small and large seeds. It is very reasonable because the intact seeds consist of several tubers, both large and small, while for large and small seed form, it consists of one tuber only. For large seeds form, they also have more shoots than small seeds significantly. The low production of shallot in Palu valley with total production of 3.5-5.5 ton/ha is caused using small form seeds with relatively similar harvesting age with consumption age. The various tuber weight involving 1-2.5 g, 2.6 to 3.5 g, and 3.6 to 4.6 g were not different significantly on the production of dry tuber weight [10,11]

Furthermore, cutting tuber 25% is higher than 50%. Research conducted by Setiawan et al. showed that it is relatively similar in which cutting tuber by one third can significantly improve growth and production for plant height parameter at 2 week after planting, number of leaves, number of tillers, number of tuber, fresh tuber weight per

sample, dry tuber weight per sample comparing to cutting tubers by half [12].

The production is always influenced directly by the population of shallot that is planted. If many plants die, plant population is decreased resulting in low production. Based on three factors of treatment, the percentage of cuts tuber significantly affected plants die. Treatment of cuts 25% slightly causing plants to die that is 3.5% and 16.3% at the age of 35 HST and 45 HST respectively. While for cutting tuber 50% increase mortality percentage 1.7% and 34.3% respectively at the age of 35 HST and 45 HST. The high percentage of deaths of tubers cut by 50% is most likely due to the high contamination of disease triggered by the extent of cut at seed tubers.

Treatment	Plant Height (cm)		Number of tillers		Die plant (%)		Dry production (t/ha)
	35 HST	45 HST	35 HST	45 HST	35 HST	45 HST	
U1	29.0 b	35.1	5.3 a	5.7 a	12.9 a	30.5	10.3
U2	31.4 a	36.5	4.5 b	4.7 b	3.4 b	20.1	12.7
B1	30	35.5	5.9	6.3 a	6.5	25.5	12.5
B2	30.4	36.1	5.3	5.6 b	10.2	25.3	12.3
B3	30.2	35.9	3.6	3.7 c	7.6	25.1	9.6
P1	31.2 a	36.9	4.8	4.9	3.5 a	16.3 b	13.1
P2	29.2 b	34.8	5	5.6	12.7 b	34.3 a	9.8

Table 1: Parameter of Growth and Production according to seed ages, form and cutting tuber seed of Shallot.

(Numbers mean followed by the same letter are not significantly different according to DMRT test at 5% significance level).

Various treatments that have been examined did not significantly affect the production of shallot. However, differences among the treatments that have been studied provide high production values at economic scale. Shallot production tends to be higher for seed at the age of 2 months (12.7 ton/ha), followed by the form of intact seeds (12.5 ton/ha), and cutting of 25% (13.1 ton/ha). Based on the results that have obtained, the farmers can use mature seeds age, and they can also use seeds intact, at least large-sized seeds, and the cutting of tubers 25% instead of 50%. According to Sadjad, the size of the seeds or tubers are positively correlated with the content of food reserves that will affect the production [13].

The interaction of two factors

There are two parameters of the various interaction of two factors that have been examined have significant effect, namely parameter of production for interactions of seed age and tuber form and percentage of die plants as interaction between seeds age and the percentage of cutting seed (Table 2).

Treatment	Plant Height (cm)		Number of shoot		Death Plant (%)		Dry production (ton/ha)
	35 DAP	45 DAP	35 DAP	45 DAP	35 DAP	45 DAP	
U1B1	28.2	33.3	6.6	7.4	9.7	25.1	12.1 ab
U1B2	29	35.4	5.5	5.6	17.5	37.4	8.8 b
U1B3	29.7	36.8	3.8	4.1	11.3	29.1	9.9 b
U2B1	31.6	37.8	5.2	5.2	3.3	26	12.8 ab
U2B2	31.7	36.9	5	5.7	2.9	13.3	15.9 a
U2B3	30.7	34.9	3.4	3.2	3.9	21	9.3 b
U1P1	30.2	36.4	4.8	5	5.2 b	18.4	12.2
U1P2	27.7	33.9	5.7	6.4	20.6 a	42.6	8.3
U2P1	32.1	37.4	4.8	4.7	1.9 b	14.3	14
U2P2	30.6	35.7	4.3	4.8	4.9 b	25.9	11.3

B1P1	31.3	37	5.6	5.8	2.9	13.7	14.7
B2P1	30.9	36	5.3	5.3	5.7	22.9	13.3
B3P1	31.4	37.7	3.5	3.5	1.9	12.3	11.4
B1P2	28.7	34	6.8	6.8	10.1	37.3	10.2
B2P2	29.9	36.3	5.9	5.9	14.7	27.7	11.4
B3P2	29	34.1	3.9	3.9	13.3	37.8	7.8

Table 2: Parameter of Groeth and Production According to Interaction of Two Factors of Age and Seeds Form, Ages and Cutting Tuber, and Form and Cutting Tuber of Shallot.

(Numbers mean followed by the same letter are not significantly different according to DMRT test at 5% significance level).

Based on the interaction between seed ages and seed form, the highest production and significantly different can be obtained through the interaction which use seeds with age 2 months and large seed form and it can produce 15.9 ton/ha. However, it is not significantly different with the use of seed age 2 months with intact seeds form (U2B1) and use of seeds 1 month with intact seeds form (U1B1). While for interaction that is avoided because it produces lower than 10 ton/ha is seeds age 1 month and two months that use small seeds (U1B3 and U2B3) and seeds age a month using large seed (U1B2).

Interaction of three factors

Interaction between seeds ages, seed form and cutting seed have significant effect only to a parameter observed involving number of shoots at the age of 45 DAP. The highest number of shoots and significantly different from the interaction of other factors involving seeds age at a month combined with intact seed form and seed cutting 50% and it produces 8.7 shoots per plant (Table 3).

The cutting tuber 50% will produce shoots more than cutting tuber 25%, this pattern can also be seen on the interaction of two factors (Table 2).

Treatment	Plant growth (cm)		Number of shoots		Dead plant (%)	
	35 DAP	45 DAP	35 DAP	45 DAP	35 DAP	45 DAP
U1B1P1	29.7	34	5.8	6.0 b	3.4	11
U1B1P2	26.7	32.6	7.5	8.7 a	16	39.2
U1B2P1	30.1	36.8	5.3	5.2 bc	9.7	35.3
U1B2P2	28	33.9	5.7	6.0 b	25.3	39.4
U1B3P1	30.8	38.4	3.4	3.8 de	2.4	8.9
U1B3P2	28.6	35.2	4.1	4.4 cd	20.3	49.4
U2B1P1	32.9	40	5.5	5.5 bc	2.4	16.5
U2B1P2	30.6	35.5	4.9	5.0 bc	4.3	35.5
U2B2P1	31.7	35.1	5.3	5.4 bc	1.7	10.6
U2B2P2	31.8	38.7	4.7	5.9 b	4.1	16
U2B3P1	32	37	3.5	3.1 e	1.5	15.8
U2B3P2	29.5	32.9	3.3	3.3 de	6.3	26.2

Table 3: Parameter of Growth and Production According to the interaction of Age, Form, and Cutting Seeds of Shallot.

(Numbers mean followed by the same letter are not significantly different according to DMRT test at 5% significance level).

For the production results, the best interaction that can produce up to 15 ton/ha include the interaction of U2B2P2 (16.3 ton/ha), U2B1P1 (16 ton/ha), and U2B2P1 (15.5 ton/ha) (Figure 2). On the other side, for lowest production below 8 ton/ha can be obtained at interaction of U1B2P2 6.4 ton/ha and U1B3P2 (7.6 ton/ha). In the field, the performance of shallot growth during the experiment is presented at Figure 3.

Based on the interaction of these three factors, the best production can be obtained with the use of seed age 2 months, and large seed form

or intact seed form. The production more than 15 ton/ha, can therefore be achieved through all percentages of cutting.

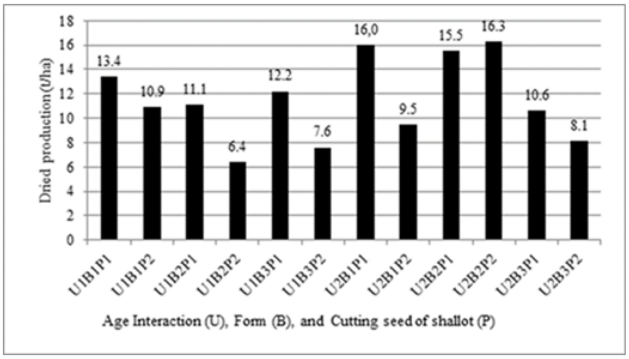

Figure 2: The Interaction between age, form and cutting seed of shallot that have non-significant effect to the dried production.

Figure 3: The performance of shallot growth during the experiment.

Conclusion

The age of seeds has significantly affect to plant height the at the age of 35 DAP, number of shoots at 35 DAP and 45 DAP, number of dead plants at 45 DAP. Seeds form has significant effect to the number of shoots at 45 DAP. Cutting seeds has significant effect to the plant height at 35 DAP, dead plants at 35 DAP and 45 DAP with each percentage of cutting 12.7% and 43% respectively for cutting seeds 50%. The single factor of the treatment does not have significant effect to the production, however, the cutting seeds of 25% produce highest yield 13.1 ton/ha, while the use of small seeds form produce the lowest yield of 9.6 ton/ha. The interaction of two treatment factors of seeds age and form have significantly effect to production, treatment of U2B2 resulted in the production of 15.9 ton/ha. The interaction of three factors including seeds age, seeds form and cutting seed does not have significantly effect to the overall parameters observed, while the highest production of 16.3 ton/ha can only be provided by U2B2P2. Further study can be proposed for the use of seeds age more than two months and the use of seeds without cutting.

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