

Growth and Yield Response of Shallots (*Allium ascalonicum*) to Various Water Height from Soil Surface

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Abstract—The research was conducted from May to October 2008 in Payakumbuh Agriculture Polytechnic. The objective of the research was to get appropriate level of water surface from ground and suitable for optimal shallot yield and growth. This research was arranged in Randomized Block Design with three treatment. The treatment was the water surface level (W) with three water level (10, 25 and 40 cm from soil surface). Statistical analysis was performed with SAS System for Windows v6.12. The result showed that water surface level significantly affecting the plant height, relative growth rate, number of leaf, number of tuber, and tuber yield ($t\ ha^{-1}$) due to water availability. Water surface level that significantly increase the yield of shallot was water level condition at 25 cm from soil surface.

Keywords—shallots, water surface level, soil surface

I. INTRODUCTION

Shallot (*Allium ascalonicum* L.) is one of the versatile tuber vegetables are widely used as an everyday kitchen spices, flavoring various dishes, but it is also useful as a lot of traditional medicine. The demand of shallot will grow continue with increasing population. The consequence is domestic demand is still dependent on imported shallot.

West Sumatra shallot production when compared to the national onion production is still very low. National production in 2003 ranged from 938 293 tonnes with 104 289 ha harvested area [1], [2], while production of West Sumatra only 12 757 tonnes with 1,617 ha crop area [3]. This figure shows that the West Sumatra shallot production is only 1.36% of the national shallot production.

The ironic condition occurs in the Limapuluh Kota Regency of West Sumatra, where amid strong public demand for shallots, it instead dropped its local production. Central Statistical Agency of Limapuluh Kota Regency showed that between the years 2003 - 2005 production of shallots in this regency was only 975 tons and even then only in 2005 and only produced in Bukik Barisan District, one of 13 districts in the county.

Limapuluh Kota Regency is suitable and potential for shallot commodity according to hydrology and climatology condition. Shallot plants need plenty of water but it is very

sensitive to excess and shortage of water, especially in the root zone and tubers. Farmers in Central Java Brebes regulate the water supply to make a 50-60 cm deep ditch. The ditch has a dual function that is for water supply and drainage [2]. The existence of proper water level is very important for maintain soil moisture conditions remain on the threshold of field capacity and permanent wilting point in order to produce good tubers [2].

From the description above research was carried out regarding "Growth And Yield Response Of Shallots (*Allium ascalonicum* L.) To Various Water Level From Soil Surface" to obtain information about the proper water needs in the development of shallot commodity in Limapuluh Kota Regency.

The purpose of this study was to obtain information about the condition of the soil water availability for growing shallot, and to determine the proper water level and suitable for planting shallot.

II. RESEARCH METHODS

A. Time and Place

The field experiment was conducted at the Experimental Field Payakumbuh State Agricultural Polytechnic for 6 months from May to October 2008.

B. Materials and Equipment

Materials used are shallot seed varieties Bima Brebes, bokashi manure from chicken manure, insecticides Curater 3G, urea, SP36, KCl, plastics fence, rope, bamboo stake. The tools used are bucket, hoe, stainless steel blades, rakes, hand sprayer, scales, meter, tub with water level regulator. Support equipment used include: digital cameras, PCs, bucket, hoe, marker, stationery etc.

C. Experiment Design

The experiment using randomized block design with high factor groundwater levels in five replication. Factors ground water level, consists of three levels. The treatment are :

1. (W1) ground water level 10 cm
2. (W2) ground water level 25 cm
3. (W3) ground water level 40 cm

Each experimental unit was placed in a container measuring 50 x 65 cm with 80 cm high container. Plants arranged at a spacing of 15 x 15 cm, so that each container obtained in 12 stand of plants. The data were processed by analysis of variance (F test), followed by DNMRT test at 5% significance level.

D. Implementation

Setting the ground water level was done by means of water level on-set constant during the plant growth, by flowing water continuously through the inlet pipe and remove excess water through pipes

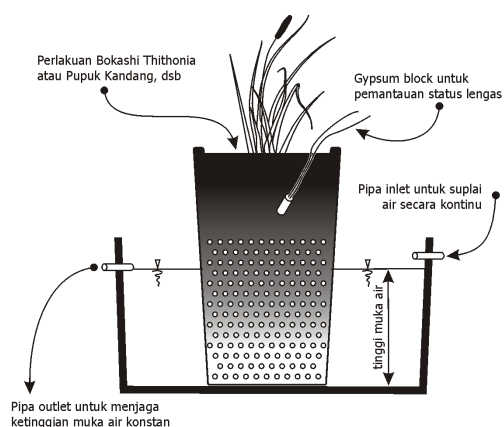


Fig 1. Abstraction setting of soil water surface height

Soil which used as a growing medium cleaned from weeds and trash. The soil was placed in a container and compacted. Soil samples were taken in each container to be analyzed. Chicken manure bokashi given as fertilizer plot basis after making experiments with a dose of 15 ton ha⁻¹ by spreading on experimental plots. Once evenly mixed directly with the soil and also added Curater

Basic inorganic fertilizers are also provided along with a dose of 150 kg / ha P₂O₅ (417 kg / ha SP36 or 62.55 g / plot) and 100 kg / ha K₂O (172 kg / ha KCl or 25.80 g / plot, carried out 1 weeks before planting. Fertilizer N is applied 2 times, giving the first age of 1 week after planting and the provision to the second age of 4 weeks after planting each half dose by spread around the plants.

Planting is done by putting the seeds that had been cut earlier in the prepared planting hole so that 2/3 of the seed into the soil at a spacing of 15 cm x 15 cm. Seed covered with a thin layer of soil. Each container planted with 20 seedlings of shallot, so it takes 20 x 36 = 720 seedlings.

Pillar placed 1 week after planting with a distance of 5 cm from plant samples and marked 5 cm from the soil surface to aid in the assessment of plant height. Maintenance is done every day at plants that get interference in other environments (other than treatment) such as weeds, pests and diseases and irrigation. Harvest was done in 55-60 days after planting to visually see where 60-70% of all plants per plot experiment the leaves have yellowed or dry, drooping neck bulbs, stem tubers have hardened and partially protruding above ground.

E. Observations

1. Plant height
2. Number of leaf
3. Number of tillers
4. Number of tubers
5. Weight of tubers per hectare

F. Supporting Observations

Supporting observation of the nutrient content of soil N, P, K and C (before planting) as well as the nutrient content of manure used bokashi i.e. N, P, K and C.

III. RESULT AND DISCUSSION

A. Plant Height (cm)

Plant height showed that given of high ground water level of different shows a significantly different effect on the growth of plant height. The average height of onion plants after further tested with DNMRT at 5% significance level, can be seen in table 1.

TABLE I
AVERAGE OF SHALLOTS PLANT HEIGHT AGE 45 DAP AT VARIOUS CONDITIONS OF WATER AVAILABILITY.

Groundwater Height	Replication					Average
	1	2	3	4	5	
	----- cm -----					
10 cm	31.17	28.68	26.83	27.88	29.86	28.88 b
25 cm	32.59	32.33	30.08	32.59	30.69	31.65 a
40 cm	33.16	29.16	27.92	29.09	31.10	30.08 ab

Note : The number in the column followed by the same lowercase letter do not differ significant at 5% significance level according to DNMRT.

B. Number of Leaves (strands)

Results of analysis of variance was observed in the number of leaves when the plant was 45 Day After Planting (DAP), showed that give of high ground water level of different shows a significantly different effect on the number of leaves of the plant. The average number of red shallot at 45 HST in table 2.

TABLE III
AVERAGE OF LEAVES NUMBER OF SHALLOT 45 DAP AT VARIOUS
CONDITIONS OF WATER AVAILABILITY

Groundwater Height	Replication					Average
	1	2	3	4	5	
	----- strand.tiller ⁻¹ -----					
10 cm	29.00	32.17	30.67	29.50	31.72	30.61 b
25 cm	33.42	36.25	31.92	34.54	33.30	33.89 a
40 cm	37.59	28.08	32.59	33.92	31.98	32.83 ab

Note : The number in the column followed by the same lowercase letter do not differ significant at 5% significance level according to DNMR.

Differences in ground water level showed a significantly different effect on the number of leaves of the plant. These data showed that treatment of the ground water level of 25 cm showed the highest number of leaves.

C. Tiller Number (clumps)

Results of analysis of variance on the number of tillers were observed when the plant was 45 DAP, showed that the water level of different soil showed a significantly different effect on the amount of shallot seedlings. The average number of shallot seedlings age 45 DAP, as Table 3.

TABLE IIIII
AVERAGE OF SHALLOT CLUMPS AGE 45 DAP AT VARIOUS CONDITIONS OF
WATER AVAILABILITY.

Groundwater Height	Replication					Average
	1	2	3	4	5	
	----- clumps -----					
10 cm	7.58	7.84	7.00	7.50	7.44	7.47 b
25 cm	7.67	8.83	7.59	7.83	8.23	8.03 a
40 cm	8.59	6.42	8.67	7.90	7.88	7.89 ab

Note : The number the column followed by the same lowercase letter do not differ significant at 5% significance level according to DNMR.

D. Number of Tubers

Results of analysis of variance showed that the number of tubers ground water levels are different shows a significantly different effect on the number of shallot bulbs. The average number of shallot bulbs age 45 HST as Table 4.

TABLE IVV
AVERAGE OF SHALLOT TUBERS NUMBER AGE 45 DAP AT VARIOUS
CONDITIONS OF WATER AVAILABILITY.

Groundwater Height	Replication					Average
	1	2	3	4	5	
	----- tuberr tiller ⁻¹ -----					
10 cm	6.07	8.11	7.64	7.57	8.34	7.54 b
25 cm	9.03	8.55	9.00	9.37	11.15	9.42 a
40 cm	8.33	8.35	8.40	9.20	9.25	8.71 ab

Note : The number the column followed by the same lowercase letter do not differ significant at 5% significance level according to DNMR.

E. Tuber Weight per Hectare (ton.hectare⁻¹)

Results of analysis of variance tuber weight per hectare, showed that given of ground water levels are different indicate a significantly different effect on weight of onion bulbs per hectare. The average weight of onion bulbs age 45 HST as Table 5.

TABLE V
AVERAGE OF TUBER WEIGHT PER HECTARE AGE 45 DAP AT VARIOUS
CONDITIONS OF WATER AVAILABILITY.

Groundwater Height	Replication					Average
	1	2	3	4	5	
	-----ton.hectare ⁻¹ -----					
10 cm	5.50	5.70	10.64	7.54	9.17	7.71 b
25 cm	4.53	6.91	9.15	6.80	12.02	7.88 a
40 cm	6.15	6.83	8.72	6.84	10.53	7.81 a

Note : The number the column followed by the same lowercase letter do not differ significant at 5% significance level according to DNMR.

F. Shallot Plant Growth

Based on the experimental results show that the different ground water levels (10,25 and 40 cm), showed a significantly different effect on the growth and yield of shallot plants, such as plant height, number of tubers, number of tillers, number of tubers and tuber weight per hectare.

Table 1 shows that a various of ground water level gives significant effect on plant height. At a depth of 25 cm water table is best water availability conditions for the growth of plant height. According to the Directorate General of Horticulture (2003), soil water content / soil moisture affected growth and yield of shallot. Shallot crop will produce good tubers if soil water is in a state of field capacity since the plant growth to tuber formation. Drought during vegetative growth can result in stunted growth, while drought during tuber formation may lead to crop failure. Conversely, if the condition of the water in a stagnant state, then growth will also be hampered, because the roots will be starved of oxygen. This can be seen on the high ground water level 10 cm, although still not differ significantly with high ground water table 25 cm and 40 cm, but already showed a decrease in plant height.

Differences in ground water level also provides a significantly different effect on the number of leaves and number of tillers (Table 2, 3). At a depth of 25 cm water table is best water availability conditions for growing number of leaves and number of tillers. At a height of 10 cm water table, showing the growth of the number of leaves and the lowest number of tillers. This is due to excessive water availability conditions resulting in the root zone of stagnant water. As a result, a dense root zone soil and the soil pores filled with water so the roots face difficulties to get oxygen. If the roots lack the oxygen supply, the process of respiration is impaired, so the energy for photosynthesis will be reduced, so that tillering and leaves is inhibited (Suseno, 1974).

The condition of the ground water level 40 cm, showing the growth of the number of tillers and number of leaves also

declined, although not significantly different with the ground water level 25 cm. This is related to the ability of the soil to provide plant nutrient elements. These nutrients, usually absorbed in the form of ions with the help of water (Viets, 1972). Supply of nutrients to the plants is directly related to the movement of water to the roots. If the movement stops, as a result of low soil water content, the roots are prevented obtain nutrients in the form of ions through diffusion (Gardner and Mitchell, 1991). Then Viets (1972) adds that the amount of water in the soil not only affects the amount of nutrients in the soil solution, but also the rate of movement to the root surface, either through diffusion or mass flow of water and then absorbed by the roots.

G. Shallot Plant Yield

Differences in ground water level also provides a significantly different effect on tuber number and weight of tubers per hectare (Table 4, 5). At a depth of 25 cm water table is best water availability conditions for growing the number of tubers and tuber weight per hectare. At a height of 10 cm water table, showing the number of bulbs and tubers lowest weight. Tuber weight while on ground water levels 25 and 40 cm, showed no significant difference. This is due to the condition of the availability of large amounts of water, causing root zone moist, causing many tubers rot (fungal attack). This causes the "loss results" are impacting the decline in results.

IV. CONCLUSIONS AND RECOMMENDATIONS

Ground water level gives a significantly different effect on plant height, number of tillers, number of leaves, number of tubers and tuber weight per hectare. The best water availability conditions for improving shallot yields is at a height of 25 cm groundwater.

It is need to pay attention to technical factors in research mainly on observations of soil water availability conditions that can minimize the "human error".

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