Growth and Physiology of *Deli* Tobacco (Nicotiana tabaacum) Varieties of Deli-4 on Drought

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Abstract: The purpose of this research is to find out the drought effect on growth and physiological effect on tobacco, varieties of Deli-4. This study uses a non-factorial randomized design group with seven water levels (P) such as P_0 (300 ml/polybag), P_1 (30ml/polybag), P_2 (60 ml/polybag), P_3 (90 ml/polybag), P_4 (120 ml/polybag), P_5 (150 ml/polybag), and P_6 (180 ml/polybag). The seeds used are varieties of Deli-4. The research is done at Tobacco Plant Research Hall of Deli, Sampali, Deli serdang District, the Province of North Sumatra. The results show that the seven water levels significantly effect the tobacco`s growth and physiology , and the level of water from 300 ml/polybag to 30 ml/polybag can inhibit the growth of tobacco plant, as well as increase the root length and levels of nicotine.

1 INTRODUCTION

Water is one of the limiting factors for growth and production, affecting the appearance of the morphology, anatomy and physiology of the plant especially the leaves. A cigar wrapper tobacco of *Deli* desired is broadleaf, thin and elastic, while the lack of water causes the broad leaves to be narrower and thicker. The character of general morphology to infer the level of tolerance of crops against drought can be found by observing the development of rooting to identify plant resistance or sensitivity. (Fadli, 2014).

Field capacity is the state of the soil moist to show the amount of water to be held by the soil against the withdraw of gravity style. In general the plant requires the availability of soil water in a roomy capacity, but in the presence of tobacco cultivation, drought can increase the concentration of alkaloid and nicotine levels of leaves, affecting the profitable quality of the tobacco (Fadli, 2014).

Tobacco grows in dry land and the limited availability of water becomes an obstacle. Therefore, drought becomes a serious problem for the growth of tobacco plant. These conditions cause the crop productivity at locality to below (Djumali, 2013).

2 RESEARCH METHOD

This research is carried out atT obacco Plant Research Hall Deli, PTPN II, Sampali, Deli Serdang District at an elevation of approximately 25 mdpl. using a non-factorial Randomized Design Group with one factor, level of watering, and for the treatments, the following materials are used:

P_0 : control (300 ml/plant/day)
P_1 : 10% water (30 ml/plant/day)
P_2 : 20% water (60 ml/plant/day)
P_3 : 30% water (90 ml/plant/day)
P_4 : 40% water (120 ml/plant/day)
$P_{.5}$: 50% water (150 ml/plant/day)
$P_{.6}$: 60% water (180 ml/plant/day)

Poly bags (50 x 50 cm) are used as the medium, and each treatment is repeated three times.

The implementation is done by preparing an area for research, media, tools, materials, and the granting of substance N for tobacco seeds. Fertilizing is done for 3 times; the first fertilization is done before planting, pruning and both are done by1 MST in conjunction with the first turn-up of the soil, then the third fertilizing is conducted by 2 MST simultaneously with the second turn-up of the soil.

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The whole fertilizing of NPK fertilizer is mixed with a dose of 10 Gr./plant. Weeding is done manually by unplugging the growing weeds in polybag once a week. The turn-up of the soil is done twice and in conjunction with fertilization. Harvesting is done by way of citing the leaves on several stages, namely at the age of 92, 94 and 96 days from planting.

Parameters of observation include, broad leaf sand (cm^2), walk 1 (cm^2) and 2 (cm^2), root length (cm), wet weight (g), dry weight (g) and water content (%), as well as the amount of chlorophyll (mm/grain) and nicotine levels (%).

3 RESULTS AND DISCUSSION

3.1 Leaf Breadth

The results show that there is an effect on the treatment of degrees of water on the broad leaf sand, leg 1 and leg 2 in Deli tobacco plants (Deli-4 varieties). The average breadth of leaves of the tobacco plant of Deli is presented in table 1.

Tabel1:Leaf Breadth of Tobacco Plant (cm^2).

Treatment	Sand Leaf	Leg 1	Leg 2
P_0 (control)	209,27 a	226,46 a	152,43 a
P_1	55,33 c	62,13 d	54,10 e
P_2	90,46 b	78,60 c	68,03 de
P_3	88,49 b	96,26 c	75,44 cde
P_4	97,18 b	120,29 b	87,57 bcd
P_5	106,22 b	135,66 b	118,30 b
P_6	110,02 b	138,50 b	107,37 bc

Explaination: The Figures followed a similar letter at same coloumndid not differ in the extent of 5%

Table 1 shows that the breadth of leaf, leaf leg 1 and leg 2 of the largest tobacco plant contain treatment P_0 (300 ml water) and distinction against the treatment of P_1 (30 ml), P_2 (60 ml water), P_3 (90 ml), P_4 (120 ml), P_5 (150 ml water) and P_6 (180 ml water).

This is because the shortage of water received by the plant cell or lengthening process obstructs the growth of the plant so that the leaves becomeabnormal. This is in accordance with the opinion of Fadli (Fadli, 2014), that the decrease in the level of the grant of the watermakes the plants decline in growth including the leaves. This is also in line with the research of Maryani (Maryani, 2012), that owing to shortage of water, turgor in plant cells become less maximum in nutrient absorption and consequently, cell division is hampered. Conversely, if water needs can be fulfilled optimally then there will be a maximum plant growth enhancement due to the photosynthetic production assigned to the organs of the plant.

3.2 Root Length

The results show that there is an effect on the treatment of degrees of water on the plant root length on Deli tobacco (deli-4 varieties. The average length of the root of Deli tobacco plant is presented in table 2

Tabel 2:Root Length of tobacco plant(cm).

Treatment	Average
P_0 (control)	61,30 a
P_1	43,76 ab
P_2	38,73 ab
P_3	34,53 ab
P_4	33,73 ab
P_5	31,93 ab
P_6	28,86 b

Explaination: The Figures following similar letters at same coloumndo not differ in the extent of 5%.

Table 2 shows that the longest length of the root of tobacco plant contain treatment P_0 (300 ml water) and distinction against the treatment of P_1 (30 ml), P_2 (60 ml water), P_3 (90 ml), P_4 (120 ml), P_5 (150 ml water) and P_6 (180 ml water).

This is because when the tobacco plants earn very little moisture then the growth process of tobacco plant organs is hampered primarily in the root organs so that the roots become abnormal. This is in accordance with the opinion of Maryani (Maryani, 2012), that in the plant of a shortage of water, turgor in plant cells become less maximum in nutrient absorption and consequently, cell division is hampered. Conversely, if water needs can be fulfilled optimally then there will be a maximum plant growth enhancement due to the photosynthetic production assigned to the organs of the plant.

3.3 Wet Weight, Dry Weight and Moisture

The results show that there is an effect on the treatment of degrees of water on wet weight, dry weight and moisture of tobacco plants on a Deli (deli-4 varieties). The average of wet weight, dry weight and moisture of Deli tobacco plants is presented in table 3.

Tabel 3: wetweight, dry weight and moisture of tobacco plant.

treatment	wetweight (g)	Dry Weight (g)	moisture (%)
P_0 (control)	139,30 a	45,32 a	67,55 c
P_1	28,31 c	5,65 b	80,09 b
P_2	39,44 bc	6,83 b	82,54 ab
P_3	46,72 bc	7,68 b	83,44 ab
P_4	71,39 b	12,86 b	82,41 ab
P_5	66,65 b	10,53 b	84,17 a
P_6	70,15 b	10,72 b	84,62 a

Explanation: The Figures following a similar letter at same coloumndo not differ in the extent of 5%.

Table 3 shows that the weight of the wet and the dry weight are found in the highest treatment of P_0 (300 ml water) real and distinctive on the treatment of P_1 (30 ml water), P_2 (60 ml water), P_3 (90ml), P_4 (120 ml water), P_5 (150 ml water) and P_6 (180 ml water).

When the tobacco crop gets shortage of water then the process of photosynthesis, cell multiplication and enlargement on the tobacco plant is being obstructed so that the organs of the plants have size and weight relatively small/abnormal. This is in accordance with the results of the research of Bayu et al (Bayu et al. 2014) in which it is found that the excessive granting of water treatment on tobacco plant makes the plants produce broad leaves, and fresh weight of leaves with dry weight and the leaves get high compared to those growing on conditions of water shortage. Then the highest water content on treatment of P_6 (180 ml water) is real and distinctive on P_0 and P_1, but there is no significant mark on the treatment of P_2, P_3, P_4, P_5.This is because when a plant obtains excessive water in the body then the plant will compensate by way of enlarging the stomata thus transpiration increases so there is no succulence within the plant body. Instead when the plant has no water then the plant will directly show the response that is by rolling and shrinking its leaves as well as minimizing the size of the stomata so that the evaporation is excessive and the moisture content in the body is not preserved. This is in accordance with the opinion of the Fatkhur and Ruly (Fatkhur and Ruly, 2017) stating that the greater size of the stomata will increase the rate of transpiration.

3.4 Chlorophyll Amount

The results show there is an effect of the treatment of degrees of water on the amount of chlorophyll in Deli tobacco plant of deli (deli-4 varieties). The averagechlorophyll amount of the tobacco plant is presented in table 4.

Tabel 4: ChlorophyllAmount of tobacco plant (mm/grain).

Treatment	Average
P_0 (control)	211,36 a
P_1	43,19 b
P_2	56,16 b
P_3	121,60 ab
P_4	125,69 ab
P_5	163,86 a
P_6	176,16 a

Explanation: The Figures following a similar letter at same coloumndo notdiffer in the extent of 5%.

Table 4 shows that the amount of chlorophyll present in most treatment of P_0 (300 ml water) is real and distinctive on the treatment of P_1 (30 ml water), P_2 (60 ml water), but there is no difference from real treatment of P_3 (90ml water), P_4 (120 ml water), P_5 (150 ml water) and P_6 (180 ml water). This is because the tobacco plants have enough water to launch the process of photosynthesis in the body so that the physiological processes such as the formation of the stomata and green leaves are not hampered; in addition of the plants obtain enough water so the growth process of the leaves is not hampered as the larger the leaf is, the more light is received and this can increase the amount of chlorophyll. According to Kozlowski et al (Kozlowski et al. 1991) the extents of the leaf is associated with the increase of the chlorophyll, giving impact to the increase of the products of

photosynthesis and the rate of growth and plant production.

3.5 Nicotine Levels

The results show there is an effect of the treatment of degrees of water on the levels of nicotine in Deli tobacco plants (deli-4 varieties). The average levels of nicotine of Deli tobacco plant is presented in table 5.

Tabel 5: Nicotine Levels of tobacco plant (%).

Treatment	Average
P_0 (control)	1,26 c
P_1	2,63 a
P_2	2,50 a
P_3	2,36 ab
P_4	2,23 ab
P_5	2,13 ab
P_6	1,96 b

Explanation: The Figures following a similar letter at same coloumndo not differ in the extent of 5%.

Table 5 shows that the highest levels of nicotine found in the treatment of P_1 (30 ml water) are real and distinctive against P_0 (300 ml water), $p._3$ (90ml), $p._4$ (120 ml water), $p._5$ (150 ml water) and P_6 (180 ml water), but there is no difference from the real treatment of P_2 (60 ml water). This is because when the tobacco plant is experiencing a water shortage, the tobacco plant would increase levels of nicotine in order to keep the tobacco plants survive in conditions of drought. This is agreed by Arsyadmunir etal (Arsyadmunir etal. 2011) stating that generally crops requires the availability of water in the ground with airy capacity, but the presence of tobacco cultivation in drought increases the concentration of alkaloids and nicotinelevels of leaves so profitable tobacco quality could be improved.

4 CONCLUSIONS

The results of the study show that giving water to some extent to Delitobacco plant (Deli-4 varieties) influencesthe physiological process in the body of the tobacco plant. This is apparent through the treatment of P0 (300 ml water), thatthe physiological process ofthe tobaccoplant is under normal circumstances while on treatment of P_1 – $P_6$the physiology process is hampered.

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