

Growth in The Various Ecotypes from Vetiver Plant at Different Salinity Levels

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Abstract. The vetiver plants were appertained to the Gramineae family, densely clumped. The ecotypes from plants were distinct a pattern besides at environmental situation in geographical areas of the variety. In this study, we were determined to growth to various ecotypes of vetiver at different salinity levels. This research was used a factor complete random design in two (2) factors. Then, the first factor included salinity (S) which consists of 6 levels (: So: without salinity, S1: saline soil 4 dsm-1, S2: saline soil 8 dsm-1, S3: saline soil 12 dsm-1, S4: soil copy 16 dsm-1, S5: soil saline 20 dsm-1). The second factor was the Ecotype (E) which consists of 3 levels (E1: Bogor Ecotype, E2: Bojonegoro Ecotype, E3: Padang Ecotype). Results were found that the vetiver ecotype has a significant role on the various levels from salinity in the observations of plant height at 6 WAP, number of leaves at 6 WAP and number of tillers at 8 WAP. Thus, this study obtained vetiver ecotypes that were able to survive at several levels of salinity stress.

1 Introduction

The annual plant known as vetiver (*Vetiveria zizanioides* L.) is native to India. In tropical regions, the various was identified by its deep and wide root system, which can reach a depth of five meters [1]. Some plants have better ability to adapt to various environment drought, include salinity. [2]. Vetiver has been widely used for saline soil rehabilitation [3].

Morphological characteristics in plant is necessary to detect the special traits purpose, identify ecotypes from duplicated, and arrange variety from the conservation aims them [4]. The morphological variations in occurred cause the environmental situation to indicate from plant. It was carried out in adaptation. Furthermore, a population adaptive for certain environmental areas was name of ecotype. The distinct from ecotypes plant or population was a pattern because of environmental to the geographical that distribution to variety [5].

The vetiver was discovered at a salinity threshold of 8.0 dSm⁻¹, which corresponds to 5.26%-unit dSm⁻¹ for decreased growth. Recently, vetiver in different ecotypes has responded to salinity on the same scale; at 100, 150, and 200 mM NaCl. Nonetheless, it was

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shown that a wild vetiver variety from southern China had a salt threshold that was only ~ 10 dSm⁻¹ tolerant of salinity. The proportional growth of vetiver decreases with increasing salt levels [6]. This study aims to the growth for different the vetiver ecotypes at distinct salinity levels.

2 Materials and methods

2.1 time and place of research

This study was conducted from September to November 2021. This study took place in the greenhouse of Politeknik Pembangunan Pertanian Medan.

2.2 The vetiver seedling

The vetiver seeds were used in this study were 6-month-old vetiver seedlings from different ecotypes, namely the Bogor ecotype, Bojonegoro ecotype, and Padang ecotype as plant material. The saline soil used comes from Percut Sei Tuan taken from several places according to the level of salinity given do to clean up in the weeds and the roots. It was no longer needed (that ward plants for disturbing species).

2.3 Parameters

The treatment variation consisted of 2 factors, including the factors of salinity stress (S), and ecotype factor (E).

2.3.1 The salinity levels (S)

The level of salinity factors (S) in six (6) levels, namely:

So : not salinity

S1 : saline soil 4 dsm-1

S2 : saline soil 8 dsm-1

S3 : saline soil 12 dsm-1

S4 : saline soil 16 dsm-1

S5 : saline soil 20 dsm-1

2.3.2 The ecotype factor (E)

The ecotype factor (E) included 3 levels, i.e:

E1 : Bogor Ecotype

E2 : Bojonegoro Ecotype

E3 : Padang Ecotype

2.4 Land Preparation

The land used was the greenhouse of the Politeknik Pembangunan Pertanian Medan. The soil was cleared. The soil was measured for salt content based on each treatment. The saline soil was taken from the Percut area, Sei Tuan. Equipped with filling of polybags with soil according to each treatment

2.5 Planting Seeds

Polybags containing soil according to the first treatment were planted with vetiver seeds according to each treatment, namely vetiver seedlings for the Bogor ecotype, Bojonegoro ecotype, Padang ecotype.

2.6 Parameter observation

Parameters for observation included plant height 6 WAP (cm), the number from leaves 6 WAP (strands), the number of tillers 6 WAP (saplings). Plant height was measured using a tape measure at the age of 6 WAP. While the data from leaves was analyzed the number on each sample plant at the age of 6 WAP. In addition, observing the number from tillers of the sample plants analyzed counting in number of tillers in the polybag areas.

2.7 Analysis of the data

The research were factorial Completely Randomized Design (CRD) in 2 factors, wherein, the formula to carry out [7]:

$$Y_{ijk} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \epsilon_{ijk} \quad (1)$$

Notes:

Y_{ijk} = observation on the kth repetition that received the i-level S factor and j-level E factor

μ = common mean

α_i = The factor influences S level i

β_j = The factor influences E level j

$(\alpha\beta)_{ij}$ = The interaction of effect factor from S (level i), and the factor from E (level-j)

ϵ_{ijk} = Effect of error component by factor S (level i), the factor E (level-j) and repetition of-
k

If there is a significant difference, Duncan's follow-up test is carried out.

3 Result and Discussion

3.1 The vetiver of plant height

The salinity parameters were very significant in the effect from the plant height. It was found the variable at 6 WAP. Results showed difference analyzed mean of the plant height to the salinity stress and it was shown in Table 1. The salinity was found to be a significant means in the plant's height. The treatment from S1 was significantly different from S0, S2, S3, S4 and S5. Each treatment gave significantly different results from other treatments. Ecotype treatment had a very significant effect on E1, E2 and E3. Each treatment gave significantly different results from other treatments. The interaction of salinity and ecotype treatments had a significantly different effect on the observed variables of plant height in the six (6) WAP.

Three ecotypes differing in many morphological and physiological characteristics were found to be associated with salinity levels and suitable habitats, indicating an important role of natural selection in maintaining the characteristics of each area. Vetiver root experienced a decrease in growth in line with the increase in the level of salinity in its vegetative growth. Giving NaCl is a dissolved saline in the soil which is important but if excess can affect growth patterns. Osmotic stress, which made it difficult for plants to absorb water, and the influence of excessive Na and Cl ions, which hindered cell division and expansion, were the two main causes of the diminishing plant development [8-10].

Table 1. Mean of plant height at 6 WAP in Various Ecotypes of Vetiver at Different Salinity Levels

Salinity	Ecotypes			Average
	E1 (Bogor)	E2 (Bojonegoro)	E3 (Padang)	
S0 (0 dSm ⁻¹)	114.00 cde	136.00 a	133.00 a	127.67
S1 (4 dSm ⁻¹)	116.33 cd	129.00 ab	122.83 bc	122.72
S2 (8 dSm ⁻¹)	110.67 de	126.33 ab	110.50 de	115.83
S3 (12 dSm ⁻¹)	93.50 f	108.17 e	112.50 de	104.72
S4 (16 dSm ⁻¹)	80.00 g	105.33 e	94.17 f	93.17
S5 (20 dSm ⁻¹)	49.00 i	80.33 g	68.67 h	66.00
Average	93.92	114.19	106.94	

Notes: Numbers pursue unequal of the letters, and in the same column it was significantly different based on 5% DMRT Test.

3.2 Number of leaves

The salinity parameters were very significant roles in the number of leaves at 6 WAP. Results showed difference analyzed in average number of leaves to salinity stress data shown in Table 2. The treatment of S1 was significantly different from S0, S2, S3, S4 and S5. Each treatment gave significantly different results from other treatments. Ecotype treatment has a very real effect on E1, E2 and E3. Each parameter gave significantly different results from other treatments. The interaction of salinity and ecotype treatments had a significantly different role observed variable to number of leaves in the six (6) WAP.

The number of leaves of the three Vetiver ecotypes decreased with increasing salinity stress. The ecotype that has the highest number of leaves is Bojonegoro. The more leaves on a plant, the lighter the plant absorbs for the photosynthesis process, so it has a big influence on plant growth and development. Apart from that, the number of leaves is related to the plant's ability to carry out photosynthesis which takes place in the plant's leaves.

Table 2. Average Number of Leaves 6 WAP in Various Ecotypes of Vetiver at Different Salinity Levels

Salinity	Ecotypes			Average
	E1 (Bogor)	E2 (Bojonegoro)	E3 (Padang)	
S0 (0 dSm ⁻¹)	10.33 c	13.50 a	11.67 b	11.83
S1 (4 dSm ⁻¹)	8.67 e	10.67 c	9.50 d	9.61
S2 (8 dSm ⁻¹)	8.17 e	9.50 d	8.83 de	8.83
S3 (12 dSm ⁻¹)	7.50 f	7.17 fg	6.50 gh	7.06
S4 (16 dSm ⁻¹)	6.00 hi	6.50 gh	5.33 ij	5.94
S5 (20 dSm ⁻¹)	5.17 j	5.67 ij	5.00 j	5.28
Average	7.64	8.83	7.81	

Notes: Number determined to unequal the letters same column was significant differently in the 5% DMRT Test.

3.3 Number of Tillers

Salinity parameters a very significant in the number of tillers 8 WAP. Results showed in different means number of tillers for salinity stress described at Table 3. The salinity had been a significant means to the number of tillers. S0 treatment was significantly different from S1, S2, S3, S4 and S5. The treatment of S1 was significantly different from S0, S2, S3, S4 and S5. Each parameter gave significantly different results from other treatments. Ecotype treatment has a very real effect on E1, E2 and E3. Each treatment gave significantly different

results from other treatments. The interaction of salinity and ecotype treatments had a significantly different role observed by a variable number of tillers in eight (8) WAP.

Table 3. Average number of tillers 8 WAP in various ecotypes of vetiver at different salinity levels

Salinity	Ecotypes			Average
	E1 (Bogor)	E2 (Bojonegoro)	E3 (Padang)	
S0 (0 dSm ⁻¹)	4.17 cd	4.50 c	5.67 a	4.78
S1 (4 dSm ⁻¹)	4.50 c	4.67 bc	5.00 ab	4.72
S2 (8 dSm ⁻¹)	4.17 cd	4.33 c	4.50 c	4.33
S3 (12 dSm ⁻¹)	3.67 d	3.83 d	4.17 cd	3.89
S4 (16 dSm ⁻¹)	3.67 d	3.67 d	3.67 d	3.67
S5 (20 dSm ⁻¹)	2.00 f	2.33 f	2.83 e	2.39
Average	3.69	3.89	4.31	

Notes: Numbers to follow the unequal letters at the same column were a significant difference in the 5% DMRT Test.

The vetiver survival rates have been studied with the number of tillers, double and triple tillers per clump, each wherein survival vetiver ecotypes level in the single case and the double tillers were found to be higher, whereas for three offspring were found to be lower in one ecotype. In addition, other studies found a net increase in tillers of 6.2 and 5.2 for single and triple tillers. There was a higher rate of increase in tillers per clump, which may have been due to the length of time the experiment was taking. In distinct an ecotype, double tillers are better than three times that of a farmer's ecotype [11-12].

For study that was found the vetiver ecotype had a significant effect on various levels of salinity in observing the number of leaves also the number of tillers, where in best growth was obtained in Bojonegoro ecotype vetiver plants. Furthermore, this study obtained vetiver ecotypes that were able to survive at several levels of salinity stress [13-15]. In another study, vetiver plants were able to reduce erosion on easily eroded, unstable and saline soils, especially soils on steep slopes. This species is widely used for soil conservation, water, steep slope stabilization, and other environmental protection purposes. Then, the benefits of the vetiver plant are stated to benefit soils with highly salinity [16].

4 Conclusions

The salinity treatment was responses of growth the vetiver plants. Best to responses were found by the height of 127.67 cm, the number of leaves was 11.83, the number of tillers was 4,78. While the vetiver ecotype showed the best response to plant height (114.19 cm), namely the Bojonegoro ecotype, the number of leaves in the Bojonegoro ecotype (8,83 leaves), and the number of tillers, namely the Padang ecotype (4.31 tillers). Then, interaction of both no significantly an affect plant height, number of leaves and number of tillers. The vertiver growth was increase the growth to the vetiver grass most effect in environmental agricultural improvement and conservation.

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