

Artikel

DROUGHT TOLERANCE OF SOME EGGPLANT ACCESSIONS (*Solanum spp.*)

Setyadi, D.B.^{1*}, Rahmi S.S.², and Taryono^{1,2}

^{1*}Faculty of Agriculture, Universitas Gadjah Mada, Yogyakarta, Indonesia
²Agrotechnology Innovation Centre, Universitas Gadjah Mada, Yogyakarta, Indonesia

*Correspondence Email:
daniel.bobby.s@mail.ugm.ac.id

ABSTRACT

Eggplant is one of the commodities that started to be favouritely consumed and had economics value. There were many factors that affect the growth and development process of plant. One of those many factors are the environment condition such as drought. This research aims to know the tolerance level of eggplant accessions to drought. Plants grew in two comparative conditions, normal and drought. Drought is given by using interval water application about every 7 days. Observations were carried out to growth and yield components and continue measuring the stress effect using drought sensitivity index. The results show that plants develop an adaptation mechanism to drought by reducing its growth and yield components to survive. The result of further test and drought sensitivity index show that half of accessions have good tolerance to drought. Accessions that had good tolerance to drought were SLTE 2, SLTE 3, SLTE 5, SLTE 6, SLTE 8, SLTE 13, SLTE 15, SLTE 18, SLTE 42, and SLTE 44.

Keyword: accessions, drought, eggplant

INTRODUCTION

Eggplants is one of the commodities that started to be favouritely consumed and had economics value too. There were many factors that affect the growth and development process of plant. One of that many factors are the environment condition. Eggplants are one of the plant species that sensitive to environment condition that could affect its productivity, quality, and post-harvest (Sekara et al, 2012). One of many environment condition that mostly important was drought. Drought stress weather temporary or permanent, affect the growth and productivity more than other environment

condition that mostly important was drought. Drought stress weather temporary or permanent, affect the growth and productivity more than other environment factors (Zhang, 1997). The problem of drought can be solved by 2 ways, change the environment so that drought could be minimized or develop tolerant variety (Soemartono, 1995). Developing tolerant genotypes became a good choice because it had long term goal. Earliest procedure in the developing tolerant genotypes to drought was by making evaluation the existing accessions to drought (Arsa et al., 1997). Evaluation can be done by applying drought stress to accessions to know their tolerant levels (Rosawanti, 2015).

MATERIAL AND METHODS

The research was done at Agrotechnology Innovation Centre of Universitas Gadjah Mada (AIC-UGM) in Kalitirto, Berbah, Sleman, Yogyakarta. Research materials consist of 20 eggplant accessions as first factor which was collection of AIC-UGM. Accessions were splitted into 2 groups i.e. drought stress application through watering every 7 days and control. Drought stress application was considered as mainplot, whereas accessions were as subplot. Treatments were arranged in Completely Randomized Design with 10 replications. Plants were planted with row system and every row contains 10 plants of each eggplant accessions. Observation were done on its vegetative and generative components. Vegetative components include root length, root fresh weight, root dry weight, plant height, number of leaf, leaf size, leaf fresh weight, leaf dry weight, stem fresh weight, stem dry weight, leaf specific size, and shoot/root ratio while generative components were day of flowering, fruit weight, fruit length, fruit diameter, and number of fruit. The result would be used to know the drought sensitivity index with formula from Fischer and Maurer (1978) in Sumartini et al. (2013):

$$S = \frac{1 - \frac{Y_d}{Y_p}}{D}$$

Y_d = data on drought stress

Y_p = data on an optimal condition

$$D = 1 - \frac{\text{average } Y_d \text{ result on all accessions}}{\text{average } Y_p \text{ result on all accessions}}$$

Clarke (1984) cit. Sumartini *et al* (2013) categorized drought tolerant to 3 groups i.e.

1. $S < 0.50$ = Tolerant to drought (T)
2. $0.50 < S < 1.00$ = relatively tolerant to drought (RT)
3. $S \geq 1.00$ = relatively sensitive to drought (RS)

RESULT AND DISCUSSION

Generally, eggplant accessions that used in the research showed adaptation to drought stress by making change to its morphology and physiology on its component weather vegetative or generative components. Plant that exposed to drought stress would reduce its components compared to normal condition. On vegetative components, every accessions

had its own excellence on the adaptation mechanism to drought. Plant height, root length, root dry weight, leaf size, specific leaf size of most accessions showed some reduction compared to control. On root fresh weight, SLTE 3 accessions gave the best response. On leaf number, accessions SLTE 42 and SLTE 46 gave best response. On leaf fresh weight, accessions SLTE 2 and SLTE 13 gave best response. On leaf dry weight, accession SLTE 2 gave best response. On stem fresh and dry weight, accession SLTE 2 gave best response. On stem-root ratio, accessions SLTE 4, SLTE 46, and SLTE 74 gave best response. Generally, SLTE 2 accession had the best adaptation to drought on vegetative component.

On generative component, there were some accessions that did not tolerate to drought on generative phase which shown by no fruit form. On the day of flowering, accession SLTE 25 and SLTE 47 gave the best response. On fruit weight, accession SLTE 15 gave the best response. On fruit length, accessions SLTE 15, SLTE 42, and SLTE 44 gave the best response. On fruit diameter, accession SLTE 15 gave the best response. On fruit number, accession SLTE 3 and SLTE 15 gave the best response. Generally, accession SLTE 15 gave the best response on the generative components. From these result, drought sensitivity index would be used to determine the tolerant level of eggplants accessions.

The result showed that there were variations on the tolerant level of accessions to drought stress. Accessions that had good tolerant level is classified as tolerant (T) with the amount index result below 0.5. Accessions that had moderate resistance level classified as relatively tolerant (RS) with the amount of index result between 0,5 to 1. Accessions that had sensitive level is classified as sensitive (S) with the amount of index result higher than 1.

According to sensitivity index value of any variable, it could be seen the general tolerant level of the accessions. There was 1 accession that included to Tolerant (T) category which was SLTE 44. There were 9 accessions that included to relatively tolerant (RT) category which were SLTE 1, SLTE 2, SLTE 3, SLTE 5, SLTE 8, SLTE 13, SLTE 15, SLTE 18, and SLTE 42. Last, there were 10 accessions that included to sensitive (S) category which were SLTE 4, SLTE 6, SLTE 7, SLTE 9, SLTE 25, SLTE 28, SLTE 45, SLTE 46, SLTE 47, and SLTE 74. The result of sensitivity index showed that half of the accessions had good enough tolerant level to drought stress.

Table 1. Drought sensitivity index of 20 eggplant accessions

No	Accession	Index Value									
		Plant height	Root length	Fresh root weight	Dry root weight	No. of leaves	Leaf size	Fresh leaf weight	Dry leaf weight	Fresh Stem weight	Dry stem weight
1	SLTE 1	0.246 (T)	0.722 (RT)	0.491 (T)	0.257 (T)	0.936 (RT)	0.491 (T)	0.903 (RT)	1.102 (S)	0.975 (RT)	1.058 (S)
2	SLTE 2	0.185 (T)	1.531 (S)	0.423 (T)	0.897 (RT)	0.022 (T)	0.035 (T)	0.146 (T)	0.129 (T)	0.481 (T)	0.025 (T)
3	SLTE 3	0.279 (T)	0.642 (RT)	0.097 (T)	0.101 (T)	1.211 (S)	0.642 (T)	0.506 (RT)	0.841 (RT)	0.791 (RT)	1.151 (S)
4	SLTE 4	0.200 (T)	1.291 (S)	0.715 (RT)	0.265 (T)	1.142 (S)	1.032 (S)	1.057 (S)	1.052 (S)	1.074 (S)	1.019 (S)
5	SLTE 5	0.237 (T)	0.025 (T)	0.847 (RT)	0.501 (RT)	0.772 (RT)	0.616 (RT)	0.507 (RT)	0.825 (RT)	0.821 (RT)	0.229 (T)
6	SLTE 6	0.062 (T)	2.448 (S)	0.957 (RT)	1.126 (S)	0.951 (RT)	0.818 (RT)	1.181 (S)	1.155 (S)	1.175 (S)	1.164 (S)
7	SLTE 7	2.957 (S)	0.547 (RT)	1.791 (S)	1.948 (S)	1.896 (S)	2.019 (S)	1.741 (S)	1.548 (S)	1.406 (S)	1.494 (S)
8	SLTE 8	0.449 (T)	0.926 (RT)	0.539 (RT)	0.031 (T)	0.931 (RT)	0.014 (T)	0.734 (RT)	1.112 (S)	0.891 (RT)	1.041 (S)
9	SLTE 9	2.969 (S)	1.858 (S)	1.897 (S)	2.141 (S)	1.628 (S)	1.364 (S)	1.403 (S)	1.442 (S)	1.597 (S)	1.732 (S)
10	SLTE 13	0.452 (T)	1.208 (S)	0.131 (T)	0.098 (T)	1.319 (S)	1.249 (S)	0.896 (RT)	1.248 (S)	0.704 (RT)	0.922 (RT)
11	SLTE 15	0.307 (T)	1.611 (S)	0.185 (T)	0.021 (T)	0.734 (RT)	0.123 (S)	0.503 (RT)	0.687 (RT)	0.028 (T)	-0.351 (T)
12	SLTE 18	1.224 (S)	0.342 (T)	0.394 (T)	0.956 (RT)	0.709 (RT)	1.275 (S)	0.185 (T)	0.176(T)	0.919 (RT)	0.287 (T)
13	SLTE 25	2.258 (S)	0.141 (T)	0.803 (RT)	0.062 (T)	1.346 (S)	1.481 (S)	1.507 (S)	1.279 (S)	0.677 (RT)	1.295 (S)
14	SLTE 28	0.049 (T)	2.017 (S)	1.577 (S)	1.198 (S)	0.644 (RT)	1.051 (S)	1.402 (S)	1.241 (S)	1.244 (S)	1.274 (S)
15	SLTE 42	0.272 (T)	1.591 (S)	0.111 (T)	0.004 (T)	0.426 (T)	0.507 (RT)	1.053 (S)	0.914 (RT)	0.864 (RT)	1.015 (S)
16	SLTE 44	1.379 (S)	0.046 (T)	0.552 (RT)	0.204 (T)	1.172 (S)	0.885 (RT)	0.346 (T)	0.039 (T)	0.538 (RT)	0.416 (T)
17	SLTE 45	1.822 (S)	0.248 (T)	1.943 (S)	1.909 (S)	1.594 (S)	1.723 (S)	1.471 (S)	1.296 (S)	1.361 (S)	1.272 (S)
18	SLTE 46	1.131 (S)	0.839 (RT)	1.878 (S)	2.021 (S)	0.598 (RT)	1.671 (S)	1.349 (S)	1.317(S)	1.478 (S)	1.456 (S)
19	SLTE 47	1.931 (S)	0.555 (RT)	2.613 (S)	4.043 (S)	0.982 (RT)	2.291 (S)	1.604 (S)	0.888 (RT)	1.525 (S)	1.457 (S)
20	SLTE 74	2.023 (S)	0.548 (RT)	1.829 (S)	2.429 (S)	0.663 (RT)	0.083 (T)	0.337 (T)	1.361 (S)	0.928 (RT)	1.453 (S)

Information :

T = tolerant (<0.5)
 RT = relatively tolerant (1<x<0.5)
 S = sensitive (>1)

Continue of table 1. Drought sensitivity index value on tested accessions

No	Accession	Index Value						
		Fruith weight	Fruit length	Fruit diameter	No. of fruit	Day of flowering	Leaf specific size	Shoot/root ratio
1	SLTE 1	1.427 (S)	1.442 (S)	1.561 (S)	1.092 (S)	0.675 (RT)	2.321(S)	1.255(S)
2	SLTE 2	1.427 (S)	1.442 (S)	1.561 (S)	1.092 (S)	0.424 (T)	0.481(T)	-0.471(T)
3	SLTE 3	0.841 (RT)	0.619 (RT)	0.461 (T)	0.655 (RT)	2.532 (S)	1.777(S)	1.241(S)
4	SLTE 4	1.427 (S)	1.442 (S)	1.561 (S)	1.092 (S)	0.839 (RT)	1.015(S)	1.124(S)
5	SLTE 5	1.161 (S)	0.957 (RT)	0.845 (RT)	0.955 (RT)	1.338 (S)	0.609(RT)	0.295(T)
6	SLTE 6	0.859 (RT)	0.904 (RT)	0.534 (RT)	0.987 (RT)	0.661 (RT)	1.712(S)	1.497(S)
7	SLTE 7	1.427 (S)	1.442 (S)	1.561 (S)	1.092 (S)	1.374 (S)	0.349(T)	1.016(S)
8	SLTE 8	0.803 (RT)	0.939 (RT)	0.489 (T)	0.997 (RT)	0.464 (T)	3.813(S)	1.305(S)
9	SLTE 9	1.427 (S)	1.442 (S)	1.561 (S)	1.092 (S)	0.741 (RT)	2.568(S)	1.553(S)
10	SLTE 13	0.841 (RT)	0.863 (RT)	0.574 (RT)	0.963 (RT)	0.971 (RT)	0.740(RT)	0.998(RT)
11	SLTE 15	0.449 (T)	0.275 (T)	0.072 (T)	0.728 (RT)	1.137 (S)	1.513(S)	0.705(RT)
12	SLTE 18	0.647 (RT)	0.959 (RT)	0.911 (RT)	1.049 (S)	0.000 (T)	-0.975(T)	1.232(S)
13	SLTE 25	1.427 (S)	1.442 (S)	1.561 (S)	1.092 (S)	1.001 (S)	1.781(S)	1.661(S)
14	SLTE 28	1.277 (S)	1.122 (S)	0.923 (RT)	0.546 (RT)	0,114 (T)	2.256(S)	1.226(S)
15	SLTE 42	0.513 (RT)	0.277 (T)	0.247 (T)	0.819 (RT)	0.909 (RT)	1.303(S)	1.166(S)
16	SLTE 44	0.762 (RT)	0.121 (T)	0.747 (RT)	0.946 (RT)	0.848 (RT)	-0.828(T)	0.216(S)
17	SLTE 45	1.427 (S)	1.442 (S)	1.561 (S)	1.092 (S)	2.257 (S)	-0.116(T)	1.008(S)
18	SLTE 46	1.427 (S)	1.442 (S)	1.561 (S)	1.092 (S)	0.104 (T)	0.515(RT)	1.314(S)
19	SLTE 47	1.427 (S)	1.442 (S)	1.561 (S)	1.092 (S)	0.382 (T)	-1.851(T)	-2.127(T)
20	SLTE 74	1.427 (S)	1.442 (S)	1.561 (S)	1,092 (S)	2.199 (S)	5.918(S)	1.282(S)

Information :

T = tolerant (<0.5)
 AT = relatively tolerant (1<x<0.5)
 S = sensitive (>1)

2, SLTE 5, SLTE 15, SLTE 18, and SLTE 44 show good tolerant level.

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CONCLUSIONS

It can be concluded that eggplant accessions had an adaptation mechanism to drought by reducing its growth and development, accessions that had good tolerant level show a smaller reduction comparing to control, and based on drought sensitivity index, SLTE

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