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PAPAYA GERMPLASM DROUGHT STRESS RESPONSE IN THE GERMINATION AND SEEDLING PHASE

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ABSTRACT

Response of a biotic resistance for genetic resources against can be done gradually. Initial selection was done on the seed and nursery phase. Polyethilen glycol (PEG)-6000 was often used in the germination media as a osmotikum solution to indirectly select the drought resistance plants. The study aimed to obtain the response information of 20 genotypes of papaya germplasm to drought in the early phase of growth. The research was conducted in the screenhouse of KP Sumani, Tropical Fruit Research Institute from January to December 2015. The study consisted of two phases, namely the germination and nursery phase. The research design used was a randomized block design of two factors. In the germination phase, the first research factor was PEG-6000 concentration, namely field capacity (without PEG-6000), 10% PEG-6000, and PEG-6000 15%, whereas the second factor was20 genotypes of papaya. In the nursery phase, the first factor was moisture content, comprised of media FC, FC-PEG, 50% FC, FC-PEG 50%, whereas the second factor was 5 papaya genotypes which were selected from the germination phase. The results showed that the drought resistance selection in the seed germination phase based on germination perentage and seed vigor index> 60% in a concentration of 15% PEG-6000, genotypes 18,19, 28,29, and 20were selected. The results also showed that the height plants grew in polybags was strongly influenced by drought stress either given during germination and nursery phases. Value on drought vulnerability index both of germination and nursery phases, 20 genotypes of papaya germplasms were chatagorized as relatively drought-resistant.

Keywords: germination, drought stress, moisture content, papaya.

1. INTRODUCTION

The early selection in the seed phase to drought stress is one of the activities required in assembling a superior variety. The aim is to find out which genotypes have the potential to adapt well to dry land. Genetic material selection in large quantities requires a lot of cost, energy and time, because it needs to be supported by effective and efficient selection methods in the field. So it is necessary to assemble superior varieties of papaya resistant to environmental stress needed for the future.

Plant responses to drought begin with physiological responses that followed by morphological changes, both as a mechanism of plant resistance and the impact of processes due to drought

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stress. Morphological changes also have an impact on changes in advanced physiological processes, resulting in mutual influence between the two (Sujinah and Jamil, 2016). One mechanism of plant resistance to drought stress is that plants are able to control transpiration (Pitono et al. 2008). Lapanjang *et al.* (2008) stated that drought-stricken plants attempt to maintain growth by reducing water use by minimizing all plant surfaces associated with evapotranspiration.

One of screening plants methods against drought stress resistance is by germination and inhibition of growth in osmolic solutions including the use of PEG (*PolyEthylene Glycol*). The use of *polyethylene glycol* (PEG) with molecular weights > 6000 has been widely used in the research of the water stress effect on the growth of Purwanto plants (1999). According to Guo *et al*. (2014) germination is one of the most critical periods in the plant life cycle. Furthermore, according to Lestari (2006) seeds selected through screening using polyethylene glycol (PEG) can grow well in drought stress in the field, such as in corn, boer lovegrass (*Eragostis curvula Nees*) and paddy.

Several researches had used PEG-6000 as a simulator to predict drought resistance in the germination phase, including peanuts (Adisyahpura *et al*., 2004), oil palm (Palupi and Dediwiryanto 2008), alfalfa (Hamidi and Safarnejad, 2010), soybean (Savitri, 2011), cotton (Meneses et al., 2011), hybrid paddy (Afa *et al*. 2012). The research of Efendi *et al* (2009) used PEG-6000 with 0, 10, 15 concentration and 20% corn early selection. The same research used PEG-6000 concentrations of 15% and 20% on 36 genotypes of soybeans (Widoretno, 2011).

Screening of Papaya germplasm genotype which has the potential for genetic control sources in the assembly of papaya superior varieties is needed. It is hoped that by using this early selection, potential genotypes which have drought resistance will be obtained.

2. MATERIALS AND METHODS

The research was conducted from January to December 2015, at the Sumani Experimental Garden, Research Institute for Tropical Fruit Plants. It consisted of two stages: the first stage in the germination phase and the second in the nursery phase. The design used was a 2 factor randomized design with 3 replications. The first factor was the PEG concentration consisted of three levels, namely: controlling (without PEG), PEG-6000 10% and 15%. The second factor was 20 papaya genotypes (10 hybrids, 5 elders and 5 local papayas).

Germination Phase

The PEG-6000 treatment to the sand media was 65 ml per germination box with a weight of 275g sand media, while for the control media, the sand was moistened with water with the same volume. Each treatment consisted of 4 germination boxes, each planted with ten papaya seeds. Plant nurture includes watering with a 5% PEG-6000 solution which was done every 2 days (± 10-15 ml) while the control was watered the water by using a hand sprayer until media moisture was as initial and pest control was done by sprinFCing 3G curator around the germination tray.

The germination phase observation was carried out on the first day until the 21st day. Calculating the germination and vigor of the seeds every day until they were 21 days after

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sowing. Observations were made twice, counting normal germination on day 14 and day 21 (seeds number that did not germinate day 14). The criteria for normal germination is if the hypocotyl grows straight and is healthy the cotyledon has been fully opened, accompanied by healthy shoots. Abnormal and dead sprouts were also calculated, the percentage of seed germination (SG), vigor index (VI) calculated the number of normal sprouts that appeared in the first count observations (day 14), plant wet weight (g), plant dry weight (g), primary root length (cm).

Seedling phase

After 21 days the seed germination was transferred to the polybag based on the results of the selection in the germination phase with the germination power (GP) and the highest vigor index in the 15% PEG-6000 germination media and controlling (FC without PEG). Regulating soil moisture content was done by adding water every day according to treatment using the gravimetric method. Wind dry soil used was 4000 grams per polybag. The soil used was the latosol type which has previously been determined dry wind moisture content (WM) and moisture content at field capacity (CF) based (Abdurachman *et al*. 2008).

Selected genotypes were transferred to polybags with two media humidity namely FC and 50% FC. The polybags used were 20x40 cm which contained a mixture of soil + manure media (1: 1) with 4 kg media weight. To get the moisture of FC media at the beginning of water, add 2 liters of water and 50% FC of 1 liter, then maintenance of 2 days of watering by adding water in accordance with the initial weight of polybags (gravimetric method). Plants were maintained and observed until they were 45 days after moving. Plant observations were made on the variables of plant height, leaves number (data not show) and stem diameter up to 45 days after moving.

The drought susceptibility index is calculated using the formula compiled by Fischer and Maurer (1978) in Clarke et al. (1984) namely:

$$D = \frac{\text{YD results on all genotypes}}{\text{YP results on all genotypes}}$$

$$S = \frac{1 + \left\{\frac{YD}{YP}\right\}}{D}$$

YD = observation average value under drought conditions (PEG-6000 15%)

YP = observation average value under irrigation conditions (without PEG-6000)
The drought vulnerability category according to Clarke *et al.* (1984) are:

a. S <0.50 : relatively drought resistant
b. 0.50 <S <1.0 : somewhat drought resistant
c. S> 1.0 : relatively drought resistant

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Data analysis: Observation data were analyzed by variance and follow-up tests analysis using the BNJ test.

3. RESULTS AND DISCUSSION

Drought Stress in the Germination Phase

Average germination of 20 papaya genotypes on PEG 6000 media Table 1. Almost 50% of genotypes were very responsive to PEG-6000. It was seen that germination was decreasing with an increase in PEG-6000 concentration. This was due to the influence of PEG-6000 which had high osmotic pressure which caused water uptake (imbibition) to be inhibited by seeds. As a result, cell activation and enzyme activity was disrupted so that the percentage of germination power was low. Research results (Okcu *et al*., 2005; Lestari, 2006; Meneses *et al*., 2011; Brevedan *et al*., 2012) high osmotic pressure caused a decrease in water uptake by seeds which caused a low percentage of germination. PEG has the property to control seed imbibition and hydration. In addition, PEG is also used in testing the resistance of seeds to drought by taking into account the drought index.

According to Guo *et al*. (2014) germination is one of the most critical periods in the plant life cycle. In a low water potential pressure condition is a determining factor in inhibiting seed germination.

Tabel 1 .Germination means of 20 papaya genotypes on the drought stress in germination phase

Number	*Genotype code*	*Germination (%)*			
		Non PEG-6000	**PEG-6000 10%**	**PEG-6000 15%**	**GenotypeAverage**
1	G2	51,67	36,67	21,67	36,67a-d
2	G4	46,67	46,67	20,00	34,44 a-c
3	G7	33,33	20,00	16,67	23,33 ab
4	G9	51,67	33,33	26,67	37,22a-d
5	G11	38,33	46,67	33,33	39,44b-e
6	G13	56,67	53,33	55,00	55,00e-h
7	G15	58,33	68,33	33,33	53,33e-g

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8	G17	85,00	58,33	43,33	62,22f-i
9	G18	85,00	71,67	58,33	71,67 h-j
10	G19	86,67	60,00	56,67	67,78 g-i
11	G20	83,33	58,33	66,67	69.44g-j
12	G22	53,33	61,67	23,33	46,11 c-f
13	G23	18,33	18,33	33,33	23,33 a-b
14	G24	66,7	25,00	48,33	26,67 a-b
15	G25	50,00	43,33	43,33	45,56 c-f
16	G26	46,67	55,00	65,00	55,56 e-h
17	G27	25,00	18,33	16,67	20,00 a
18	G28	85,00	75,00	53,33	71,11 g-j
18	G29	88,33	81,67	63,33	77,78 i-j
20	G30	90,00	90,00	78,33	86,11 j
Mean of germination media		56,08 a	50,17 b	43,17c	

The followed numbers by the same uppercase and lowercase letters in the same row and column are not significantly different in the BNJ test level α 0.05 (arcsine transformed data).

The genotypes with the highest percentage of germination power in the 15% PEG-6000 media were G18, G19, G20, G26, G29 and G20 ranging between 50-73%. This shows that the six genotypes were relatively resistant to water shortage conditions during germination so that they could still germinate normally in drought conditions. According to Vergara (1995) that water absorbed in the process of seed germination will be used in the dehydration process and to increase the metabolic activity of cells in the seed. The stronger a genotype faces high osmotic stress, the more resistant it is to drought stress.

Tabel 2. Vigor Index Average of 20 papaya genotypes on the drought stress in germination phase

Number	***Genotype code***	**Indeks Vigor (%)**	***Genotypes Average***

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		Non PEG-6000	PEG-6000 10%	PEG-6000 15%	
1	G2	40,00	33,33	13,33	28,89 c-e
2	G4	48,33	21,67	8,33	26,11 b-e
3	G7	11,67	13,33	6,67	10,56 a-b
4	G9	36,67	33,33	25,00	31,67 c-e
5	G11	38,33	26,67	5,00	23,33 b-d
6	G13	61,67	41,67	11,67	38,33 d-g
7	G15	55,00	48,33	26,67	43,33 e-g
8	G17	58,33	80,00	25,00	54,44 g-h
9	G18	71,67	50,00	20,00	50,56 f-h
10	G19	73,33	48,33	40,00	53,89 g-h
11	G20	81,67	61,67	50,00	64,44 g
12	G22	43,33	45,00	15,00	34,44c-f
13	G23	18,33	10,00	1,67	10,00 a-b
14	G24	40,00	6,67	10,00	18,89 a-c
15	G25	43,33	35,00	8,33	28,89 c-e
16	G26	18,33	40,00	8,33	43,33 e-g
17	G27	11,67	5,00	1,67	6,11 a
18	G28	68,33	31,67	18,33	39,44 d-g
18	G29	61,67	73,33	26,67	53,89 g-h
20	G30	63,33	65,00	33,33	53,89 g-h
Mean of germination media		50,42 a	38,50 b	18,25 c	

The followed numbers by the same uppercase and lowercase letters in the same row and column are not significantly different in the BNJ test level α 0.05 (arcsine transformed data).

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The interaction between genotypes and PEG-6000 had no significant effect on the vigor indexes percentage shown in Table.2. The sole effect of PEG-6000 was significantly on the vigor index variable, in media without PEG-6000 (control) the percentage of vigor index (50.42%) was significantly different from the 10% PEG-6000 (38.50%). The 15% increase in PEG-6000 concentration further reduced the vigor index to 18.25%. The research results of Afa *et al*. (2013)The distribution of PEG-6000 for early detection of hybrid paddy tolerance to drought stress using PEG-6000 significantly affected the decline in seed vigor index, this was caused by stunted root growth and budding. Zapico *et al*. (2008) reported that the distribution of 15% PEG-6000 in sensitive lowland rice decreased seed germination.

The vigor index decrease was in approximately 50% of the conditions without stress. According to Syafruddin and Miranda (2015) high seed vigor was characterized by the rapid and prevalent growth and being able to produce mature plants that are normal and produce well in a sub-optimal growing environment. Seed vigor can be important information to know the ability to grow normally under optimal and sub optimal conditions (Shankar, 2006). According to Basha *et al*. (2015) a good growth rate (vigor) can be used as an important benchmark for the selection of tolerant germ-plasma.

Normal sprouts dry weight variable (NSDW) as in Table 3, the interaction between genotype and PEG-6000 distribution had no significant effect. The PEG-6000 distribution effect was significantly on the NSDW variable, where the mean value of PEG-6000 without PEG-6000 control 0.15g decreased to 0.04-0.05g. Normal germination weight decreased with increasing concentration of PEG-6000. The single effect of genotype was significantly different on the variables of the genotype which had a mean value of> 0.1 g including G15, G18, G19, G20, G26, G28, G29 and G20. The high number of genotypes is due to the growth of leaves, roots and hypocotyl in the condition of water deficit still developing. According to Afa *et al*. (2013) tolerant plants respond the water deficits by optimizing physiological processes at a critical phase so plants can grow and conserve water.

Tabel 3. Average dry weight of normal sprouts of 20 papaya genotypes in the drought stress phase of germination

Number	Genotype code	Dry weight of normal sprouts (g)			Genotype Average
		Non PEG-6000	PEG-6000 10%	PEG-6000 15%	
1	G2	0.09	0.05	0.02	0.05c
2	G4	0.14	0.02	0.01	0.06c
3	G7	0.23	0.02	0.01	0.09c
4	G9	0.09	0.03	0.03	0.05c

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5	G11	0.12	0.04	0.06	0.07c
6	G13	0.17	0.05	0.08	0.10bc
7	G15	0.23	0.06	0.03	0.11bc
8	G17	0.18	0.07	0.02	0.09c
9	G18	0.24	0.07	0.13	0.15abc
10	G19	0.28	0.07	0.05	0.13abc
11	G20	0.23	0.06	0.06	0.11abc
12	G22	0.16	0.05	0.02	0.08c
13	G23	0.10	0.01	0.01	0.04c
14	G24	0.21	0.01	0.01	0.07c
15	G25	0.12	0.04	0.01	0.06c
16	G26	0.33	0.05	0.02	0.13abc
17	G27	0.06	0.05	0.00	0.04c
18	G28	0.47	0.17	0.16	0.26a
19	G29	0.42	0.09	0.24	0.25ab
20	G30	0.34	0.22	0.18	0.25ab
Germination Media Average		0.15a	0.05b	0.04b	

Numbers in the same column and row followed by the same lowercase letters are not significantly different in the BNJ test level $\alpha = 0.05$ (data transformed ($\sqrt{x} + 0.5$)

The interaction effect of PEG-6000 distribution and 20 papaya genotypes was not significant on the variables of primary root length Table.5. The average primary root length of 20 genotypes in media without PEG (control) 3.95 cm was significantly different from the PEG 10% and 15% (3.21cm and 1.97 cm) distribution. The average root length decreases with an increase in PEG-6000 concentration in the germination medium. This is an inhibitory effect on root growth of the PEG 6000 molecule. In line with the research of Anwer *et al*. (2004); Basal *et al*. (2005) in peanuts, and Sumartini *et al*. in cotton (2013) where root length decreased with an increase of PEG-6000 concentration. The drought mechanism appeared on the root character and leaf character was used as an indicator to evaluate the drought resistance in Suwarno et al. (2016)

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Tabel 4. Rootlength average of 20 papaya genotypes in the drought stress of the germination phase

Number	Genotype Code	Root Length (cm)			Genotype Average
		Non PEG-6000	PEG-6000 10%	PEG-6000 15%	
1	G2	3.29	4.36	2.03	3.23 abcd
2	G4	5.72	3.67	1.62	3.67 abcd
3	G7	3.29	3.11	1.36	2.59 abcd
4	G9	3.64	4.72	3.51	3.95 abc
5	G11	5.19	3.96	1.94	3.70 abcd
6	G13	6.16	3.67	2.50	4.11 abc
7	G15	5.92	4.65	3.75	4.77a
8	G17	4.47	4.19	2.50	3.72 abcd
9	G18	5.42	4.37	3.84	4.54 ab
10	G19	5.25	4.12	3.70	4.36 ab
11	G20	5.41	4.09	4.05	4.51 ab
12	G22	4.71	4.65	2.31	3.89 abcd
13	G23	2.92	1.69	1.18	1.93 bcde
14	G24	3.53	1.01	2.03	2.19 abcde
15	G25	4.60	3.75	2.18	3.51 abcd
16	G26	5.74	4.46	1.56	3.92 abcd
17	G27	3.60	3.34	0.88	2.61 abcd ab
18	G28	5.98	4.15	3.16	4.43 ab
19	G29	6.05	4.18	3.57	4.60 a
20	G30	5.47	4.24	3.57	4.43 ab

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Germination media Average	3.95a	3.21b	1.97c	

Numbers in the same column and row followed by the same lowercase letters are not significantly different in BNJ test level $\alpha = 0.05$ (data transformed ($\sqrt{x} + 0.5$)

The genotypes influence on root length varied with 20 genotypes having root lengths of 0.17-4.77 cm. The genotypes that have the longest root length > 4 cm were G6, G13, G15, G18, G19, G20, G28, G29 and G30. According to Basal *et al.* (2005) root length can be used as a selection criteria for cotton plants for resistance to drought in the germination phase. Better root growth systems under stress conditions can be considered as tolerant germ-plasma.

Table 5. Drought coolness index based on the formula of Fischer and Maurer (1978) in Clarke *et al*. (1984) showed that the 20 papaya genotypes selected at the germination stage by germinating variables, vigor index and root length obtained scores > 1.0 with a relatively intolerable category. Furthermore, the 20 genotypes selection that moved to polybags was based on the percentage of germinating power at a 15% PEG-6000 concentration.

Table 5 Drought susceptibility index of 20 papaya genotypes in the germination phase

Genotype Code	Root Length	Vigor Index	Geminates Power	Score	Category
G2	3,22	3,8	2,2	>1,0	RTT
G4	2,59	3,6	2,3	>1,0	RTT
G7	2,61	-	3,02	>1,0	RTT
G9	3,88	8,84	3,58	>1,0	RTT
G11	2,74	3,39	2,17	>1,0	RTT
G13	2,85	3,63	2,49	>1,0	RTT
G15	3,46	4,33	2,58	>1,0	RTT
G17	3,49	5,26	2,52	>1,0	RTT
G18	3,46	4,40	2,99	>1,0	RTT
G19	3,73	4,80	3,45	>1,0	RTT
G20	3,53	4,87	2,78	>1,0	RTT
G22	3,17	3,92	2,32	>1,0	RTT
G23	2,80	3,25	2,18	>1,0	RTT

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G24	5,81	3,83	2,75	>1,0	RTT
G25	2,90	3,67	2,29	>1,0	RTT
G26	2,50	3,20	2,29	>1,0	RTT
G27	2,38	3,66	2,29	>1,0	RTT
G28	3,10	3,85	3,03	>1,0	RTT
G29	3,24	4,32	2,96	>1,0	RTT
G30	3,33	4,81	3,15	>1,0	RTT

Note: RTT: relatively cannot stand

Drought Stress in the Seedling Phase

Drought stress selection in the germination phase obtained five selected genotypes that were relatively tolerant of drought stress using PEG-6000. The selected genotypes were G18, G19, G28, G29 and G30. Furthermore, the five genotypes of age 21 days after germination were transferred to the polybags media with soil moisture (SM) and 50% Field Capacity (50% FC). The transferred genotypes came from different germination media, namely without PEG-6000 (FC) and PEG-6000 15%.

Table 6. Mean height of plants of five papaya genotypes under drought stress at 45 days after moving to polybags

Genotype Code	Plant Height (cm)				
	FC	FC-PEG	FC 50	FC50-PEG	Genotype Average
A(G18)	36.94bc A	29.98de B	21.50fghi C	17.67ijk D	26.52
B(G19)	36.22bc A	27.42ef B	20.52ghij C	12.39k D	24.14
C(G28)	34.14cd A	22.66fghi B	19.44ghij C	15.22jk D	22.87
D(G29)	43.11a A	23.83fgh B	27.06ef C	21.43fghi B	28.86

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E(G30)	40.66ab A	18.83ghij B	24.22efg C	18.00hijk B	25.43
Average moisture of media	38.22	24.54	22.55	16.94	

The numbers followed by the same uppercase and lowercase letters in the same row and column are not significantly different in the BNJ test level α 0.05

FC : field capacity with seed without stress in germination

FC50 : 50% field capacity of seeds without stress in germination

FC-PEG : field capacity of the seed comes from the stress of PEG-6000 15%

FC50-PEG : 50% of the capacity of the seed field comes from the stress of PEG-6000 15%

The observation results showed the interaction between media humidity and five real papaya genotypes on the plant height variable, while on the leaf number and stem diameter variables the interaction had no significant effect. Plant height with a medium field capacity (FC) in Table 7, ranged from 34.14 to 43.11 cm in which the G29 genotype had a significantly different height from the other genotypes. The G 29 plant height was different in the condition of the medium half the field capacity (50FC) decreasing to 27.07 cm. The genotypes that were very responsive to media stress were G 18, G19 and G30 where the plant height of the three genotypes was significantly different in the condition of experiencing media stress both during germination and in the humility of the polybags media. According to Sujinah and Jamil (2016) the growth response expressed in plant morphology and physiology can be used as an indicator that can be used in the selection of tolerant varieties lacking water.

Drought stress during the germination phase and 50% FC (50FC-PEG) media influenced plant height where G29 had a higher plant than the other four genotypes. This indicates that the genotype possessed good ability to survive drought stress conditions. It can grow in conditions of water shortage. According to Kramer (1983) plant growth, including height, started by the forming shoots process which were cell division and enlargement. This process could occur at high levels of cell turgidity. Furthermore Muller (1979) explains cell turgor is a hydrostatic pressure which is determined by the amount of water in the protoplasm at a time. The ability of plants to improve cell tugor due to the availability of water according to their needs so that cell division is active again.

The interaction effect of media humidity with the genotype was not significant on the leaf number variable, but the leaves number was influenced by a single factor of media humidity but was not significantly affected by the genotype. The leaves average number of the five genotypes

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at FC media moisture content (17.53) was significantly different from FC-PEG (11.67). Decreasing in the number of leaves occurred in plants that experience the stress in the germination phase. Whereas in the stress media 50% FC the mean number of leaves was not significantly different. This illustrates the plants that suffer from drought stress early were difficult to spur growth, including the leaves addition.

The media humidity interaction and genotype did not significantly affect the variable of plant stem diameter (Table 9). The single effect of genotype also had no significant effect on stem diameter, but the single effect of media humility significantly affected the average diameter of the stem. Table 9 shows the field capacity (FC) of the five papaya genotypes that have a stem diameter of 1.28-1.36 cm, but in the condition of stem diameter drought stress decreased from 0.3 to 0.5 cm.

Table 7. Average stem diameter of five papaya genotypes with a dry age of 45 hsp (45 days after planting in polybags)

Genotype Code	StemsDiameter (cm)				
	FC	**FC-PEG**	**FC 50**	**50 FC - PEG**	**Genotype Average**
G1	1.20	1.00	0.90	0.62	0.95 tn
G2	1.36	0.93	0.83	0.55	1.22
G3	1.28	0.96	0.89	0.62	0.94
G4	1.36	0.99	0.88	0.63	0.92
G5	1.37	0.89	0.93	0.71	0.98
Media Mean Moisture	1.33a	0.93bc	1.13ab	0.63c	

The numbers followed by the same uppercase and lowercase letters in the same row and column are not significantly different in the BNJ test level α 0.05

FC : Field capacity of seed without stress in germination

50 FC : 50% field capacity of seeds without stress in germination

FC-PEG : Field capacity of the seed comes from the stress of PEG-6000 15%

50FC-PEG : 50% of the capacity of the seed field comes from the stress of PEG-6000 15%

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The plants diameters that do not experience drought stress (FC) have larger stems (1.13-1.33 cm) while the diameter of the stems originating from drought stressed seedlings in the germination phase (FC-PEG) was significantly different from the range of stem diameter 0.89-1.00 cm. The seeds that have been stressed since the germination phase of FC-PEG and 50 FC-PEG had a stem diameter that is not significantly different. This shows that in the germination phase was a crucial period of plant growth, seeds that experience stress increased in stem diameter were difficult to increase even though they have optimum conditions.

Table 8. above shows the drought susceptibility index of five papaya genotypes after being transferred to a polybag, from the calculation results obtained the five genotypes had a value (S) score >1 with relatively non-resistant categories (Clarke *et al*. (1984). The five genotypes tested on three variables plant height, number of leaves and stem diameter showed a decreased response to growth compared to conditions in the field capacity.

Table 8. Drought susceptibility index of five papaya genotypes aged 45 days after planting

Genotype Code	Plant Height	Leaves Number	Stem Diameter	Score	Catagory
A (G18)	2,93	2,89	2,27	>1	Relatively cannot stand
B (G19)	2,97	2,88	3,84	>1	Relatively cannot stand
C (G28)	3,15	2,98	2,29	>1	Relatively cannot stand
D (G29)	3,64	2,82	2,51	>1	Relatively cannot stand
E (G30)	3,89	2,67	2,48	>1	Relatively cannot stand

4. CONCLUSION

1. Drought selection in the germination phase based on seed germination power and seed vigor index> 60% at PEG-6000 concentrations of 15% selected genotypes 18, 19, 28, 29 and 30.
2. Plant growth results in polybag indicates the plant height that is strongly influenced by drought stress both given during germination and seedling.
3. Based on the drought susceptibility index both in the germination phase and in the seedling 20 genotypes of papaya plasma germ including the category of relatively cannot stand for the drought.

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Suggestion

This research only gets preliminary information from the selection and evaluation of papaya germ plasma against drought stress, so it is necessary to carry out more comprehensive further research related to the analysis of pro-line and molecular content of genes resistant to drought.

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