Effect of Corn Extract and Solution of PEG to Increase Viability and Vigour of Sweet Corn Seed Deterioration at Different Incubation Periods

[1*]Herma Julendri, [2]Halimursyadah, and [2]Hasanuddin

[1]Student of Departement of Agrotechnology, Faculty of Agriculture, Syiah Kuala University, Darussalam, Banda Aceh
[1]Lecturer of Agriculture Faculty, Syiah Kuala University, Banda Aceh 23111, Indonesia
[*] *Corresponding Author*: hermajulendri@ymail.com, rhalimursyadah@yahoo.com

Abstract
This study aims to determine the combination of young corn extract and PEG with an incubation period of seed viability and vigor of the sweet corn expired. The study carried out at the Laboratory of Seed Science and Technology Faculty of Agriculture, Syiah Kuala University, Darussalam-Banda Aceh, which lasted from December 2012 to July 2013. Materials used in this study is Expired sweet corn seed with 50% germination. Other materials used are corn extract, PEG 6000, and distilled water. This research used Completely Randomized Design (CRD) factorial 4 x 3, so there are 12 combinations of treatments. Each repeated three times, in order to obtain 36 units of the experiment. Young corn extract concentration factor and solution PEG-2 bar consists of 4 levels, namely: control, 5% + - 2Ψ , 10% + - 2Ψ, and 15% + - 2Ψ. Factors incubation period consists of 3 levels : 18 hours, 24 hours, and 30 hours. Variables measured were potential growth, germination, speed of growth, growing unanimity, vigor index and normal seedling dry weight. The results showed that the concentration of young corn extract very significant effect on the potential variables grow, germination, growing simultaneity, speed of growth, vigor index and normal seedling dry weight. The incubation period of very significant effect on germination variables, simultaneity growth, speed of growth and vigor index. The incubation period significantly affect the potential growth and seedling dry weight normal. There is a significant interaction between young corn extract concentration and incubation period of the vigor index variables. Control treatment (water) with an incubation period of 18 hours is recommended as an alternative to improve the viability and seed vigor of sweet corn expired.
Keyword: Sweet corn expired, Corn Extract, PEG, Viability

Intoduction

Quality seed is one factor that plays an important role in the cultivation of plants. Quality seed has a seed viability of seeds that include high germination percentage and vigour (Sadjad, 1993). Sweet corn (*Zea may saccharata*) seeds belonging to the sugar and carbohydrates (8.20 g) as a cause of the rapid decline of viability especially during storage. Sweet corn seeds may decline during the storage process that will reduce the potential viability and vigor, to the detriment of the crops. Losses incurred, will increase the cost, late of planting time, high percentage of germination failure and abnormal growth (Copeland and Mc Donald, 1997)).Seed which has suffered a setback can be given treatment with chemicals and extract certain materials to improve their vigor. The treatment is called seed invigoration and this treatment is given before the seed is planted. According Rahardja (1998) young corn extract can be used as a medium seed invigoration because the extract contains organic material that can stimulate seed germination after soaking. Young corn used for seed invigoration aged 40 days after anthesis (DAA) which is characterized corn starch began to fill with fluid that forms 'milk stage', corn hair length 3 -5 cm, and green husk (Adisarwanto, 2004). According Efendi (2005) young corn extract can be used to increase the value of seed vigor and viability sweet corn expired. Concentration of young corn is most appropriate to increase the value of seed vigor and viability expired sweet corn is at the level of 5% and the incubation period of the most effective seed is 24 hours. The result of this study indicated germination percentage 70%, growth rate 11.1% / etmal, the potential to grow 71% and simultaneity grow 24%. Polyethylene Glycol (PEG) is one of the compounds used in the priming where PEG has the properties in the control of seed imbibition and hydration. Munifah (1997) on cashew with priming method that uses the PEG can improve the speed of germination and seed growth medium quality and low quality, accelerate the vegetative and generative growth phase, and be able to increase the yield components, and seed quality were produced.

Materials and Methods

Research conducted at the Laboratory of Seed Science and Technology, Agrotechnology Departement, Faculty of Agriculture, Universitas Syiah Kuala, Darussalam, Banda Aceh on December 2012 - July

2013. The material used sweet corn seed varieties F1 Bonanza with gemination 50% as much as 900 grains, solution young corn extract milk ripe stage (phase R3). This phase is formed 18-22 days after silking, Glycole Polyethylene (PEG) 6000 as many as 430.2 g (calculated based on the formula of Michel and Kaufmann), rice paper size 20 x 30 in 180 pieces as substrate test potential viability and vigor test method with paper rolled in plastic test, and aquabidestilata. The tools used: germinator standart type Memmert 217/529-3723, analytical balance Chyo JP2-160 type, aerator, and a blender. The experimental design was completely randomized design (CRD) 4 x 3 factorial design with three replications with two factors, namely the concentration of young corn extract and PEG solution (J) and the incubation period the seed (I). Young corn extract concentration factor and PEG solution (J) consists of four levels, namely: J0 = Control (distilled water), J1 = 5% + - 2Ψ, J2 = 10% + - 2Ψ, J3 = 15% + - 2Ψ (bar), and the incubation period the seed (I) consists of three levels, namely: I1 = 18 hours, I2 = 24 hours, I3 = 30 hours. There are 12 combinations of treatments and three replications that have 36 units experiment. Research methods. Young corn extracts blended and added PEG 6000. PEG Requirement calculated using the formula:

$$\Psi = -(1{,}18 \times 10^{-2})\, C - (1{,}18 \times 10^{-4})\, C^{-2} + (2{,}67 \times 10^{-4})\, CT + (8{,}39 \times 10^{-7})\, C^2T$$

Description: Ψ = Potential osmotic solution (bar) = concentration of PEG ((gr PEG)/(Kg H2O)), 1 bar = 0.1 MPa, T = room temperature (°C), C = coefficient

Seed germination. Incubation of corn seeds expired in young corn extract and PEG solution in a container that has been installed aerator. The container was placed at a temperature of 25°C in the incubation period of 18, 24 and 30 hours. Germination of seed is done with 25 grains of seeds for each treatment combination. Germinated seeds in rice paper substrate using test methods established in plastic Rolled Paper. To keep the environment remains optimum germination of the seed used standart germinator.

*Observations***.** Observations were made on various variables germination which consists of maximum growth potential (%) variables which was calculated on the final count observation (day 7), germination ability (%) was calculated normal seedling on first count (day 5) and final count (day 7), relative growth rate (%/etmal) calculated normal seedling every day, vigor index was calculated on the first count (day 5) for normal seedling, growing simultaneity (%) was calculated normal seedling on day 6 (between the first count and final count) and normal seedling dry weight (gram).

Results and Discussion

Effect of concentration of young corn extract and PEG

Concentration of extract young corn and PEG very significant effect on variable potential growth, germination, simultaneity grow, growth rate, vigor index and normal seedling dry weight. Mean of potential growth, germination, growing simultaneity, speed of growth, vigor index and seedling dry weight normal sweet corn seed treatment as a result of the concentration of extract of corn are presented in Table 1.

Table 1. Mean of viability and vigor of sweet corn expired due to treatment of concentration extract young corn and PEG

Variable	Concentration of Extact Young Corn and PEG				HSD 0,05
	control (J_0)	5% + PEG – 2 bar (J_1)	10% + PEG -2 bar (J_2)	15% + PEG -2 bar (J_3)	
Potential Growth (%)	54,22 b	48,44 b	42,22 ab	33,78 a	12,38
Germination (%)	49,33 b	45,33 b	40,00 ab	30,67 a	11,95
Growth Simultaneity (%)	41,21 c (43,56)	36,70 bc (36,44)	32,94 b (30,22)	21,37 a (13,78)	6,95
Speed of Growth (%/etmal)	3,34 c (10,82)	3,06 bc (9,00)	2,86 b (7,94)	2,36 a (5,16)	0,42
Vigor Index (%)	38,22 c	32,89 bc	25,78 b	8,89 a	10,07
Normal Seedling Dry Weight (g)	8,01 b	7,55 b	6,59 ab	4,75 a	2,30

Note : Figures followed by some letter in same colomn are not significantly different at 5% level (HSD 0.05)

Table 1 shown that the potential for growth and germination highest found in the control treatment J0 that is significantly different from the concentration of extract of corn 15% + PEG (J3) but not

significantly different from the concentration of extract of corn 5% + PEG (J1) and 10% + PEG (J2). While the growing simultaneity, speed of growth and vigor index of the highest encountered in treatment J0 are significantly different from the 15% + PEG (J3) and 10% + PEG (J2) but not significantly different from the 5% + PEG (J1). The highest normal seedling dry weight found in treatment J0 significantly different with 15% + PEG (J3) but not significantly different from the 5% + PEG (J1) and 10% + PEG (J2). This condition may be the seed used in the study was not able to repair itself due to limited oxygen obtained in the process invigoration. Invigoration effective in seed treatment with moderate vigor. Research results Widajati *et al*., (1990) states that the priming effect is more noticeable on peanut seeds which have a medium vigor seen in the benchmarks shoot dry weight, number of leaves and the growing power field (field emergence).

Effect of Incubation Period on Seed Viability and Vigor Sweet Corn

From the research can be shown that the incubation period is very significant effect on variables germination, growing simultaneity, speed of growth and vigor index. The incubation period of significant impact on potential growth and seedling dry weight is normal. Mean of potential growth, germination, growing simultaneity, speed of growth, vigor index and seedling dry weight normal sweet corn seed treatment as a result of the incubation period are presented in Table 2.

Table 2. Mean of of viability and vigor of sweet corn seed treatment as a result of the incubation period

Variable	Period of incubation			$HSD_{0,05}$
	18 hours (I_1)	24 Hours (I_2)	30 Hours (I_3)	
Potential Growth (%)	51,33 b	44,00 ab	38,67 a	9,70
Germination (%)	48,33 b	41,00 ab	34,67 a	9,36
Growth Simultaneity (%)	37,92 b (38,67)	34,28 b (32,67)	26,97 a (21,67)	5,45
Speed of Growth (%/etmal)	3,20 b (9,95)	2,94 b (8,30)	2,57 a (6,43)	0,33
Vigor Index (%)	34,67 b	27,67 b	17,00 a	7,89
Normal Seedling Dry Weight (g)	7,86 b	6,70 ab	5,62 a	1,80

Note : Figures followed by some letter in same colomn are not significantly different at 5% level (HSD 0.05)

Table 2 shown that the potential for growth, germination, simultaneity grow, growth rate, index vigor and dry weight of normal seedling were the highest found in the incubation period of 18 hours (J1) which is significantly different from the incubation period of 30 hours (J3) but not significantly different with a 24 hours incubation period (J2). This is probably due to that the time required by the seed to fix itself has reached the maximum limit. Khan (1999) states that, if a seed is too long incubated the ability of seeds to germinate also decreased. This is probably caused germination which should have been ready for the seeds to germinate but still soaked thus inhibiting its process. Bradford (1988) stated that during the process of metabolism is activated incubated seed to initiate germination while taking on water after the seeds reached the maximum demand of water.

Interaction between Young Corn Extract Concentration and Incubation Period on Seed Viability and Vigor

The result showed that there was significant interaction between young corn extract concentration and the incubation period of the vigor index variable.

Mean of sweet corn seed vigor index due to the treatment of young corn extract concentration and the incubation period was presented in Table 3.

Table 3. Mean of sweet corn seed index vigor due to the treatment of young corn extract concentration and incubation period

Concentration of Young Corn Extract and PEG	Period of Incubation (hour)		
	18 (J1)	24 (J2)	30 (J3)
Control (J0)	53,33 e	33,33 cde	28,00 abcd
5% + PEG (J1)	41,33 de	41,33 de	16,00 abc
10% + PEG (J2)	32,00 cde	29,33 bcd	16,00 abc
15% + PEG (J3)	12,00 abc	6,67 a	8,00 ab
$HSD_{0,05}$		22,81	

Note : Figures followed by some letter in same colomn and raw are not significantly different at 5% level (HSD 0.05)

Table 4 shows that the highest vigor index values found in young corn extract concentration of 0% (control) with an incubation period of 18 hours (J0J1). It is possible that the sweet corn seed that invigoration with water for 18 hours can improve metabolism system that has been damaged due to storage. Increased vigor index at 18 hours invigoration then decreased at 24 hours and 30 hours was also due to the type of seed used. The success of priming effect depends among other things: either the seed type and age of the species, types osmoticum, imbibition temperature, concentration or osmotic potential and priming duration and the presence of O2 (Liming *et al.*, 1992). Seed priming treatment, are still too high or too fast imbibition and risky to seed doubt about the quality, because the priming treatment slowed the rate of imbibition. Water absorption occurs slowly can restore to normal membrane (Fu *et al.*, 1988), so it can improve the metabolism of seeds. Gardner *et al.*, (1991) stated priming can lead to the strengthening of (healing) plasma membrane, reduce electrolyte loss and improve germination and seedling strength. Priming also increase the percentage and rate of appearance of sweet corn seedling in a solid matrix that is done and combined with sodium hypochlorite (Parera and Cantliffe, 1992; Parera and Cantliffe, 1994).

Conclusion

Based on the experiment we conclude that using of young corn extract with a concentration of 5-10% + PEG -2 bar was still able to maintain viability and vigor, but can not increase the germination of seeds of sweet corn that has expired with an effective incubation period is 18-24 hours. This is strongly influenced by the species of seeds, germination rates, invigoration media, concentration, and temperature.

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