Yield Stability of Some Aloe Vera Clone

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Keywords: Aloe vera, Stability, Yield.

Abstract: Research conducted in the field that was in Pontianak, Jl. Reformasi, Universitas Tanjungpura. Research on third year using peat soil origin Rasau Jaya I, II and III. Observations were made on several properties such as the increase in the number of leaves, the weight of the harvest (g), the width of the leaves (cm) and the number of harvestable leaves. Observation results and components of yield is done to facilitate the assessment of some of the clones produced.

1 INTRODUCTION

Total aloe vera harvest in Pontianak City in 2011 amounted to 460,000 m2 with total production of 7,360,000 kg with an average production of 16 kg / m2. In North Pontianak Subdistrict, aloe vera harvest area in 2010 amounted to 120,000 m2 with total production of 478,800 kg or average production of 3.99 kg / m2 (BPS Pontianak, 2011). Most of the aloe vera plant is cultivated in peatlands.

Peat is a type of soil formed from the accumulation of plant remnants that are half-decomposed, therefore the content of organic matter is high. Peat is defined as a material or organic material buried naturally in a state of excessive wet, incompressible and not or only slightly underwent. Peat is organic soil, but does not mean organic soil is peat soil (Noor, 2007). Generally peat soils react sourly, so plants will be exposed to environmental stresses that blindly disturbed plant growth.

The application of physical and chemical mutagenes to somaclonal aloe vera is studied in order to increase the frequency of somaclonal diversity (Espina *et al.*, 1991). Ethyl methane sulfonate (EMS) is one type of alkylating agents that effectively induces mutations in various organisms (Fishbein, *et al.*, 1970). EMS can also be used for plant mutagenesis, but this report has not mentioned the types of somklonal diversity formed by the treatment (Epp, 1986) thus need to be studied somaclonal diversity caused by the provision of EMS especially on aloe vera.

The diversity in the resulting plants was observed, then evaluated in the field. This evaluation is important to determine whether the resulting clones are resistant to acidity, how potential yields are among the clones, the morphological changes of how they occur, the answer to this question will be the selection criteria for producing aloe vera clones that tolerate acidity stress.

Aloe vera plants that allegedly originated from the Canary islands in the west of Africa have been known as medicine and cosmetics since centuries ago recorded The Egyptian Book of Remendies. In the days of Cleopatra, aloe vera is used for beauty materials as a skin moisturizer. Pharmacy use was first performed by the Samaritans approximately 1750 M. In China aloe vera is used as a traditional medicine by drinking the liquid in order to cleanse the organs of the body of the disease. Allegedly aloe vera into Indonesia around the 17th century that originally as an ornamental plant (Sumarno, 2002). Aloe vera extract is a lot of benefits for health.

Utilization of aloe vera as a beverage is very beneficial for health, among others, to maintain kidney function, heart muscle, lower blood sugar level, improve the immune system lowers blood cholesterol levels, reduces symptoms of rheumatism, canker sores, bleeding gums, sore throat digestive tract, asthma, symptoms of dengue fever, deep heat, reducing acne, and can be slimming (PT Botani Tropical Lestari and Biology Department FMIPA-UI, 2002). Constraints faced in the expansion of aloe vera cultivation in peatlands is the likelihood of seeds that resist stress acidity.

Efforts to obtain aloe vera seeds resistant to environmental stress, free of pests and diseases can be done through network cultivation. The success of

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tissue cultivation in the form of clonal opens opportunities for genetic improvement of aloe vera plant. The occurrence of deviation of the nature (offtype) called somaclonal variation in seeds of tissue culture can increase the genetic variability of plants (Larkin, 1981 in Israeli *et al.*, 1991).

The availability of sufficient genetic diversity is needed to support the success of the selection program. This report is a fact which shows that the occurrence of somaclonal diversity in tissue culture seeds can be utilized for genetic improvement of plants.

The study of EMS on Cavendish banana and banana Kepok Kuning resulted in the response of EMS on Cavendish banana culture on growing percentage, shoot number and shoot length decreased in straight line with increasing of EMS concentration level and morphological change that was formed explant rate indicating mutation (Hidayat , 2002, 2004).

The study of the use of EMS 5 on Aloe vera by Cornelia (2003), showed faster growth time than without EMS, and 0.05% concentration level. which has created diversity. The results showed that there was somaclonal diversity at the concentration level ranging from 0.05% and increasing in line with the increase of the EMS concentration level. The best concentration gives rise to somaclonal diversity at the level of 0.10% then will cause dead eksplan (Hidayat, 2006). The resulting planlet was further acclimatized to produce seeds and observed morphological changes. The role of the environment is enormous for the growth and development of plants, a growing environment that grips growth and growth of plants.

Environment is a potential environmental factor unfavorable to the life of the creature in its general (Levitt, 1980). In general, environmental stress is grouped into 2, namely: (1). Biotic cohesion consists of: a) intra-species and inter-species competition, b) infection by pests and diseases. (2). Abiotic stresses are a) temperatures (high and low), b) water (advantages and disadvantages), c) radiation (ultraviolet, infrared, visible light and ionizing radiation), d) chemicals (salts, gases, and pesticides) , e) wind, and f) sound.

Environmental stresses on peat soils may include soil acidity (pH <5.0), excess water (puddle height), pyrite, and salinity. Areas like this are widely available outside of Java.

Indonesia's swamp land is 33.4 million ha spread over Sumatra, Kalimantan, Sulawesi and Irian Jaya. 20.1 million ha is tidal swamp land and 13.3 million ha of nontidal swamps. Peat typology covers an area of 11.0 million ha, acid sulphate of 6.7 million ha and saline / somewhat saline 0.4 million ha (Balitbangtan Pangan, 1992 in Hidayat, 2009). Thus peat soil type is wide enough to be utilized.

Efforts to improve peatland productivity can be done through improved soil fertility by fertilizing and improving the soil (calcification) and other businesses such as ash, burning residue, wood processing plant waste, ash (palm rest residue), volcanic ash, and marine mud.

An effort would require large expenses and very large material inputs (eg to raise the soil pH of a single cake required 50 tons / ha of lime) so that it is less efficient, one of the alternatives offered is the search and assembling of resistant and suitable varieties / clones in the local environment needs attention.

Patent Search Description Based on patent search results on some patent sites such as www.uspto.gov, www.jpo-miti.go, www.ipaustralia.gov.au., Www. patents1.ic.gc.ca/ intro-e-html, and www.european-patent-office.org/ espacenet / info / index.h, www.delphio.com have not found any patent regarding making aloe vera clones. Several studies are directed at utilization of Aloe vera leaf bleed. Some search results are presented in Table 1.

Additional Some Patent Search Results About Aloe Vera: **7,205,012 B1** = Scar reducing and massage emollient by Wendy L. Hill, 4758 Appleton St., San Diego, Calif. 92117 (US) Filed on Feb. 25, 2005, as Appl. No. 11/65,661. Int. Cl. A01N 65/00 (2006.01) U.S. Cl. 424—764 [424/765; 424/745; 424/744] 2.

Claims: 1. A method of making a scar reduction emollient, said method comprising the steps of: Mixing together calendula flowers, chamomile flowers, comfrey leaf, rose petals, rosemary and rose geranium to form a herb mixture; Positioning the herb mixture in a cooking vessel and covering the herb mixture with almond oil and olive oil and heating the cooking vessel at a temperature below the boiling point of the olive and almond oils to define a heated mixture; Straining the heated mixture through cheesecloth to define a strained oil; Melting beeswax and mixing together said beeswax with shea butter, lavender oil, Ylang Ylang oil, **Aloe vera gel**, jojoba oil, wheat germ oil, evening primrose oil and said strained oil to define said emollient; and Positioning said emollient in at least one container.

Table 1: Search Results of Aloe Vera Patent Document

No.	No. Patent	Total claim	Description patent	Inventor	Year
1.	US 7,196,072 B2	18	High molecular weight polysaccharide fraction from Aloe vera with immunostimulatory activity	David Stanley Pasco, Oxford, Miss. (US); Nirmal Derek Ceri Pugh, Oxford, Miss. (US); Mahmoud ElSohly, Oxford, Miss. (US); and Samir Ross, Oxford, Miss. (US) Assigned to University of Mississippi, University, Miss. (US)	PCT Pub. No. WO02/03999, PCT Pub. Date Jan. 17, 2002.
2.	US 7,262,224 B2	1	Cosmetic rejuvenating and healing product, method of its manufacture and uses thereof Myong Hun Chong, Arlington, Tex. (US)	Hanna Isul Skin Therapy, Inc., Fort Worth, Tex. (US)	Prior Publication US 2003/0223953 A1, Dec. 04, 2003
3.	US 7,332,151 B2	2	Liquid animal hoof conditioner	Ben Ray Yoder, N. 4825 Highway 104, Brodhead, Wis. 53520 (US)	Prior Publication US 2005/0266103 A1, Dec. 01, 2005
4.	US 7,198,779 B2	14	Compositions for the relief of xerostomia and the treatment of associated disorders	Ana Rifa Piñol, Martorell (Spain); and Montserrat Mata Moliner, Sant Sadurni d'Anoia (Spain	PCT Pub. No. WO03/028699, PCT Pub. Date Apr. 10, 2003.
5.	S 7,252,846 B2	18	Topical composition and method for the treatment and prophylaxis of dermal irritations	Raied Dinno, 727 South Ave., Weston, Mass. 02439 (US)	Prior Publication US 2005/0266094 A1, Dec. 01, 2005
6.	7,205,012 B1	2	Scar reducing and massage emollient	Wendy L. Hill, 4758 Appleton St., San Diego, Calif. 92117 (US)	Filed on Feb. 25, 2005, as Appl. No. 11/65,661.
7.	US 7,329,421 B2	7	Process of Manufacturing Clear Juice From The Leaves of The Aloe Vera Plant	Agashe Mandar Dnyaneshwar, 242, Shaniwar Peth, Pune 411 030 (India)	Prior Publication US 2006/0134238 A1, Jun. 22, 2006

Source : www.uspt.gov., March 11, 2010 and April 20, 2014

2 RESEARCH METHODS

Research conducted in Pontianak Jl. Reform. The study used Randomized Block Design on the basis of observed morphological diversity such as aloe vera plant height of approximately 24 months as the basis of grouping into five groups and five treatments based on origin in laboratory ie EMS concentration. The third year research is arranged in serial / multi location with 2 series based on the origin of peat land taken by Rasau Jaya I and III. Materials research in the form of aloe vera plants from previous studies aged 24 months, chicken manure , fertilizer NPK trademark Ponska. The

necessary tools are farming tools, ATK, balance sheet, camera, and so on.

Soil processing in the form of cleaning the land to put polybags from weeds and the remnants of weeds, stumps and so on. Aloe vera plant is maintained since the previous research, maintenance in the form of weeding, fertilization, and pest control is done regularly and intensively.

The study used a Randomized Block Design consisting of 5 Aloe vera clones: E4, E5, E6, E7, and E8, as treatment and 2 sets of research ie 2 sets of research on peat soil origin Rasau Jaya I and II 2 set of research on peat soil origin Rasau Jaya I and II. The research observed were :

1. The amount of leaf, observed from the beginning to the end of the study.
2. The thickness of the leaf by measuring the thickness in the middle of the leaf
3. The length of the leaf thrower, measured from the base of the leaf to the tip of the leaf
4. Total Weight (g) leaf sheath that can be harvested
5. Weight per leaf bower is harvested, done by weighing the leaves are harvested

The research data of the combined variance analysis is then tested for power yield stability.

3 RESULTS AND DISCUSSION

Research data on each series of research then analyzed the variance by using Randomized Block Design for each series of research, then tested the combined variance. It turns out all research variables showed the inettraction genotype (clone) and Environment (GxE) have a very real effect, that aloe vera clones have a diversity that is environmentally influenced. Further analysis of yield stability obtained from aloe vera plants. The adaptability and stability results of the length component of aloe vera bark can be seen in Table 4. Looks Clone E8 is relatively stable compared to other clones.

Clone E4 is relatively stable, but no single clone is capable of general adaptation. Looks older age of aloe vera plant is the 3rd year (360 days) thick bark higher. Table 5 shows only a relatively stable E4 clone, whereas general adaptability does not contain a capable clone. It can be seen that the thickness of harvest bark on peat soil from Rasau Jaya I is thicker than that of the peat soil from Rasau Jaya III. This is possible because Rasau Jaya I peatlands are relatively more fertile compared to peatlands from Rasau Jaya III.

All clones were able to convert to Rasau Jaya I, II and III, but for Rasau Jaya II all clones were badly adapted, clone E 7 was stable. The ability to grow is influenced by environmental factors such as soil fertility and soil acidity.

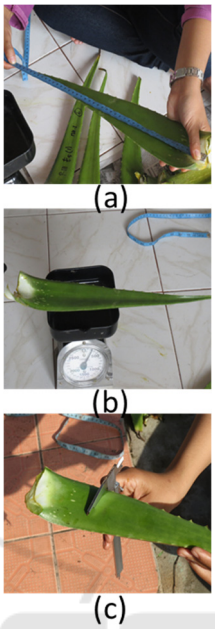

Figure 1: (a) Measurement of the leaf length, (b) Weight, (c) Thickness

4 CONCLUSIONS

1. The peatlands from Rasau Jaya I are relatively more fertile than those Rasau Jaya III and Rasau Jaya II.
2. Aloe vera clones E4 and E7 have adaptability and power stability results which is good to be cultivated in two peat soils
3. The yield stability for each clone has not been stable, so it is necessary multi-location experiments are done again.
4. A multi-location test on Rasau Jaya I and III peatlands is required to obtain better results, so clones can be removed.

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APPENDIX

List of supplementary data in this study are presented in tables as following:

Table 2: Class 424 Drug, Bio-Affecting and Body Treating Compositions.

1.11	Radionuclide or int; adjuvant or carrier compositions; intermediate or preparatory compositions
1.13	In aerosol, fine spray, effervescent, pressurized fluid, vapor or gas, or complete composition
1.17	Attached to or within viable or inviable whole micro-organism, cell, virus, fungus or specified sub-cellular structure thereof (e.g., platelet, red blood cell)
1.21	Molecular bilayer structure (e.g., vesicle, liposome)
1.25	Dissolving or eluting from solid or gel matrix (e.g., capsule, tablet)
1.29	Coated, impregnated, or colloidal particulate (e.g., microcapsule, micro-sphere, micro-aggregate, macro-aggregate)
1.33	Delivery to active site involves particle dissolving, degrading, or otherwise releasing of radionuclide
1.37	Radionuclide or intended radionuclide in an organic compound
1.41	Attached to lymphokine, cytokine, or other secreted growth regulatory factor, differentiation factor, or intercellular mediator specific for a hematopoietic cell (e.g., interferon, interleukin, macrophage factor, colony stimulating factor, erythropoietin); derivative thereof
1.45	Attached to cyclopentano-hydrophenanthrene (e.g., cholesterol, bile acid, steroids, cholane), hormone, or neurotransmitter, or other secreted growth regulatory factor, differentiation factor, or intercellular mediator (e.g., t3, t4, insulin, human chorionic gonadotropin, intragonadal regulatory protein, mullerian inhibiting substance, inhibin, epidermal growth factor, nerve growth factor, dopamine, norepinephrine); derivative thereof
1.49	Attached to antibody or antibody fragment or immunoglobulin; derivative
1.53	Attachment via an added element (e.g., bifunctional compound or coordinate, coupling agent, spacer compound, bridging compound, conjugated chelate)
1.57	Attached to antigen or hapten; derivative thereof
1.61	In an inorganic compound
1.65	In an organic compound
1.69	Attached to peptide or protein of 2+ amino acid units (e.g., dipeptide, folate, fibrinogen, transferrin, sp. Enzymes); derivative thereof
1.73	Attached to carbohydrate compound; derivative thereof (e.g., dna, nucleotide, nucleoside, sugar, starch, tannin, saccharide, polysaccharide, cellulose, o-, n- and s-glycoside, vitamin b12)
1.77	Phosphorus-containing organic compound
1.81	Nonmetal radionuclide or intended radionuclide (e.g., carbon)
1.85	Halogen
1.89	Fluorine
9.1	In vivo diagnosis or in vivo testing
9.2	Testing efficacy or toxicity of a compound or composition (e.g., drug, vaccine, etc.)
9.3	Magnetic imaging agent (e.g., nmr, mri, mrs, etc.)
9.31	Clay or zeolite containing
9.32	Particle containing a transition, actinide, or lanthanide metal (e.g., hollow or solid particle, granule, etc.)
9.321	Liposome
9.322	Polymer containing (e.g., polypeptide, synthetic resin, etc.)
9.323	Metal is paramagnetic
9.33	Nitroxide or nitroxide containing
9.34	Polypeptide attached to or complexed with the agent (e.g., protein, antibody, etc.)
9.341	The region of the imaging agent responsible for binding to an in vivo target or the region of the target responsible for binding to the agent is specifically recited functionally or as a sequence of amino acids, carbohydrate residues, or nucleic acids
9.35	Carbohydrate or derivative thereof attached to or complexed with the agent
9.351	The region of the imaging agent responsibile for binding to an in vivo target or the region of the target responsible for binding to the agent is specifically recited functionally or as a sequence of amino acids, carbohydrate residues, or nucleic acids
9.36	Transition, actinide, or lanthanide metal containing
9.361	Heterocyclic compound is attached to or complexed with the metal
9.362	Porphyrin or derivative thereof
9.363	Hetero ring contains at least eight members
9.364	Polyamino-polycarbonyl moiety attached to or complexed with the metal
9.365	Contains at least one -c(=o)-n- group
9.37	Imageable halogen containing
9.4	X-ray contrast imaging agent (e.g. computed tomography, angiography, etc.)
9.41	Barium containing
9.411	Polymer containing (e.g., polypeptide, synthetic resin, etc.)
9.42	Transition, actinide, or lanthanide metal containing
9.43 *	Carbohydrate or derivative thereof attached to or complexed with the agent
257.1*	Escherichia (e.g., escherichia coli, etc.)

Table 3: Stability Result of Number of Harvest of Aloe Vera Clone

Clone	RJ I_1	RK	RJI_2	RK	RJII_1	RK	RJ III_1	RK	RJ III_2	RK	RJ I_1	RK	RJII_3	RK
E_4	10.60	3	8.93	5	15,25	2	11.67	3	9.67	5	41.25	5	45.75	2
E_5	10.47	4	8.93	4	13.33	5	13.07	1	11.53	1	42.25	2	40.00	5
E_6	10.20	5	9.00	3	14.92	3	12.73	2	11.13	3	41.50	4	44.75	3
E_7	11.73	1	9.07	2	14.08	4	10.87	5	11.33	2	55.50	1	42.25	4
E_8	11.60	2	9.80	1	15.92	1	11.47	4	9.77	4	42.25	3	47.75	1
Tot.	54.60		45.73		73,50		59.80		53.43		222.7		220.5	
Avr.	10.92		9.15		14.70		11.96		10.69		44.55		44.10	

General average = 22,58

Note : RJ I_1= Rasau Jaya I first year; RJ III_1= Rasau Jaya III first year ;
RJ I_2= Rasau Jaya I Second year ; RJ III_2= Rasau Jaya III Second year
RJ II_1= Rasau Jaya II first year ; RJ I_3= Rasau Jaya I first year;
RJ II_3= Rasau Jaya II third year; RK = rank

Table 4: Stability of Wide Harvest Results of Aloe Vera Clone.

Clone	RJ I	RK	RJI*	RK	χ^2	RJ III	RK	RJ III*	RK	χ^2
E_4	6.99	3	35.00	4	96.00	6.07	3	30.51	2	10.29
E_5	7.20	2	35.81	1	0.00	6.49	1	30.48	3	43.20
E_6	7.36	1	35.01	2	10.29	6.11	2	30.52	1	0.00
E_7	6.65	5	35.01	3	43.20	6.05	4	25.52	5	163.64
E_8	6.82	4	34.98	3	163.64	5.77	5	30.48	4	96.00
Total	35.02		30.49	5		27.71				
Average	7.00					6.10				

General average= 10,14

Note: RJ I= Rasau Jaya I ; RJ III= Rasau Jaya III; RJI* = konversi data RJ I data conversion; RJ III*= Conversion of data Rasau Jaya; RK = rank

Table 5: Stability of Long Leaf Harvesting of Aloe Vera Clone.

Clone	RJ I	RK	RJI*	RK	χ^2	RJ III	RK	RJ III*	RK	χ^2
E_4	46.48	1	215.66	1	0.00	35.65	5	202.57	1	0.00
E_5	41.77	4	215.65	3	43.20	35.98	4	202.54	5	163.64
E_6	43.40	3	215.64	4	96.00	36.86	2	202.55	4	96.00
E_7	39.44	5	215.64	5	163.64	36.14	3	202.57	2	10.29
E_8	44.57	2	215.66	2	10.29	37.64	1	202.56	3	43.20
Total	215.66					182.27				
Average	43.13					36.45				

General average = 30,11

Note: RJ I= Rasau Jaya I ; RJ III= Rasau Jaya III; RJI* = konversi data RJ I data conversion; RJ III*= Conversion of data Rasau Jaya; RK = rank

Table 6: Stability of Width Leaf Harvesting of Aloe vera Clone

Clone	RJ I	RK	RJI*	RK	χ^2	RJ III	RK	RJ III*	RK	χ^2
E_4	1.62	4	8.72	1	0.00	1.45	3	8.49	2	10.29
E_5	1.61	5	8.70	4	96.00	1.42	4	8.75	1	0.00
E_6	1.64	2	8.69	5	163.64	1.50	1	8.39	4	96.00
E_7	1.65	1	8.72	2	10.29	1.41	5	8.47	3	43.20
E_8	1.63	3	8.71	3	43.20	1.48	2	8.24	5	163.64
Total	8.14					7.26				
Average	1.63					1.45				

General average = 2.57

Note: RJ I= Rasau Jaya I ; RJ III= Rasau Jaya III; RJI* = konversi data RJ I data conversion; RJ III*= Conversion of data Rasau Jaya; RK = rank

Table 7: Stability of Weight Results per Harvesting of Aloe Vera Clone.

Clone	RJ I	RK	RJI*	RK	χ^2	RJ III	RK	RJ III*	RK	χ^2
E_4	631.50	3	7381.25	1	0.00	561.67	2	6370.95	2	10.29
E_5	611.75	5	7381.23	3	43.20	419.27	4	6370.96	1	0.00
E_6	644.17	2	7381.22	4	96.00	625.33	1	6370.94	3	43.20
E_7	625.58	4	7381.22	5	163.64	396.38	5	6370.92	5	163.64
E_8	650.58	1	7381.24	2	10.29	439.27	3	6370.94	4	96.00
Total	3163.58					4089.45				
Average	632.72					817.89				

General average = 494,12

Note: RJ I= Rasau Jaya I ; RJ III= Rasau Jaya III; RJI* = konversi data RJ I data conversion; RJ III*= Conversion of data Rasau Jaya; RK = rank