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Compiler:

Prof. Sobir

Prof. Muhamad Syukur

Dr. Yudiwanti WÉK

Dr. Trikoesoemaningtyas

Dr. Desta Wirnas

Editor:

Yoni Elviandri, S.P

Layouter:

Army Trihandi Putra, S.TP, Ardhya Pratama S.Ikom

Corrector:

Dwi Murti Nastiti, S.Ikom

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List of Participants

Name	Affiliation	Email
Abbdelrehim Ahmed Ali	Agronomy Department, Faculty of Agriculture, Suez Canal University	drrahem@gmail.com
Abdul Rahim Bin	Agrotechnology and Biosciences	rahim6313@yahoo.com//
Harun	Division, Malaysian Nuclear Agency	rahim@nm.gov.my
Abebe Megersa Diriba	Department of Plant Science, Seoul National University	abebemegersa@snu.ac.kr
Ade Astri Muliasari	Department of Agronomy and Horticulture, Bogor Agricultural University	adeastri07@gmail.com
Adi Surya Ikhsan	Biotechnology Department, Cukurova University	adisurya_bioindo@yahoo. com
Ady Daryanto	Department of Agronomy and Horticulture, Bogor Agricultural University	adydaryanto@yahoo.com
Ae Seon Lee	Gwangju Convention & Visitors Bureau	aeseon@gwangjucvb.or.kr
Afifuddin Latif Adiredjo	Agronomy Department, Brawijaya University	al.adiredjo@ub.ac.id
Agung Karuniawan	Padjadjaran University	akaruni@yahoo.com
Aline Sisi Handini	Department of Agronomy and Horticulture, Bogor Agricultural University	
Andari Risliawati	Indonesian Center for Agricultural Biotechnology and Genetic Research (ICABIOGRAD)	boendar@yahoo.co.id
Andi Sauleka	Department of Agronomy and Horticulture, Bogor Agricultural University	
Andi Wahyono	PT BISI International Tbk	genadiputra@yahoo.com
Apri Sulistyo	Indonesian Legumes and Tuber Crops Research Institute (ILETRI)	apri.sulistyo@gmail.com
Arina Saniaty	Department of Agronomy and Horticulture, Bogor Agricultural University	arinaagh162@gmail.com
Aris Hairmansis	Indonesian Centre for Rice Research	a.hairmansis@gmail.com
Arya Widura Ritonga	Department of Agronomy and Horticulture, Bogor Agricultural University	aryagriper@gmail.com
Aryo Benjamin Feldman	Crops For the Future	aryo.feldman@cffresearch.

Name	Affiliation	Email
Awang Maharijaya	Department of Agronomy and Horticulture, Bogor Agricultural University	awang.maharijaya@gmail. com
Azis Natawijaya	Taman Buah Mekarsari	aznatawijaya@yahoo.com
Backki Kim	Seoul National University	uptfamily@hanmai1.net
Bambang Heliyanto	Indonesian Sweetened and Fibre Crops Research Institute	b.heliyant@gmail.com
Benni Situmorang	Department of Agronomy and Horticulture, Bogor Agricultural University	benniagrohort@gmail.com
Bhalang Suriharn	Department of Plant Science and Agricultural Resources, Faculty of Agriculture, Khon Kaen University	bsuriharn@gmail.com
Camelia Rosianti Putri	Department of Agronomy and Horticulture, Bogor Agricultural University	camelia17411@gmail.com
Cucu Gunarsih	Department of Agronomy and Horticulture, Bogor Agricultural University	
Dani Satyawan	Seoul National University	dani_satyawan@snu.ac.kr
Darda Efendi	Center for Tropical Horticulture Studies, Bogor Agricultural University	dardaefendi@gmail.com
Darmawan Saptadi	Faculty of Agriculture, Brawijaya University	darmawansaptadi@gmail. com
Debby Ustari	ICABIOGRAD	debbyustari@gmail.com
Deden Derajat Matra	Tokyo University of Agriculture and Technology	matra6387@gmail.com
Desta Wirnas	Department of Agronomy and Horticulture, Bogor Agricultural University	dwirnas@gmail.com
Dewi Indriyani Roslim	Department of Biology, Riau University	dewiindriyaniroslim@ gmail.com
Dewi Sukma	Department of Agronomy and Horticulture, Bogor Agricultural University	dsukma70@yahoo.com
Didy Sopandie	Department of Agronomy and Horticulture, Bogor Agricultural University	didysopandie@gmail.com
Dwi Guntoro	Department of Agronomy and Horticulture, Bogor Agricultural University	dwiguntoro@yahoo.com

Name	Affiliation	Email
Edi Santosa	Department of Agronomy and Horticulture, Bogor Agricultural University	edisang@gmail.com
Edizon Jambormias	Departement of Agriculture, Faculty of Agriculture, Pattimura University, Ambon, Indonesia.	edy_jambormias@yahoo.
Edy Suprianto	Indonesian Oil Palm Research Institute	edygrey@gmail.com
Eka Jan Virgin Haquarsum	Department of Agronomy and Horticulture, Bogor Agricultural University	virginhaquarsum@gmail. com
Ellina Mansyah	Indonesian Tropical Fruit Research Institute	ellina_mansyah@yahoo. co.id
Endah Retno Palupi	Department of Agronomy and Horticulture, Bogor Agricultural University	erpalupi@yahoo.co.id
Eny Widajati	Department of Agronomy and Horticulture, Bogor Agricultural University	eny.widajati61@gmail.com
Erin Puspita Rini	Department of Agronomy and Horticulture, Bogor Agricultural University	erinpuspitarini@gmail. com
Ery leonardo	Department of Agronomy and Horticulture, Bogor Agricultural University	els.srg25@gmail.com
Estriana Riti	Department of Agronomy and Horticulture, Bogor Agricultural University	ritiestriana@gmail.com
Etti Swasti	Agriculture Faculty, Andalas University	ettiswasti14@yahoo.com
Eunbyeol Koh	Seoul National University	ebkoh@snu.ac.kr
Eunsoo Lee	Seoul National University	les1624@snu.ac.kr
Faradila Danasworo Putri	Department of Agronomy and Horticulture, Bogor Agricultural University	faradiladputri@yahoo.com
Faradila Median Rini	Department of Agronomy and Horticulture, Bogor Agricultural University	dila_me@yahoo.com
Ferra Anggita Agustina	Department of Agronomy and Horticulture, Bogor Agricultural University	ferraanggita@ymail.com
Fitmawati	Faculty Mathematic and Sains Riau University	fitmawati2008@yahoo. com

Name	Affiliation	Email
Fitrah Ramadhan	Department of Agronomy and Horticulture, Bogor Agricultural University	ftramadhan21@gmail.com
Galuh Kusuma Wardhani	Department of Agronomy and Horticulture, Bogor Agricultural University	galuhmawardha@gmail. com
Graham Eagleton	KPT-Kebun Raya Bogor-LIPI	grahameagleton@gmail. com
Gregori Garnadi Hambali	Taman Buah Mekarsari, Cileungsi, Bogor, Indonesia	gregham2010@yahoo.com
Hadian Permana	Tokyo University of Agriculture and Technology	hadijan.permana@gmail. com
Haneul Jeong	Seoul National University	skyts0401@snu.ac.kr
Hapsoh	Faculty of Agriculture University of Riau	hapsohdin@yahoo.co.id
Haris Maulana	Agriculture Faculty, Padjadjaran University	harismaulana89@yahoo. com
Hee-Jong Koh	Seoul National University	heejkoh@snu.ac.kr
Heni Safitri	Indonesian Center for Rice Research	henisafitri2@gmail.com
Herman Syah	Department of Biology, Riau University	hermansyahdan@ymail. com
Hidayati Fatchur Rohmah	Department of Agronomy and Horticulture, Bogor Agricultural University	hidayati_fatchur@yahoo. co.id
Ho Jun Joh	Department of Plant Science, Plant Genomics and Breeding Institute, and Research Institute of Agriculture and Life Sciences, College of Agriculture and Life Sciences, Seoul National University	jun841011@hotmail.com
Hyun-Ju Jang	Seoul National University	janghyunju12@gmail.com
Hyun-Sook Lee	College of Agriculture and Life Sciences, Chungnam National University, Daejeon, 305-764, Korea	leehs0107@gmail.com
Hyun-Su Park	National Institute of Crop Science	mayoe@korea.kr
I Made Tasma	ICABIOGRAD	imade.tasma@gmail.com
Ill-SUP Nou	Department of Horticulture, Sunchon National University	nis@sunchon.ac.kr
Indah Sulistiyorini	Department of Agronomy and Horticulture, Bogor Agricultural University	
Indrastuti Apri Rumanti	Indonesian Center for Rice Research	indrastuti_apri@yahoo. com

Name	Affiliation	Email
Indriati Husain	Universitas Negeri Gorontalo	indriati.husain@ung.ac.id
Izmi Yulianah	Faculty of Agriculture, Brawijaya University	izmiyulianah@yahoo.com
Jabal Ashar	Department of Agronomy and Horticulture, Bogor Agricultural University	jabalashar@gmail.com
JaeBuhm Chun	Crop Breeding Division, National institute of crop science(NICS)	jbchun01@korea.kr
Jayern Lee		leejayern@gmail.com
Jirawat Sanitchon	Department of Plant Science and Agricultural Resources, Khon Kaen University	jirawat@kku.ac.th
Jong-Min Jeong	National Institute of Crop Science RDA, Wan ju, Korea	jjm0820@korea.kr
Juanita Elina	Department of Agronomy and Horticulture, Bogor Agricultural University	juanitaelina@gmail.com
Jun Hyeon Cho	Department of Southern Area Crop Science, National Institute of Crop Science	hy4779@korea.kr
Junghoon lee	Department of Plant Science, Plant Genomics and Breeding Institute, and Research Institute of Agriculture and Life Sciences, College of Agriculture and Life Sciences, Seoul National University	jonghoonlee@snu.ac.kr
Ju-Won Kang	Department of Agronomy, Chungnam National University	hgorilla@gmail.com
Khairol Ismail	Research Officers, MARDI, Malaysia	khairol@mardi.gov.my
Kwon Kyoo Kang	Dept. of Horticulture, Hankyong National University	kykang@hknu.ac.kr
Kyu-Chan Shim		zktnrl@gmail.com
Kyung-Ho Kang	Rice Research Dept. of National Institute of Crop Science	khkang@korea.kr
Lukita Devy	Department of Agronomy and Horticulture, Bogor Agricultural University	d_lukita@yahoo.com
M Rauful Mizan	Department of Agronomy and Horticulture, Bogor Agricultural University	miatulmizan@gmail.com
Maera Zasari	Department of Agronomy and Horticulture, Bogor Agricultural University	maera_zasari@yahoo.com

Name	Affiliation	Email
Marina Yuniawati	Department of Agronomy and Horticulture, Bogor Agricultural University	marina@batan.go.id
Mega Dewi H.	Department of Agronomy and Horticulture, Bogor Agricultural University	megadewiindica@yahoo. com
Megumi Kashiwagi	United Graduate School of Agricultural Science, Tokyo University of Agriculture and Technology	mugumi127@gmail.com
Mi-Ok Woo	National Academy of Agricultural Science, Rural Development Administration	miok1004@hanmail.net
Mohd Din Amiruddin	Malaysian Palm Oil Board, Persiaran Institusi	mohddin@mpob.gov.my
Moon Young Kim	Department of Plant Science and Research Institute for Agriculture and Life Sciences, Seoul National University	moonykim@snu.ac.kr
Motoki Kanekatsu	Tokyo University of Agriculture and Technology , Japan	kanekatu@cc.tuat.ac.jp
MR Alfarabi Istiqlal	Department of Agronomy and Horticulture, Bogor Agricultural University	alfa.istiqlal@gmail.com
Muhamad Syukur	Department of Agronomy and Horticulture, Bogor Agricultural University	muhsyukur@yahoo.com
Muhammad Imam Surya	Cibodas Botanical Garden – Indonesian Institute of Sciences	misurya084@gmail.com
Naoya Ueno	Tokyo University of Agriculture and Technology	un.nasuke@gmail.com
Neni Rostini	Agriculture Faculty of Padjadjaran University	nenithamrin@yahoo.com
Ni Made Armini	Department of Agronomy and Horticulture, Bogor Agricultural University	nmarmini@gmail.com
Nita Ekana'ul	Department of Agronomy and Horticulture, Bogor Agricultural University	nitaekanaul@rocketmail. com
Noraziyah Binti Abd Aziz Shamsudin	Faculty of Science and Technology, Universiti Kebangsaan	nora_aziz@ukm.edu.my
Nur Kholilatul Izzah	Indonesian Industrial and Beverage Crops Research Institute	lila_ref@yahoo.co.id
Nurul Hidayatun	Indonesian Center for Agricultural Biotechnology & Genetic Resources	nurulhi23@yahoo.com

Name	Affiliation	Email
Nurwanita Ekasari Putri	Department of Agronomy and Horticulture, Bogor Agricultural University	nurwanita2004@yahoo. com
Panca Jarot Santoso	Indonesian Tropical Fruit Research Institute, IAARD, Jl. Raya Solok- Aripan Km. 8, P.O. Box	jarot305@yahoo.com
Patcharin Tanya	Dept. of Agronomy, Faculty of Agriculture at Kamphaeng Saen, Kasetsart University, Kamphaeng Saen, Nakhon Pathom 73140, Thailand	altanya55@yahoo.com
Peerasak Srinives	Kasetsart University	agrpss@yahoo.com
Pieter Lontoh	Department of Agronomy and Horticulture, Bogor Agricultural University	
Prakit Somta	Department of Agronomy, Kasetsart University	pksomta@gmail.com
Puji Lestari	ICABIOGRAD	plestari129@yahoo.com
Rahmatika Alfi	Department of Agronomy and Horticulture, Bogor Agricultural University	
Rahmi Henda Yani	Department of Agronomy and Horticulture, Faculty of Agriculture, Bogor Indonesia, 16680	rahmi_hendayani@yahoo. com
Rakesh Kumar Singh	Plant Breeding, Genetics, and Biotechnology Division, International Rice Research Institute, Philippines	r.k.singh@irri.org
Ramakrishnan Madhavan Nair	AVRDC – The World Vegetable Center, South Asia, ICRISAT Campus, Patancheru	ramakrishnan.nair@ worldveg.org
Ratih Wahyuni	PT BISI International Tbk	nunik_ratih@yahoo.com
Razlin Azman Halimi	Crops For the Future (CFF)	razlin.azman@cffresearch.
Reflinur	ICABIOGRAD	reflinur@yahoo.com
Reni Indrayanti Sukardiono	Dept. Biologi, Universitas Negeri Jakarta	reni_yanti@yahoo.com
Respatijarti Atmadji	Faculty of Agriculture, Brawijaya University	patiatmadji@gmail.com
Rima Margareta Retnyo Gumelar	Department of Agronomy and Horticulture, Bogor Agricultural University	rimamargareta@gmail.com
Rossa Yunita	Department of Agronomy and Horticulture, Bogor Agricultural University	rossa_yunita@yahoo.com

Name	Affiliation	Email
Rudy Soehendi	Indonesian Ornamental Crop Research Instituti-IAARD	rsoehendi@gmail.com
Sandra Arifin Aziz	Department of Agronomy and Horticulture, Bogor Agricultural University	sandraaziz@yahoo.com
Sangnag Ahn	Chungnam National University	ahnsn@cnu.ac.kr
Sangrea Shim		sangreashim@gmail.com
Satoto	Indonesian Center for Rice Research	satoto_ski@yahoo.com
Sentoor Kumeran Govindasamy	Fakulti Pertanian, Universiti Putra Malaysia	sentoor@mardi.gov.my
Sherly Lapuimakuni	Department of Agronomy and Horticulture, Bogor Agricultural University	lapuimakunisherly@gmail.
Shungo Higuma	Graduate School of Agricultual Science, Tokyo University of Agriculture and Technology	grizzly9266@gmail.com
Sigit budi santoso	Indonesian Cereals Research Institute	nanoboed@gmail.com
Simon H.T. Raharjo	Faculty of Agriculture, Pattimura University	indobio@gmail.com
Siti Marwiyah	Department of Agronomy and Horticulture, Bogor Agricultural University	wie.marwiyahs@gmail. com
Siti Nurhidayah	Department of Agronomy and Horticulture, Bogor Agricultural University	dayah.ipb@gmail.com
Sofyan Zaman	Department of Agronomy and Horticulture, Bogor Agricultural University	
Sri Sunarti	Indonesian Cereals Research Institute	sri.sunarti01@yahoo.co.uk
Suchila Techawongstien	Faculty of Agriculture, Khon Kaen University Khon Kaen	suctec.kku@gmail.com
Sudarsono	Department of Agronomy and Horticulture, Bogor Agricultural University	s_sudarsono@ymail.com
Suluh Nurmasiwi	PERIPI	snsuluhsiwi10@gmail.co
Surjono H Sutjahjo	Department of Agronomy and Horticulture, Bogor Agricultural University	surjonohadisutjahjo@ yahoo.com
Suseno Amien	Faculty of Agriculture, University of Padjadjaran	suseno2011@gmail.com
Suskandari	Indonesian Ornamental Crop Research	suskandari@gmail.com
Kartikaningrum	Institute	

Name	Affiliation	Email
Suyeon Ha		hasuyeon@snu.ac.kr
Syarifah Iis Aisyah	Department of Agronomy and Horticulture, Bogor Agricultural University	syarifahiis@yahoo.com
Tae-Hwan Jun	Department of Plant Bioscience, Pusan National University	thjun76@pusan.ac.kr
Taeyoung Lee	Department of Plant Science and Research Institute for Agriculture and Life Sciences, Seoul National University	alima9002@gmail.com
Tantri Dyah Ayu A		tantrianggraeni210@ gmail.com
Taryono	Faculty of Agriculture, University of Gadjah Mada	tariono60@gmail.com
Tengku Laila Kamaliah	Department of Agronomy and Horticulture, Bogor Agricultural University	tengkulailakamaliah@ gmail.com
Tri Hastini	Department of Agronomy and Horticulture, Bogor Agricultural University	trihastini@gmail.com
Trias Sitaresmi	Indonesian Center for Rice Research	sitares_trias@yahoo.com
Trikoesoemaningtyas	Department of Agronomy and Horticulture, Bogor Agricultural University	trikadytia@gmail.com
Untung Susanto	ICCR of IAARD	untungsus2011@gmail.
Usamah Jaisyurahman	Department of Agronomy and Horticulture, Bogor Agricultural University	usamah_jaisyu@yahoo. com
Victor Manotar Pademan Manalu	Department of Agronomy and Horticulture, Bogor Agricultural University	victormpmanalu@yahoo. com
Willy Bayuardi Suwarno	Department of Agronomy and Horticulture, Bogor Agricultural University	bayuardi@gmail.com
Wiwik Hardaningsih	PS. Budidaya Tanaman Pangan, Jurusan Budidaya Tanaman, Politani	jeng_wiwik@yahoo.com
WooJae Kim	National Institute of Crop Science, RDA	wjkim1993@gmail.com
Yeong-Ho Lee		yhl413@hanmail.net
Yong-Gu Cho	Department of Crop Science, Chungbuk National University	ygcho@cbnu.ac.kr
Young Chan Cho	National Institute of Crop Science, RDA	yccho@korea.kr

List of Participants

Name	Affiliation	Email
Yudhistira Nugraha	Indonesian Center for Rice Research	yudhistira.nugraha@gmail. com
Yudiwanti Wahyu	Department of Agronomy and Horticulture, Bogor Agricultural University	yudiwanti@apps.ipb.ac.id
Yuliasti	Center for Application Isotope Radiation Jakarta Indonesia	upikyuliasti@yahoo.com
Yun-A Jeon		jya0911@cnu.ac.kr
Yunandra	Department of Agronomy and Horticulture, Bogor Agricultural University	yunandraasnur71@gmail. com
Yuni Widyastuti	Indonesian Center for Rice Research	yuniweicrr@gmail.com
Yunjoo Kang	Chungnam National University	yunjook.92@gmail.com

CONTROLLING GENETIC FACTORS TO SOYBEAN SEED STORABILITY UNDER ROOM TEMPERATURE CONDITIONS

Eny Widajati*, Desta Wirnas, and Kade Ari Oktaviani

Department of Agronomy and Horticulture, Faculty of Agriculture, Bogor Agriculture University (IPB), Dramaga Bogor 16680, Indonesia
*Corresponding Author: enywidajati@gmail.com

SUMMARY

The objective of the research was to obtain information on genetic control of seed soybean storability. The research was conducted at seed testing laboratorium of Department of Agronomy and Horticulture (Bogor Agricultural University), Bogor, Indonesia. Genetic material used were 3 national varieties and 17 advanced breeding lines. The research was arranged in randomized completely block design with three replications. Black soybean seeds are stored in airtight plastic packaging at a temperature of 27–30°C and 57–60% RH for a 14 weeks. The results showed that all characters observed was significantly affected by genotypes. Traits related to seed storability are affected by genetic factors. All traits observed showed a high heritability. There is possiblity to improve seed soybean storabilty by breeding program. Based on growth rate of seedling and vigor index, SSD-10, SSD-17, SSD-18, SSD-39, SSD-82, SSD-91 dan SC-39- are the best seed storability.

Keywords: Soybean, seed storability, heritability

INTRODUCTION

An important of seed is its storability in many various environment (Kueneman, 1981). Storability may vary according to the genetic factors. Seed strorability also depend on environment factors instorage conditions (Balesevic-Tubic *et al.*, 2010), such as temperature, moisture content, mechanical damage. Based on the Harrington Law, environmental factors such as room temperature storage of seed influence on the rate of deterioration. Low temperatures needed to slow down the aging seed.

Genetic factors will affect the hardness of the seed coat and the permeability of the seed coat. The harderthe seed coatwill be longer the seed storability. Seed cotton and soybean seed has a similar chemical composition, but the seed cotton could maintain viability for longer than soybean seed. Soybean seed has a morphological structure that can cause critical parts of seeds more easily damaged.

Improvement seed quality after storage periodthrough selection in a breeding program is an alternative to produce high seed quality. This research aims to investigate the effect of genetic factors on the storability of black soybean seed (*Glycine max* (L.) Merr.).

MATERIALS AND METHODS

Research was conducted at the Seeds Laboratory and Plant Breeding Laboratory of the Department of Agronomy and Horticulture, Faculty of Agriculture, Bogor Agricultural University, Dramaga and Center for Development Seed Quality Testing of Food Crops and Horticulture. The research was conducted in March until July 2012.

The materials used are 17 promising lines of black soybean lines, namely SSD-10 SSD-13 SSD-17 StheSD-18 SSD-20 SSD-27 SSD-39 SSD-46 SSD-51 SSD-54, SSD-75 SSD-82 SSD-91 SSD-102, SC-39-1, SC-68-2, GC-74-7, and three national varieties as check, namely Cikuray, Malika and Wilis. The research used Randomized Complete Block Design. The treatment used is the single factor which is composed of 17 promising lines of black soybean seeds and three varieties with three replications. Seeds were stored on several storageperiodfor 0, 2, 4, 6, 8, 10, 12, 14 and 16 weeks.

Black soybean seeds stored in airtight plastic containers at temperature of 27-30°C and RH 57–60%. Once the seeds are conducted several tests to determine the storability of seeds at a certain time period. Parameters observed were percentage seed germination, growth rate of seedling, maximum potential growth, vigor index and seedling dry weight. Seed viability testing method used between paper methods. Seed moisture content determination used a temperature of 103 ± 2°C for 17 hours. Testing of electrical conductivity (EC) was conducted to look at the level of leakage of seeds stored for a certain period by using electric conductivity meter. Seeds soaked in distilled water for 24 hours in a sealed glass bottle. Variance analysis was performed for each parameter observed. Duncan's multiple range test was used to compare means.

RESULTS AND DISCUSSION

Storablity of Black Soybean Seed

One thousand seed weight was affected by genotype. SSD-54 SSD-75 SSD-102 and Cikurayshowed 100 seed weight highest compared to other lines. Seed volume was not affected by genotype factors. The result showed that there is a variation of 100 seed weight black soybean lines. There were posistif correlationbetween 100 seed weight and seed volume. It is estimated that seed size has a positive correlation with seed storability and viability. The larger seed size have a lower seed viability than the small one.

Variance analysis showed that genotype factor significantly affected to seed germination percentage, maximum potential, growth rate of seedling, seedling dry weight, vigor index and electrical conductivity in some storage periods (Table 1). Baktisari (2010) found that genotypes highly significant effect on all parameter observed ie. germination, the maximum growth potential, growth rate, moisture content, weight, volume, weight and electrical conductivity type. El Abady *et al.* 2013 reported that there are significant differences among soybean cultivars in seed quality traits.

Table 1. Variance analysis of parameters observed related to black soybean seed storability

Parameter	Genotype	Storage Periode	Interaction
seed germination	**	0-6, 12, 14**	**
		8, 16*	
		10ns	
Vigor Index	**	0-8,12-16**	*
		10*	
maximum potential growth	**	0,2,6,14**	tn
		4,8,10,12,16ns	
growth rate of seedling	**	2-8, 12-16**	**
		2,10*	
Seedling Dry Weigh	*	2, 6-16**	**
		0,4*	
Seed Moisture content	**	10-16**	**
		0-8ns	
Electrical conductivity	**	4,8,12,16**	*

*and **significant at 5% and 1% level, respectively

Seed germination at 0-week storage period ranged from 54–92%. Promising line that have the high seed germination at 0-week period are SSD-10 and SC-39-1 with the value of 85.33% and 91.33%. Seed germination in 2-week storage period showed remained high such as SSD-10 SSD-27 SSD-82, SC-39-1 and Willis varieties have more than 80%. Seed germination beginning to decline in the storage period of 6 weeks ranged between 41–87%. Promising line that have high viability at 6-week storage period are SSD-82, SC-39-1 and Wilis varieties with a value of 80.67%, 86.67% and 82.67%. Many promising line have low seed germination at 16-week storage period showed at ranged between 16–40%. Strain SC-39-1 has remained high seed germination, that is 74.67% (Table 2).

The maximum growth potential is very high at 0-week storage period ranged between 78–94%. The maximum growth potential remains high until the storage period of 8 weeks. The maximum growth potential began to decline in the 10-week storage period reaches 49–76%. The promising line that have high maximum potential growth at the 14-week period is SC-39-1 with a value 90.67% (Table 3).

The growth rate of seedling in the 0-week storage period is high, ranged between 15–26%. The best promising line based on growth rate of seedling are SSD-10, SC-39-1 and Wilis. The growth rate of seedling began to reduce in the storage period of 6 weeks (11–23%) for all lines except SC-39-1 that have high the growth rate is 28.22% (Table 4).

Vigor index at 0-week storage period ranged between 34–72%. The promising line that have high vigor index was SSD-10 and SC-39-1 with a value of 66% and 72%. Vigor index began to reduce fastly in the storage period of 6 weeks, reaching 17–62%. The promising line SC-39-1 can still maintain vigor index remains high compared with other lines (Table 5).

Table 2. Seed germination percentage of many promising line in 16-weeks storage periode

т.	Storage periode (weeks)												
Lines	0	2	4	6	8	10	12	14	16				
		Seed germination (%)											
SSD-10	85.33	80.67	88.67	76.67	73.33	50.67	56 ^A	40C	40				
SSD-13	54.67 ^{abc}	60°	60	41.33 ^{ac}	46.67	50.67	34.67	13.33 ^b	22.67				
SSD-17	71.33	63.33°	63.33	58	64	49.33	36	25.33	16				
SSD-18	78.67	78.67	70.67	68.67	64	53.33	32	33.33	25.33				
SSD-20	77.33	78.67	78	78	65.33	53.33	33.33	33.33	22.67				
SSD-27	80	81.33	78.67	70.67	61.33	57.33	29.33	33.33	24				
SSD-39	77.33	80	72.67	66.67	48	49.33	33.33	28	18.67				
SSD-46	72	74.67	73.33	68	65.33	49.33	34.67	38.67	22.67				
SSD-51	82.67	78.67	74.67	69.33°	85.33 ^{AB}	60	41.33	32	25.33				
SSD-54	64	54.67 ^{ac}	56°	48.67°	54.67	38.67	33.33	25.33 ^b	20				
SSD-75	46^{abc}	60.67°	62	47.33	49.33	44	28	13.33	16				
SSD-82	71.33	80	86	80.67	68	57.33	44	32	28				
SSD-91	84.67	78	72.67	62.67	61.33	53.33	42.67	28	26.67				
SSD-102	70	70	75.33	64.67	58.67	52	29.33	30.67	25.33				
SC-39-1	91.33	86.67 ^B	66.67	86.67	93.33 ^B	73.33	81.33 ^{ABC}	84 ^{ABC}	74.67 ^{ABC}				
SC-68-2	63.33	56.67°	70	52°	50.67	52	41.33	29.33	16				
GC-74-7	70	36^{abc}	46 ^{ac}	53.33°	52	49.33	38.67	34.67	24				
Cikuray	76	74.67	74	76	62.67	60	32	41.33	38.67				
Malika	74.67	64.67	69.33	65.33	53.33	65.33	37.33	34.67 ^C	17.33				
Wilis	79.333	83.33	82.667	82.67	70.67	58.67	45.33	17.33 ^b	17.33				
F-value	6.87**	7.75**	2.98**	3.44**	3.20*	1.23 ^{tn}	4.73**	7.80**	3.09*				
KK	9.56	11.07	14.37	17.86	18.69	21.77	24.31	27.62	49.93				

Note: * = significant defferent at α = 5 %, ** = significant defferent at α = 1 %, the non significant, a = less significant different than Cikuray, b = less significant different than Malika, c = less significant different than Wilis, A = less significant different than Cikuray, B = less significant different than Malika, C = less significant different than Wilisbased on Dunnett test at $\alpha = 5$ %.

Table 3. The maximum potensial growth of many promising line in 16-weeks storage periode

Promising Line	Storage periode (weeks)											
	0	2	4	6	8	10	12	14	16			
	maximumpotensial growth (%)											
SSD-10	90	85.33	92.67	70.67	86.67	54.67	68	66.67	69.33			
SSD-13	80^{b}	74.67	73.33	44.67	70.67	57.33	50.67	41.33 ^a	48			
SSD-17	82	73.33	73.33	59.33	80	53.33	50.67	50.67	37.33			
SSD-18	89.33	84	80.67	72.67	76	61.33	48	58.67	41.33			
SSD-20	87.33	84	85.33	74.67	73.33	60	48	61.33	49.33			
SSD-27	78^{abc}	88.67	86	66	78.67	65.33	50.67	58.67	54.67			
SSD-39	88.67	87.33	80	69.33	65.33	64	52	53.33	42.67			
SSD-46	90	84.67	83.33	64.67	82.67	56	54.67	58.67	40			

Table 3. The maximum potensial growth of many promising line in 16-weeks storage periode (Cont.)

Promising Line	Storage periode (weeks)											
Eine	0	2	4	6	8	10	12	14	16			
maximumpotensial growth (%)												
SSD-51	89.33	84	80	64.67	89.33	65.33	58.67	58.67	46.67			
SSD-54	80.67 ^b	70c	68.67	50.67	76	49.33	49.33	53.33	40			
SSD-75	86.67	69.33	74	50	66.67	53.33	41.33	32 ^{ab}	44			
SSD-82	86	86	92.67	78.67	76	69.33	56	49.33	46.67			
SSD-91	80.67 ^b	91.33	83.33	65.33	88	61.33	57.33	56	52			
SSD-102	82.67	79.33	85.33	61.33	70.67	58.67	44	58.67	42.67			
SC-39-1	92.67	90	71.33	75.33	94.67	76	84	90.67 ^{ABC}	78.67			
SC-68-2	78.67	64°	78.67	50	73.33	60	49.33	58.67	45.33			
GC-74-7	81.33 ^b	42°	61.33	72.33	70.67	52	50.67	61.33	42.67			
Cikuray	90	81.33	82.67	71.33	84	64	53.33	65.33	53.33			
Malika	93.33	71.33°	81.33	65.33	70.67	68	49.33	58.67	44			
Wilis	90	90.67	90.67	74.67	78.67	69.33	58.67	49.33	38.67			
F-value	3.24**	7.62**	1.76 ^{tn}	3.45**	1.40 ^{tn}	1.40 ^{tn}	0.6 ^{tn}	4.34**	1.42 ^{tn}			
KK	5.47	9.38	13.12	14.27	15.01	16.46	24.69	16.39	31.01			

Note: * = significant defferent at α = 5 %, ** = significant defferent at α = 1 %, ** = non significant, a = less significant different than Cikuray, b = less significant different than Malika, c = less significant different than Cikuray, B = less significant different than Malika, C = less significant different than Wilis based on Dunnett test at α = 5 %,

Table 4. The growth rate of seedling of many promising line in 16-weeks storage periode

Promising													
Line				Stor	age period	de (weeks	3)						
	0	2	4	6	8	10	12	14	16				
•••••	the growth rate of seedling(%)												
SSD-10	23.77	23.93	24.86	22.11	23.22	19.67	16.22	12.11 ^C	11.11				
SSD-13	15.82°	16.46 ^{bc}	18.71	13.11 ^a	13.67c	10.56 ^a	9.67	4.22	6.89				
SSD-17	19.84	18.93	18.57	14.61	14.78c	14.67	10.11	7.78	4.78				
SSD-18	19.8	21.84	19.38	11.78 ^{abc}	16.56c	15.89	9	10.33	7.44				
SSD-20	20.62	23.99	22.8	17.67	21.78	14.11	9.44	9.56	7				
SSD-27	21.81	23.01	21.82	18.94	17.33c	18	8	9.89	6.78				
SSD-39	21.61	20.86	21	16.5	20.33	16.67	9.33	8.56 ^C	6				
SSD-46	21.62	18.96	20.94	16.5	19.11	17.89	9.67	11.56	6.89				
SSD-51	22.14	22.36	21.41	15.83	18.56 ^c	16.89	11.56	9.33	7.89				
SSD-54	17.64	19.14	18	13.56 ^a	12.56 ^c	12.44 ^a	9.67	7.22	7				
SSD-75	16.73	16.72°	14.51	13.83 ^a	15.11 ^c	14.78	8.22	4	5.56				
SSD-82	19.56	25.04	27.17^{B}	20.56	18.33°	21.44	13.11	9.89	8.78				
SSD-91	21.99	21.6	21.5	20.28	18.11 ^c	16	12.56	8.56	7.67				
SSD-102	20.9	20.16	19.61	14.83	19.44	16.44	8.67	9	7.78				
SC-39-1	25.42	22.76	27.94^{B}	28.22	29.11	26.56 ^B	26.89 ^{ABC}	27.89 ^{ABC}	23.89 ^{ABC}				
SC-68-2	18.34	20.6	19.62	15.28	14.33°	14.56	12.44	8.56	7.11				
GC-74-7	17.48	6.07 ^{abc}	17.56	11.11 ^{abc}	10.22abc	14.67	11.44	9.89	7.33				

Table 4. The growth rate of seedling of many promising line in 16-weeks storage periode (Cont)

Promising												
Line		Storage periode (weeks)										
	0	2	4	6	8	10	12	14	16			
			th	e growth	rate of se	edling(%	o)					
Cikuray	21.12	22.32	21.53	22.83	20.33	22.22	9.33	12C	12.11			
Malika	20.39	24.47	19.33	21.78	21.78	15.78	10.67	10.11	5.56			
Wilis	23.8	24.79	21.27	21.22	28.56	18.44	12.78	5.11	6.22			
F-value	1.96*	5.47**	3.28**	4.12**	21.05**	3.04*	6.6**	11.37**	3.72**			
KK	14.89	15.25	14.48	20.77	4.52	21.74	24.53	25.19	44.43			

Note : * = significant defferent at α = 5 %, ** = significant defferent at α = 1 %, then no significant, a = less significant different than Malika, c = less significant different than Wilis based on Dunnett test at α = 5 %,

Table 5. The vigor index of many promising line in 16-weeks storage periode

0	2	4	6	8	10	12	14	16			
SSD-10 66 54 66.67 ^A 43.33 54.67 37.33 26.67 25.33 ^C 20											
66	54	66.67 ^A	43.33	54.67	37.33	26.67	25.33 ^C	20			
38	45.33	30^{ABc}	22	22.67	33.33	12	10.67	10.67			
53.33	43.33°	37.33 ^A	29.33	36	25.33	13.33	17.33	5.33			
56	60	40.67 ^A	37.33	32	45.33	12	24 ^C	9.33			
45.33	56	52 ^A	45.33	45.33	44	13.33	14.67	12			
54.67	54.67	50.67 ^A	35.33	40	45.33	8	18.67	5.33			
54	55.33	45.33 ^A	33.33	32	38.67	12	18.67	12			
44.67	52	47.33 ^A	36	46.67	34.67	12	22.67	10.67			
58	63.33	56.67 ^A	37.33	58.67	46.67	14.67	16	14.67			
42	38.67°	31.33 ^{ABc}	24	28	21.33	16	10.67	16			
34	38°	40^{A}	24	32	22.67	14.67	8	9.33			
44.67	58.67	68.67 ^B	53.33	46.67	41.33	25.33	22.67	17.33			
52	54.67	52 ^A	30.67	44	41.33	22.67	18.67	8			
43.33	55.33	50 ^A	30	36	34.67	16	16	8			
72	54.67	52 ^A	62 ^{BC}	86.67 ^{ABC}	66.67 ^C	78.67 ^{ABC}	82.67 ^{ABC}	53.33 ^{ABC}			
50	36°	41.33 ^A	24.67	29.33	26.67	25.33	14.67	9.33			
45.33	26°	16^{ABc}	17.33ac	38.67	25.33	21.33	14.67	12			
54.67	54	52 ^A	41.33	36	42.67	16	20	20			
57.33	46.67	41.33 ^A	34.67	34.67	40	16	17.33	6.67			
54.67	64.67	51.33 ^A	40	38.67	30.67	17.33	9.33	10.67			
3.01**	4.24**	7.29**	4.82**	4.01**	2.78*	15.45**	21.15**	4.57**			
18.14	16.54	16.95	24,35	29.53	29.61	33.18	24.96	61.66			
	66 38 53.33 56 45.33 54.67 54 44.67 58 42 34 44.67 52 43.33 72 50 45.33 54.67 57.33 54.67 3.01**	66 54 38 45.33 53.33 43.33° 56 60 45.33 56 54.67 54.67 54 55.33 44.67 52 58 63.33 42 38.67° 34 38° 44.67 58.67 52 54.67 43.33 55.33 72 54.67 50 36° 45.33 26° 54.67 54 57.33 46.67 54.67 54 57.33 46.67 54.67 64.67 3.01° 4.24°	66 54 66.67 ^A 38 45.33 30 ^{ABc} 53.33 43.33 ^c 37.33 ^A 56 60 40.67 ^A 45.33 56 52 ^A 54.67 54.67 50.67 ^A 54 55.33 45.33 ^A 44.67 52 47.33 ^A 58 63.33 56.67 ^A 42 38.67 ^c 31.33 ^{ABc} 34 38 ^c 40 ^A 44.67 58.67 68.67 ^B 52 54.67 52 ^A 43.33 55.33 50 ^A 72 54.67 52 ^A 50 36 ^c 41.33 ^A 45.33 26 ^c 16 ^{ABc} 54.67 54 52 ^A 57.33 46.67 41.33 ^A 54.67 64.67 51.33 ^A 3.01** 4.24** 7.29**	0 2 4 6	0 2 4 6 8		0 2 4 6 8 10 12	0 2 4 6 8 10 12 14			

Note: * = significant defferent at α = 5 %, ** = significant defferent at α = 1 %, then no significant, a = less significant different than Cikuray, b = less significant different than Malika, c = less significant different than Cikuray, B = less significant different than Malika, C = less significant different than Wilis based on Dunnett test at α = 5 %

Electrical conductivity in the storage period of 4 weeks is $13-35~\mu S$ cm-1 g-1. Electrical conductivity of the lowest in the storage period of 4 weeks is owned by SSD-10 strains and varieties Cikuray with a value of less than 16 μS cm-1 g-1. Electrical conductivity continues to increase along with the increase in seed storage period. Electrical conductivity in the storage period of 12 weeks reached 26–60 μS cm-1 g-1 The higher the value of electrical conductivity shows the membranes damagemore severe damage. Rated electrical conductivity is inversely related to seed vigor. The higher the value of the electrical conductivity of the lower seed vigor. The electrical conductivity have a negative correlation to germination, growth rate of seedling and vigor index (Figure 1) This shows that the higher the electrical conductivity of the germination, growth rate and vigor index become lower. The electrical conductivity can be used as a character selection on seed vigor.

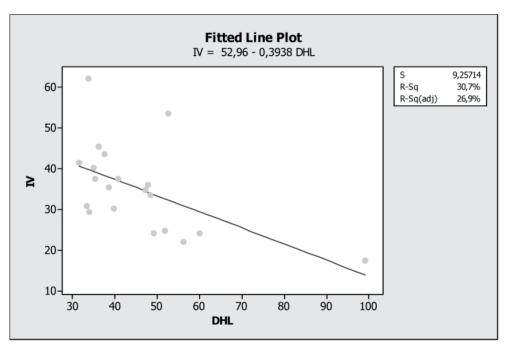


Figure 1. The correlation between electrical conductivity with vigor index

Variation and Heritability of storabillity parameter of some black soybean lines

Based on percentage of mean square, seed germination percentage, maximum potential growth and electrical conductivity has the highest mean square percentage in the storage period of 16 weeks among the parameters observed. It means that mean difference of the parameters among lines evaluated mostly caused genotype factors. All the parameters observed showed a high heritability (Table 6). Seed storability parameters are not only affected by environment, but also affected by genetic factor so that the parameter will be heritable from parents to progeny.

Tabel 6. Heritability of storability parameters of black soybean lines after 16 weeks storage periode under room temperature conditions

Parameter	σ^2 e	$\sigma^2 p$	$\sigma^2 g$	h_{bs}^{2} (%)	Criteria
Seed germination	138.31	158.58	112.81	71.14	High
Potensial growth	86.83	99.84	70.89	71.004	High
Growth rate	12.99	19.09	14.76	77.32	High
Vigor Index	72.89	117.21	92.92	79.27	High
conductivity	216.36	242.26	170.14	70.23	High

Keterangan :High Heritabiliy ($h_{be}^2 > 50$), medium ($20 \le h_{be}^2 \le 50$), low ($h_{be}^2 \le 20$)

Seed storability an important trait for agronomic aspects because it has a correlation with high seed germination and seedling vigor. Kazmi *et al.* (2012) reported that seed traits are quantitative and genetically complex. One traits Germination percentage (GP) was used to determine the degrees of seed storability.

It is very possible to make an effort for breeding program of high storability soybean seed. Selection process is important step in breeding program. To obtain satisfied genetic progress after the selection, it is necessary to determine the method and criteria for proper selection. Seed germination percentage, maximum potential growth and electrical conductivity could be used as a single trait selection or multiple traits selection.

CONCLUSION

Parameters of quality seeds of black soybean lines are influenced by genetic factors, namely seed germination percentage, maximum potential growth, growth rate of seedling, vigor index and electrical conductivity. All parameters of quality seeds have a high heritability ie germination, maximum potential growth, growth rate, vigor index and electrical conductivity with heritability of more than 70%. Seed germination percentage, maximum potential growth and electrical conductivity could be used as a single trait selection or multiple traits selection. SSD-20 SSD-82 and SC-39-1 had are two the best black soybean lines for storability parameters.

REFERENCES

Baktisari A. (2010). Keragaman Karakter Terkait Vigor Daya Simpan Benih Kedelai. Under graduate Thesis. Bogor Agricultural University, Bogor. 44p.

Balesevic-Tubic S, Tatic S, Dordevic V, Nikolic, Dukic V. (2010). Seed viability of oil crops depending on storage conditions. *HELIA*. 33 (52): 153–160.

El Abady M, El Emam AMM, Seadh SE, Youssof FI. (2013). Soybean Seed Quality as Affected by Cultivars, Threshing Methods and Storage Periods. *Research Journal of Seed Science*, 5: 115–125.

Kueneman EA.(1981). Soybean Seed Quality and Stand Establishment. Proceedings of a Conference for Scientists of Asia. January 25–31, 1981. Colombo, Sri Lanka.

- Kazmi RH, Khan N, Willems LAJ, Van Heusden AUW, Ligterink W, Hilhorst HWM. (2011). Complex genetics controls natural variation among seed quality phenotypes in a recombinant inbred population of an interspecific cross between Solanum lycopersicum × Solanum pimpinellifolium. Plant, Cell & Environment. 35 (5): 929–951.
- Yusuf M, Suharsono. (2006). Perbaikan Genetik Tanaman Kedelai untuk Produktivitas dan Adapatasi terhadap PH Rendah. Lembaga Penelitian dan Pemberdayaan Masyarakat, IPB. Bogor. 34p.