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PROSIDING

SEMINAR NASIONAL DAN RAPAT TAHUNAN DEKAN

Bidang Ilmu-Ilmu Pertanian
Badan Kerjasama Perguruan Tinggi Negeri Wilayah Barat

BUKU 2
AGROEKOTEKNOLOGI

Tema :

Revitalisasi Program Studi dan Peningkatan Peran Perguruan Tinggi Ilmu-Ilmu Pertanian dalam Pembangunan Pertanian Nasional

Tim Penyunting:
Marwanto
Hermansyah
Hasanudin
Nanik Setyowati

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DAFTAR ISI

Kata Pengantar iii
Daftar Isi v

BUKU 1 MAKALAH UTAMA 1-50

BUKU 2 AGROEKOTEKNOLOGI

Evaluasi Kesesuaian Lahan Tanaman Hortikultura pada Lahan Gambut Menggunakan Teknologi Sistem Informasi Geografi di Kabupaten Kepulauan Meranti
Besri Nasrul 51

Serangga Hama dan Predator pada Pertanaman Kacang Panjang (*Vigna sinensis* (L.) Savi Ex Has) di Kota Padang
My Syahrawati dan Munzir Busniah 59

Changes in Seed Quality of Mung Bean Genotypes with Different Seed Characteristics As Affected by Incubator Weathering during Maturity Stages
Marwanto 68

Pemanfaatan Bioaktivitas Ekstrak Selasih Hijau dalam Pengendalian Hama Lalat Buah (Diptera:Tephritidae) pada Tanaman Cabe
Triani Adam dan Yulia Pujiastuti 74

Biologi Reproduksi *Telenomus* sp. (Hymenoptera: Scelionidae) pada Telur *Eurydema pulchrum* (Westw.) (Hemiptera: Pentatomidae)
Rosdah Thalib, Arsi, Khodijah, Haperidah Nuhnilawati, dan Chandra Irsan 78

Keanekaragaman Serangga Penggerek Batang (Coleoptera:Cerambycidae) pada Tanaman Mangga dan Nangka
Yulia Pujiastuti dan Triani Adam 83

Gulma Berdaun Lebar yang Berkhasiat Obat di Desa Tanjung Seteko Kec. Indralaya Kab. Ogan Ilir
Yernelis Syawal 87

Perubahan Jenis Gulma dan Hasil Kedelai pada Penggunaan Berbagai Dosis Pupuk Organik
Teguh Achadi 91

Respon Tanaman Mentimun (*Cucumis Sativus* L.) terhadap Pemberian Kalsium pada Kondisi Stess Air
Sri Rahayu, Lidwina Ninik, dan Sri Sukarmi 94

Pengaruh Pupuk Hayati dan Mikoriza terhadap Pertumbuhan dan Produksi Tanaman Kedelai (*Glicine max* (L) Merr) di Tanah Kambisol
Andi Wijaya dan Firdaus Sulaiman 100

Optimalisasi Pupuk Hayati dan Pupuk N, P terhadap Ketersediaan serta Serapan Hara Tanaman Kedelai pada Ultisol
Margarettha 108

Pertumbuhan dan Produksi Cabai (*Capsicum annum* L.) dengan Memanfaatkan Bahan Organik Ampas Gambir dan Kompos Tandan Kosong Kelapa Sawit di Polybag
Endang Darma Setiaty, Susilawati dan Rini Fitra Sari 115

Potensi Allelopati Padi (*Oryza sativa* L.) terhadap Gulma Jajagoan (*Echinochloa cruss-galli* (L.) Beauv.)
Irawati Chaniago dan Jamsari 121

Studi Alelopati *Wedelia trilobata, Ageratum conyzoides, Chromolaena odorata* dan *Mikania micrantha* terhadap Pertumbuhan dan Hasil Sawi
Donly Avrin Togatorop, Nanik Setyowati dan Uswatun Nurjanah 126

Perakitan Varietas Jagung Hibrida Berdaya Hasil Tinggi dan Adaptif di Lahan Ultisol dengan Input Rendah
M. Taufik, Suprapto dan Heru Widiyono 135

Isolasi dan Identifikasi Bakteri dari Tanaman Pisang Bergejala Layu Bakteri di Provinsi Bengkulu
Mucharromah dan Misnawaty 139

Respon Pertumbuhan Tiga Kultivar Padi terhadap Iradiasi Sinar Gamma
Widodo 144

Ameliorasi Media Tanam Sub Soil di Pembibitan Kelapa Sawit dengan Kompos Tandan Kosong Kelapa Sawit dan Konsentrat Limbah Cair Pabrik Kelapa Sawit
Hamidah Hanum, Gantar Sitanggang, dan Olland Akbar Harahap 150

Pemanfaatan Kompos Tandan Kosong Kelapa Sawit dan Kompos Jerami dalam Meningkatkan Pertumbuhan dan Produksi Kedelai Bermikoriza pada Dua Lokasi di Sumatera Utara
Syukri, Rosmayati, Hamidah Hanum, dan Erly Tiurlan Tambunan 158

Efek Suplementasi Fosfor dan Sulfur terhadap Kecernaan dan Fermetabilitas Jerami Padi Amoniasi Secara *In Vitro*
Novirman Jamarun, Mardiati Z dan Nurhaita 166

Kelimpahan Musiman Hama Pengorok Daun (*Liriomyza* spp.) dan Potensi Parasitoid yang Berasosiasi pada Tanaman Bawang Merah di Dataran Tinggi
Reflinaldon, Nusyirwan Hasan dan Ratih Febrianti 171

Pengaruh Kombinasi Pupuk Kotoran Ayam dan Pupuk Npk 15-15-15 terhadap Pertumbuhan dan Hasil Varietas Tanaman Tomat (*Lycopersicum esculentum* Mill.)
Zulfadly Syarif, Netti Herawati dan Eldo Putra 180

Scale Up Teknik Bioremediasi dengan Slurry Bioreaktor untuk Tanah Tercemar Minyak Diesel
Fitria Riany Eris 188

Pengaruh Pemberian Pupuk Hijau *Mucuna* sp dan Lamtoro terhadap Erodibilitas Ultisol dan Hasil Jagung
Refliaty dan Nur Hasyah 193

Kemantapan Agregat Ultisol dan Hasil Jagung Akibat Pemberian Pupuk Hijau (Lamtoro dan *Mucuna* sp.)
Zurhalena dan Sri Wahyuni 199

Respons Tujuh Kultivar Kacang Tanah Lokal Asal Serang (*Arachis hypogaea* L.) terhadap Kondisi Stres Kekeringan
Rusmana 204

Pengaruh Sinar Ultra Violet terhadap Patogenisitas Cendawan Entomopatogen *Metarhizium* sp. Pada Larva *Crocidolomia pavonana*
Trizelia, My Syahrawati, dan Dodi Yarli Fitrah 210

Variabilias Genetik dan Heritabilitas Karakter Hasil dan Komponen Hasil Genotipe Padi Lokal *Oryza Sativa* L.)
Etti Swasti, Rida Putih dan Leli Susilawati 216

Penyebaran Penyakit Hawar Daun Bakteri(*Xanthomonas axonopodis* Pv. Allii) sebagai Penyakit Baru pada Tanaman Bawang Merah di Indonesia
Irfandri, Tri Murti H, Jamsari, Nasrun, Irmansyah, Yulmira. Y, Zurai R, dan Milda E 223

Pemberian Mulsa Organik pada Tanaman Gambir (*Uncaria gambir* Roxb.) Belum Menghasilkan dan Pengaruhnya terhadap Gambir dan Gulma
Nusyirwan, Lucy Robiartini, dan Dianne Paulina 231

Produksi Bibit Pisang (*Musa aab*) Raja Nangka secara Kultur Jaringan
Rainiyati 240

Galur-Galur Harapan Kedelai Berpotensi Hasil Tinggi dan Hemat Pupuk Fosfor pada Uji Multilokasi
Dotti Suryati, Mohammad Chozin, Hasanudin, dan Dwinardi Apriyanto 248

Pengaruh Pupuk Organik Cair terhadap Karakter Morfologi Bibit Kelapa Sawit pada Kondisi Cekaman Air
Tatik Raisawati 253

Pemberian Kinetin Upaya Meningkatkan Viabilitas dan Vigor Benih Padi Sawah yang Diberi Air Laut Salinitas
Faisal dan Rosmayati 261

Pertumbuhan dan Produksi Bawang Merah (*Allium ascalonicum* L.) Varietas Tuk Tuk Asal Biji dengan Perlakuan Pupuk Cair Anorganik dan Jarak Tanam
Sabar Ginting dan Ratna Rosanty Lahay 268

Dinamika Populasi *Liriomyza* spp. (Diptera: Agromyzidae) dan Parasitoidnya pada dua Varietas Tanaman Bawang Daun (*Allium fistulosum* L.)
Rusli Rustam, Aunu Rauf, Nina Maryana, Pudjianto, dan Dadang 273

Uji Potensi Hasil dan Adaptasi Beberapa Varietas Tanaman Kedelai pada Naungan Buatan
Nerty Soverda, Evita dan Gusniwati 283

Perbaikan Sifat Fisiko-Kimia Tanah Psamment dengan Pemulsaan Organik dan Olah Tanah Konservasi pada Budidaya Jagung
Adrinal, Amrizal Saidi, dan Gusmini 292

Pemetaan Tingkat Bahaya Erosi Berbasis Land Use dan Land Slope di Kecamatan Gunung Kerinci
Endriani 301

Pengaruh Bahan Kemasan dan Lama Simpan terhadap Mutu Benih Jarak Pagar (*Jatropha curcas* Linn.)
Firdaus Sulaiman dan Andi Wijaya 309

Induksi Perakaran Eksplan Tunas Manggis (*Garcinia mangostana* L.) dengan *Agrobacterium rhizogenes* melalui Kultur *In Vitro*
Lizawati 318

Identifikasi Morfologi dan Analisa Genetik Kultivar Padi Gogo Lokal Provinsi Bengkulu
Marulak Simarmata, Bilman W. Simanihuruk, dan Rustikawati 324

Identifikasi Jamur yang Berasosiasi dengan Penyakit Mati Ranting pada Tanaman Mangga
Maryeni Auliyati 332

Prediksi Erosi pada Lahan Pertanian di DAS Batang Pelepat
Sunarti 339

Dampak Pemakaian Pestisida secara Intensif terhadap Perubahan Beberapa Sifat Kimia dan Biologi Tanah
Oktanis Emalinda 345

Pengendalian Hayati Penyakit Rebah Kecambah Tanaman Cabai dengan Cendawan Pemacu Pertumbuhan Tanaman Penicillium Asal Tanah Rawa Lebak
A. Muslim, Harman H., Abdullah S., dan Komar P. 348

Kajian Keberadaan Aluminium dan Asam-Asam Organik dalam Hubungannya dengan Kandungan Fosfor Tersedia pada Ultisol menurut Kedalaman Tanah
Ajidirman dan M. Syarif 356

Studi Paket Teknologi Budidaya Lebah Madu pada Beberapa Ketinggian Tempat dan Ketinggian Stup
Alnopri, Prasetyo, dan Muktasar 361

Peran Fungi Mikoriza Arbuskula dan *Bradyrhizobium japonicum* terhadap Pertumbuhan dan Hasil Kedelai
Yaya Hasanah 365

Kajian Tingkat Bahaya Erosi pada Berbagai Jenis Penggunaan Lahan Hubungannya dengan Pendapatan Petani di Kawasan Hulu DAS Wampu (Sub DAS Lau Biang) Sumatera Utara
Akhmad Syofyan, Abdul Rauf, Sumono, dan Zulkifli Nasution 370

Induksi Mutasi Bawang Merah dengan Ethyl Methane Sulphonate (Ems) secara *In Vitro* terhadap Penyakit Hawar Daun Xanthomonas (*Xanthomonas axonopodis* Pv Allii)
Zurai Resti, Yulmira Yanti dan Sutoyo 380

Induksi Ketahanan Tanaman Bawang Merah dengan Bakteri Endofit Indigenus terhadap Penyakit Hawar Daun Bakteri (*Xanthomonas axonopodis* Pv Allii)
Yulmira Yanti dan Zurai Resti 389

Struktur Komunitas Serangga Herbivora Penggerek Polong Berbagai Jenis Legum dan Parasitoidnya
Hasmiandy Hamid, Damayanti Buchori, Sjafrida Manuwoto, dan Hermanu Triwidodo 399

Pengaruh Bahan Organik terhadap Sifat Kimia Typic Paleudults dan Pertumbuhan Vegetatif Kedelai
M. Syarif dan Ajidirman 407

Evaluasi Toleransi Plasma Nutfah Padi Beras Merah Lokal Sumatera Barat terhadap Lahan Kaya Fe
Novia Yosrini, Aswaldi Anwar, dan Irfan Suliansyah 414

Pengaruh Bokashi Berbagai Jenis Bahan Dasar terhadap Pertumbuhan dan Hasil Tanaman Mentimun (*Cucumis sativus* L.)
Evita, Elly Indraswari dan Husnul Ardi 421

Studi Inisiasi Kalus Pada Kultur Meristem Kakao (*Theobroma cacao* L) secara *In Vitro*
Hendra Alfi, Wiwik Hardaningsih dan Irfan Suliansyah 428

Komunitas Artropoda Musuh Alami pada Ekosistem Sayuran Organik di Sumatera Barat
Yaherwandi 434

Pertumbuhan dan Ketahanan Bibit Mikro Kentang Enkapsulasi (*Solanum tuberosum* L.) pada Beberapa Konsentrasi IBA
Warnita dan Irfan Suliansyah 443

Pemanfaatan Bahan Organik *In Situ* untuk Peningkatan Stabilitas Aggregat Ultisol dan Produksi Cabai (*Capsicum annum*): Efek Sisa pada Musim Tanam II
Yulnafatmawita, Gusnidar, dan Amrizal Saidi 448

Aplikasi Rhizobium dan Fungi Pelarut Fosfat dalam Rangka Meningkatkan Serapan Hara N dan P pada Beberapa Genotip Kedelai di Ultisols
Rr. Yudhy Harini Bertham, Jeffry Pabianto, dan Abimanyu D. Nusantara 452

Studi Pengaruh Intensitas Pengolahan Tanah dan Pemberian Pupuk Organik Terhadap Sifat Kimia Tanah dan Hasil Tanaman Jagung Manis (*Zea mays saccharata* Sturt.) pada Tanah Ultisols Banten
Andi Apriany Fatmawaty dan Dewi Firnia 461

Regenerasi *In Vitro* Plantlet Pisang Ambon Curup melalui Pembentukan Kalus Embriogenik
Marlin 468

Peranan Cendawan Mikoriza Arbuskular dalam Meningkatkan Daya Adaptasi Bibit Kelapa Sawit terhadap Cekaman Kekeringan pada Media Tanah Gambut Bekas Hutan
Elis Kartika 475

Efek Fungi Mikoriza Arbuskular Indigenous dan Pupuk Hijau terhadap Tanaman Jarak Pagar (*Jatropha curcas* L.) di Lahan Kritis Tanjung Alai Sumatera Barat
Muzakkir dan Wiwik Hardaningsih 483

Kecepatan Dekomposisi Bahan Organik dari Tumbuhan Akumulator dan Non Akumulator Kalsium pada Hutan Hujan Tropik Super Basah Padang Sumatra Barat
Hermansah, Yulnafatmawita dan Tsugiyuki Masunaga 489

Kajian Toleransi Cekaman Aluminium Beberapa Kultivar Padi Lokal Sumatera Barat pada Ultisols dengan Metode Penanaman SRI
Soemarsono, Teguh Budi Prasetyo, dan Irfan Suliansyah 500

Karakteristik Ciri Morfologi, Agronomi dan Genetik Kultivar Jagung Lokal Bengkulu
Suprapto, Sukarni, dan Sumardi 508

Karakterisasi Plasma Nutfah Pisang (*Musa paradisiaca* L.) Berdasarkan Penanda Molekuler RAPD
Wiwik Hardaningsih dan Irfan Suliansyah 519

Hubungan Aktivitas Sucrose Phosphate Synthase dengan Toleransi Varietas Padi pada Sawah Gambut
Widodo Haryoko, Kasli, Irfan Suliansyah, Auzar Syarif dan Teguh Budi Prasetyo 526

Keragaan Pertumbuhan Vegetatif dan Generatif Padi Lokal di Provinsi Bengkulu
Hesti Pujiwati dan Dedi Satriawan 532

Pengaruh Penyimpanan Biji Kakao Fermentasi dan Non Fermentasi terhadap Pertumbuhan *Aspergilus* sp dan Kontaminasi Senyawa Aflatoksin
Masrul Djalal, Claudia C.Fristo, dan Diana Silvi 542

Perencanaan Usahatani Berbasis Pinang untuk Pembangunan Pertanian Berkelanjutan di Sub DAS Krueng Seumpo Provinsi Aceh
Rini Fitri dan Iswahyudi 548

Model Usahatani Konservasi Integrasi di Lahan Marginal dalam Meningkatkan Ketahanan Pangan Keluarga Petani Miskin Pedesaan di Daerah Tangkapan Air Singkarak
Bujang Rusman, Aprisal, Musliar Kasim,Indra Dwipa, dan Refdinal 557

Seleksi Jamur Rizosfir Antagonis terhadap *Fusarium Oxysporum* Penyebab Penyakit Layu pada Tanaman Jarak (*Jatropha curcas* L.) di Bengkulu
Hartal 565

Persistensi Herbisida Clomazone dan Pendimethalin Pada Tanaman Kedelai Kultivar Wilis
Hasanuddin dan Hifnalisa 569

Pertumbuhan Setek Duku (*Lansium domesticum* Corr) Pada Dosis Iba, Caco3, dan Bahan Setek Berbeda
Sri Sukarmi, Lidwina N Sulistyaningsih dan Susilawati 575

Analisis Populasi Enam pada Ketahanan Cabai terhadap Begomovirus
Dwi Wahyuni Ganefianti, Sriani Sujiprihati, Sri Hendrastuti Hidayat, Muhamad Syukur... 583

Aplikasi Pupuk Organik dari Dekomposisi Beberapa Bahan Organik dan Jamur Mikorhiza terhadap Hasil dan Kualitas Kentang (*Solanum tuberosum* L)
Kasli 597

Pemberian Kompos Titonia (*Tithonia diversifolia*) dan Jerami terhadap Pengurangan Input Pupuk Buatan dan Produksi Padi Sawah Intensifikasi
Gusnidar, Syarfrimen Yasin, Burbey, Rantau Andhika, Yusnawati, Yulnafatmawita 603

ıentifikasi dan Keragaman Genetik Gen V1 (Coat Protein) Begomovirus Penyebab Penyakit)aun Kuning Keriting Cabai Asal Sumatera Barat
Jumsu Trisno, Trimurti Habazar, Ishak Manti, Jamsari, Srihendarstuti Hidayat 610

'erbedaan Pemanasan Sekam Padi terhadap Ketersediaan Si (Silika) pada Pertumbuhan dan Hasil 'anaman Padi (*Oryza sativa* L.)
Gusmini, Darmawan, Asmar, Adrinal Siska Putri 618

:ksplorasi, Karakterisasi, dan Konservasi Plasma Nutfah Padi Beras Merah di Sumatera Barat
Indra Dwipa 628

'anggap Pertumbuhan dan Produksi Rosella (*Hibiscus sabdariffa* L.) terhadap Pupuk Organik an Anorganik
Sabar Ginting, Joko Purnomo, Jasmani Ginting 634

ıorphologycal Study on Seed Coat Structure of Rafflesia Flower With SEM
Yulian, Marlin, B. Gonggo, and N. Okuda 641

:UKU 3 AGRIBISNIS, TEKNOLOGI PERTANIAN, PETERNAKAN, PERIKANAN DAN KELAUTAN, KEHUTANAN, POSTER

.GRIBISNIS

ola Kemitraan dalam Perkebunan Kelapa Sawit dan Dampaknya terhadap Perekonomian Desa di ropinsi Jambi
Armen Mar dan Yanuar Fitri 647

.plikasi Vector Autoregression (Var) dalam Integrasi Pasar CPO di Indonesia, Malaysia dan elanda
Dian Hafizah 652

engaruh Implementasi Kebijakan Impor Terhadap Usaha Penggemukan Sapi Potong di ıdonesia
Dwi Yuzaria 664

tudi Kelembagaan Gabungan Kelompok Tani (Gapoktan) Pengelola Rice Milling Unit (RMU) ılam Kerangka Pengembangan Usaha Agribisnis Nagari (Studi Kasus Pada Gapoktan Sri ecamatan Mungka Kabupaten Lima Puluh Kota)
Ferdhinal Asful dan Syofyan Fairuzi 671

ilihan Kelembagaan Pasar Atau Non Pasar: Studi Tataniaga Perikanan Tangkap Kota Bengkulu
Gita Mulyasari dan M. Mustopa Romdhon 678

ɔtensi Pengembangan Industri Pengolahan Kakao di Sumatera Barat
Ira Wahyuni Syarfi, Syofyan Fairuzi, Ferdhinal Asful 684

nalisis Kinerja Pasar Komoditas Unggulan Pertanian di Nanggroe Aceh Darussalam
Jamilah, Khusrizal 689

tribut Rumah Tangga dan Probabilitas Terjadinya Kerawanan Pangan Rumah Tangga di abupaten Muko Muko
Ketut Sukiyono 696

ɜmbinaan Kolompok Tani Dalam Usaha Pembentukan Sebagai Koperasi uatu Kajian Teoritis Dalam Kebangkitan Koperasi)
Khaerul Saleh 705

.eningkatkan Kesejahteraan Petambak Udang dengan Kebijakan Revitalisasi Tambak
Lilis Imamah Ichdayati 713

CHANGES IN SEED QUALITY OF MUNG BEAN GENOTYPES WITH DIFFERENT SEED CHARACTERISTICS AS AFFECTED BY INCUBATOR WEATHERING DURING MATURITY STAGES

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ABSTRACT

Seed resistance to field conditions conducive to deterioration after harvest maturity has been associated with small seeds. The objective of this study was to evaluate the effect of seed characteristics on mung bean seed quality due to incubator weathering prior to harvest maturity and to correlate the seed characteristics on seed quality indicators. Seeds of four genotypes were grown in research plots at Agriculture Faculty, Bengkulu University on April 10, 2007 in a split-plot arrangement with three replications. At maturity stages R7, R7.5, R8, and HM, the seeds from each genotype were harvested and aged for 1 week in an incubator set at 30^{0}C and 100% relative humidity and evaluated for seed germination and electrolyte conductivity. Seed germination of all genotypes declined as aged with incubator weathering. The decline in seed germination was followed by an increase in electrical conductivity values. Among the genotype tested, genotype with small seed size and low seed coat permeability had higher seed quality. Two large-seeded genotype representing low and high seed coat permeability were susceptible to incubator weathering. There was an inverse correlation between seed size and the two seed quality indicators. Overall, the finding of this study shows that genotypes resistant to incubator weathering had relatively small seed.

Key words: mung bean, seed quality, electrolyte seed leachate, artificial weathering

INTRODUCTION

High quality of mung bean [*Vigna radiata* (L.) Wilczek] seed is difficult to produce in the humid tropical regions due to its susceptibility to field weathering damage. Tropical conditions of high relative humidity and temperature during seed production both before and after the seed reaches a harvestable moisture level is not conducive to production of high quality seed necessary to establish acceptable stands (TeKrony et al., 1980). Such conditions cause seed to deteriorate rapidly.

Deterioration of seed in the field is usually referred to as field weathering or as field deterioration. Field weathering taking place before harvest is also called pre-harvest weathering, while after harvest is called post-harvest weathering. Field weathering of seed is associated with unfavorable weather conditions and its occurrence was mainly due to moisture, in the form of high humidity and precipitation, and temperature (TeKrony et al., 1980).

Several workers have reported that seed attains its high potential quality at physiological maturity (maximum seed dry weight) (Delouche, 1974). Unfortunately, due to high moisture content, the seed can not be harvested commercially at this growth stage and must remain in storage on the plant through a desiccation period. This period may vary from a few days to over three weeks before the seed reaches a harvestable moisture level (TeKrony et al., 1980). They further reported that when seed harvest is delayed beyond optimum maturity caused by wet field conditions, it extends exposure of mature seed to unfavorable conditions in the field and intensifies seed deterioration.

Studies on changes in seed quality due to field weathering after harvest maturity have been conducted in legume seeds. Marwanto (2003) and TeKrony et al. (1980) reported that soybean seed viability was maintained at a relatively high level for 14 days following harvest maturity, but seed vigor began to decline within a few days after harvest maturity stage. The similar result was also reported by Marwanto (2007) for mung beans. Instead of 14 days following harvest maturity, mung bean seeds maintained at high level after 21 days harvest maturity stage. He further reported that the different resistance in mung beans was associated with impermeable seed coat or hard seed character. In addition to a decrease in seed vigor, seed deterioration was also associated with the progressive loss of membrane integrity (Marwanto, 2003; Ching and Schoolcraft, 1968).

Seed size also played a role on reducing deterioration when harvest was delayed (Dassou and Kueneman, 1984). They further reported that small-seeded genotypes were more resistant to post harvest weathering than large-seeded genotypes in soybeans. However, not all small-seeded lines were resistant to filed weathering.

As mentioned earlier that the studies on changes in seed quality due to field weathering after harvest maturity have been well established. Less emphasis has been placed on understanding field deterioration prior to harvest maturity. The incubator weathering developed by Dassou and Kueneman (1984) will be used throughout this study because it was more consistent across experiments than filed weathering for evaluation soybean resistance to weathering. The objective of this study was to evaluate the effect seed characteristics on mung bean seed quality due to incubator weathering prior to harvest maturity and to correlate the seed characteristics on seed quality indicators.

MATERIALS AND METHODS

Seeds of four mung bean genotypes representing different types of seed coats were used in these studies. 'Bhakti' was classified as small seed and slow imbiber, 'Betet' was small seed and rapid imbiber, 'Merak' was large seed and slow imbiber, and 'IPB.M/97-13-60' was large seed and rapid imbiber. Their seed characteristics are given in Table 1. The seeds were planted in research plots at Agriculture Faculty, Bengkulu University on April 10, 2007 in a split-plot arrangement, with harvest stages as main plots, genotypes as subplots and pod position as sub-subplots with three replications. Each genotype was planted in a plot consisting of a single raised bed, 65 cm wide and 4 meters long. Two rows were planted per bed. Row spacing was 35 cm between rows within beds and 65 cm between beds. Seeds were planted in hills 20 cm apart with 3-4 seeds per hill. N, P, and K fertilizer at a rate of 100, 80 and 80 kg ha^{-1} was applied prior to planting.

At maturity stages R7, R7.5, R8, 1 week after R8 (harvest maturity), the seeds from each genotype were harvested for quality evaluation by hand picking of the pods at the top plant portion. For seed quality evaluation, 50 mature pods were picked from each treatment-replicate and divided into two groups of 25 pods each. The pods from each group were then given the following treatment: (i) dried by hanging them in well-ventilated plastic bag for 2 weeks as a control. The pods then were hand-treshed. The moisture content of the seed after drying ranged from 11 to 13%. It was assumed that well-ventilated plastic bag provided a uniform drying environment which minimized seed deterioration during the dry-down period; (ii) subjected to 30^{0}C and 90% relative humidity for 7 days (incubator weathering). After 7 days of weathering, the pods were removed from the incubator, force air dried to approximately 12% moisture content at 28^{0}C for 5 days and hand-threshed. To determine the effect of the weathering treatment on seed quality, following treatments seeds were then evaluated for viability by standard germination test, and leachate conductivity by electrolyte conductivity test. The time of occurrence of physiological maturity (R7) was determined by harvesting 25 pods at approximately daily intervals started at 7 days before the stage was attained and measuring the seed moisture content and weight per seed.

Table 1. Selected mung bean genotypes used in this study with their lignin content expressed as % ADL (acid delinted lignin), seed coat permeability (P) and seed weight.

Genotipe	Lignin Content (%ADL)	P (g g^{-1} hr^{-1})	100-Seed Weight * (g)
Bhakti	0.070	0.008	4.34
Betet	0.054	0.071	3.82
Merak	0.070	0.013	6.64
IPB.M/97-13-60	0.042	0.056	6.27

*: Weight in grams of 100 seeds at 12% moisture

Seed germination was determined by the standard germination test. In this test, 50 seeds from each treatment-replicate were placed on mosit paper towels, which were rolled and placed inside plastic bags and kept at a room temperature. Germinated seeds were counted aftar 5 and 8 days. Dead seeds were removed after 5 days, while hard seeds after 8 days and counted with germinated seeds. The number of germinated seeds was expressed as a percentage of the total.

DISCUSSION

The results of this study show that incubator weathering treatment resulted in lowering seed viability as reflected by seed germination and increasing membrane damage as reflected by electrolyte conductivity. Similar results were also reported by others (Marwanto, 2007, 2008; Dassou and Kueneman, 1984). According to Yaklich and Kulik (1987), the decrease in seed quality occurred mainly due to moisture in the form of high humidity and temperature during incubator weathering.

Table 2. Temperature (temp.), rainfall and relative humidity (RH) collected from Pulau Bai Weather Station, Bengkulu from May 20 to July 2 2007.

Date	Weather Condition			Date	Weather Conditions		
	Temp. (°C)	Rainfall (mm)	RH (%)		Temp. (°C)	Rainfall (mm)	RH (%)
May 20	27.2	0^{y}	81	June 11	27.0	0	81
May 21	26.4	0	83	June 12	27.1	0	84
May 22	26.3	trace	90	June 13***	27.0	0	88
May 23	27.1	0	90	June 14	26.0	5	84
May 24	26.9	0	89	June 15	26.8	0	89
May 25*	27.3	0	86	June 16	26.4	2	94
May 26	27.1	0	86	June 17	23.1	8	82
May 27	26.2	0	83	June 18***	25.8	0	82
May 28	26.1	0	84	June 19	31.8	13	82
May 29	26.4	0	85	June 20	26.9	9	76
May 30*	26.9	0	90	June 21****	26.8	8	80
May 31	26.7	0	90	June 22	25.9	25	80
June 1	27.3	0	83	June 23	25.5	27	81
June 2	26.8	0	85	June 24	26.2	0	85
June 3	26.8	0	84	June 25****	27.0	0	82
June 4**	26.6	3	88	June 26	27.2	0	87
June 5	25.4	0	91	June 27	25.9	0	81
June 6	26.4	8	86	June 28	27.0	0	86
June 7	25.7	8	87	June 29	26.8	0	82
June 8	26.4	8	87	June 30	26.5	0	82
June 9**	26.5	0	83	Juli 1	27.0	0	85
June 10	26.5	0	83	Juli 2	28.0	0	84

^{x}: trace means rainfall less than 1 mm ^{y}: 0 means no raifall   *: first harvest date

, second harvest date   *, third harvest date   ****, fourth harvest date

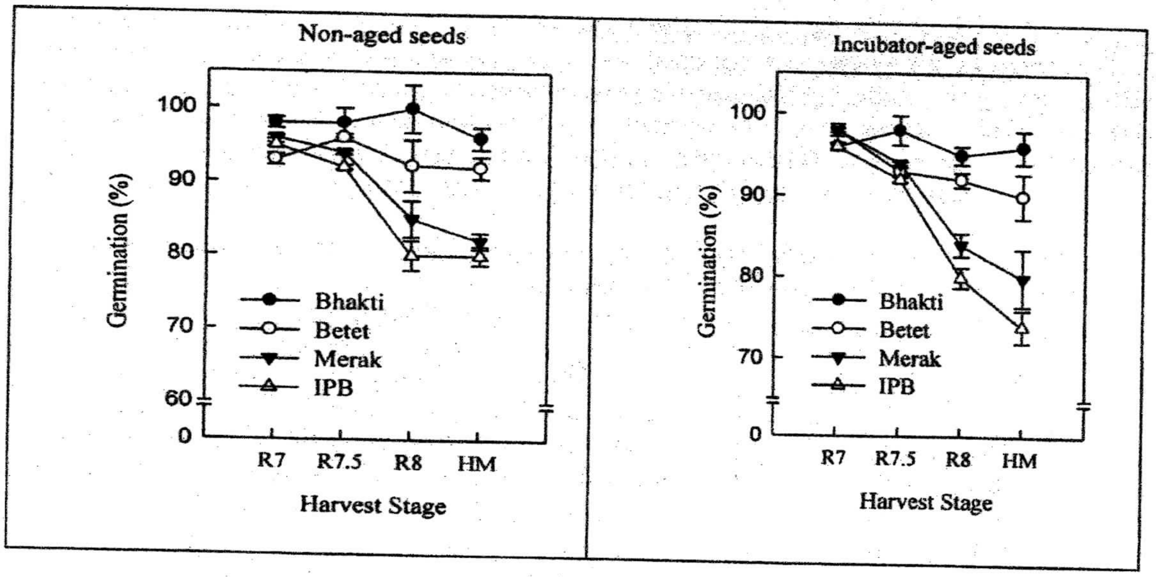

Figure 1. Effect of incubator weathering on germination of seed of each genotype at reproductive stage R7, R7.5, R8 and HM. Vertical bars represent standard error at each stage.

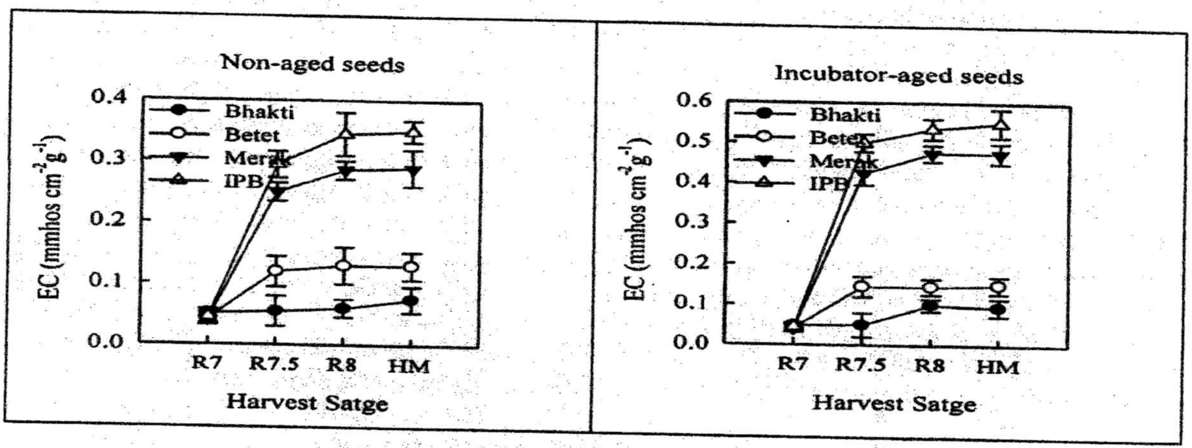

Figure 2. Effect of incubator weathering on electrolyte conductivity of seed of each genotype at reproductive stage R7, R7.5, R8 and HM. Vertical bars represent standard error at each stage.

Some researchers have suggested that seed characteristics involved in resistance to incubator weathering (Dassou and Kueneman, 1984; Marwanto, 2008; Yaklich and Kulik, 1987). They reported that small-seeded genotypes were more resistant to incubator weathering than large-seeded genotypes. The findings of this study indicate that small-seeded genotype of Bhakti was more resistant to incubator weathering than large-seeded genotypes of Merak and IPB.M/97-13-60. Significantly inverse correlations were obtained between seed size and seed quality indicators (Table 3). The other small-seeded genotype (Betet) were less resistant to incubator weathering. These results were in agreement with other researchers (Dassou and Kueneman, 1984; Marwanto, 2008; Yaklich and Kulik, 1987) who reported that not all small-seeded genotypes were resistant to incubator weathering. One possible explanation for the lack association between small-seeded genotype of Betet and resistance to incubator weathering was due to high seed coat permeability. Seeds with high seed coat permeability tended to imbibe water at a faster rate than those with low seed coat permeability and failed to protect themselves from deterioration due to incubator weathering (Calero et al., 1981).

The result of this study also demonstrated that mung bean seed with low seed coat permeability such as Merak failed to protect itself from deterioration during incubator weathering. According to Kuo (1989), slow permeability characteristics protected seed from deterioration only when harvest was delayed. Lignin content of seed coat was also not successful to protect seed from deterioration due to incubator weathering. However, when harvest was delayed, mung bean seeds with high lignin content were more resistant to deterioration in the field than those with low lignin content due to a close association between lignin content of seed coat and seed coat permeability (Marwanto, 2008). This indicates that the role of lignin content of seed coat on seed resistance to weathering was similar to seed coat permeability. It protected seed from deterioration only when harvest was delayed.

Table 3. Correlation coefficients between seed characteristis and seed quality indicators across seed type and harvest stages.

Correlated characters	Treated seed	
	Aged seed	Non-aged-seed
Seed germination vs.		
Seed size	-0,760**	-0.71**
Seed coat permeability	-0.325	-0.321
Lignin content of seed coat	-0.325	-0.204
Electrolyte conductivity vs.		
Seed size	-0.725**	-0.715**
Seed coat permeability	-0.325	-0.214
Lignin content of seed coat	-0.421	-0.312

** indicate significance at the 1% levels, respectively

CONCLUSION

Incubator weathering resulted in a decrease in seed germination and an increase in electrolyte conductivity of seed. Ther was a close correlation between seed size and the two seed quality indicators. Small-seeded genotypes exhibited greater resistance to incubator weathering than large-seeded genotypes.

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